Title Innovation Management and Commercialisation in Small Firms: A Study of Low and High R&D Intensity Firms from Australia and France

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Abstract:

This study examines the nature of innovation within small firms across two OECD countries with a particular focus on the differences between firms with low R&D intensity and those with high R&D intensity. Drawing on a sample of small to medium enterprises (SME) who were engaged in the commercialisation of at least one innovation, the study finds that while most OECD countries appear to be seeking to provide similar levels of support for innovation and commercialisation within SMEs such programs need to address the needs of both high and low to mid-tech firms.

INTRODUCTION

The Global Financial Crisis (GFC) of 2008-2009 has evoked a strong interest within countries throughout the 34 countries that comprise the Organisation for Economic Co-operation and Development (OECD) into ways to encourage the growth and innovation of small to medium sized enterprises (SMEs) (OECD 2010a). This is a response to the desire by governments to stimulate their economies and to foster the creation of jobs. This pattern of activity is reminiscent of the 1970s and 1980s when high levels of unemployment and economic stagnation in many OECD countries fostered a strong interest in the SME as a potential creator of jobs and new products (Birch 1987). Academic interest in the growth and performance of SMEs was stimulated as a result of this and many papers sought to examine the strategic behaviour (Robinson and Pearce 1984), growth and new product development (Gibb and Scott 1985), and the general theory of small firms (D'Amboise and Muldowney 1988). In many respects this GFC rekindling of interest in the role of the SME is a case of "back to the future" as researchers and policy makers seek ways to unlock the potential of the small firm within their national economies and national innovation systems (NIS).

This study seeks to understand the nature of innovation within SMEs across two OECD countries Australia and France, and within firms that have high or low levels of innovation intensity (as measured by percentage of annual turnover invested in R&D where >5% are classified as high-tech and those <5% as low to mid-tech) (Hirsch-Kreinsen, Hahn and Jacobsen 2008). First, it examines the nature of these two countries approaches to the support of innovation and commercialisation amongst SMEs with reference to their respective NIS. Second, it examines the behaviour of SMEs with low and high levels of R&D intensity in their approach to commercialisation.

THE NATIONAL INNOVATION SYSTEMS OF AUSTRALIA AND FRANCE

The concept of a National Innovation System (NIS) has emerged within the academic literature over the past thirty years, with Schienstock and Hämäläinen (2001) suggesting that the idea was first introduced by Lundvall (1985), and then widely diffused as a result of Freeman's (1987) analysis of the economic growth of post-war Japan. Since the 1980s further research into the NIS concept has been undertaken (e.g. Nelson 1992; Edquist 1997; Lundvall 1992; 1998; 2007; Lundvall et.al. 2002; Larédo and Mustar 2001), primarily as a result of government policy interest.

This literature on the NIS concept has highlighted the need for investment of public funds into scientific research, but also the importance of reducing barriers to commercialisation through the removal of compliance costs, facilitation of venture capital markets, protection of intellectual property rights, transfer of technology from public to private sectors, and the removal of established monopolies (Balzat and Hanusch 2004; Trott 2007). For countries experiencing economic slowdowns or those seeking to maintain international competitiveness investment in innovation offers the hope of a "double dividend" in the form of a restoration of economic growth and the reform of underlying economic structures (OECD 2010b).

Investment in the NIS has traditionally taken the form of government programs designed to stimulate research and development (R&D), innovation and commercialisation (Harman 2010). While the design of specific NIS varies from country to country, most comprise at least two broad elements. The first is a "common innovation infrastructure" (e.g. the technological sophistication of the country, investment in R&D, government support for innovation). The second is the "cluster specific environment for innovation" (e.g. competitive rivalry, ease of exit and entry, supplier/buyer power) found within the industries in which the firms are operating (Porter and Stern 2001).

While Australia and France are both advanced industrial economies they have many similarities and some differences. An island continent adjacent Asia and the Pacific, Australia covers a geographic area around 11 times the size of France, although the latter has a population three times larger. France is a major manufacturing nation which in 2008 was ranked in the top five nations for scientific articles published, and held around 5 per cent of the world's triadic patent families (e.g. those patents registered in Japan, USA and EU patent registries) (OECD 2010c). France also ranked second after the USA in the export of aerospace products. By comparison Australia holds a much smaller share of triadic patent families (0.6%) and has a much smaller manufacturing sector relying instead on the export of minerals, oil and gas and food products for its exports, although it has developed highly successful export sectors in education and financial services. Compared with France, Australia has also enjoyed a higher rate of economic growth managing to avoid the worst of the GFC due to its close economic links to China. Despite these differences the two countries also demonstrate many similarities on the other indicators listed in Table 1. These include national investments in R&D, venture capital intensity and the proportion of firms that are SMEs within the economy.

< Insert Table 1 Here >

Historically, both Australia and France invested heavily in large scale projects and national institutions, such as the *Commonwealth Scientific and Industrial Research Organization* (CSIRO) in Australia, or the *Centre National de la Recherche Scientifique (CNRS)* in France. However, in recent years there has been a shift towards support for innovation in industry, particularly among small firms. For example, *Australia's Innovation Agenda 2020* states that the:

> *"Australian Government is spending $8.58 billion on science and innovation in 2009-10, compared to $6.88 billion in 2007-08. A quarter of the Commonwealth's innovation spending goes towards programs that encourage business investment in innovation, including R&D tax incentives. The remainder is shared between the higher education sector, research agencies, and multi-sector initiatives such as the Cooperative Research Centres Program*. (Commonwealth of Australia 2009: 18).

In Australia government agencies such as *AusIndustry* deliver over 30 business support programs with around AUD$2 billion that encompass such things as innovation grants, tax and duty concessions, small business support and venture capital assistance. These programs include *Commercialising Emerging Technologies* (COMET) (established in 1999) that provides grants of between AUD$5,000 and AUD$120,000 for early stage commercialisation. Also *Enterprise Connect* (established in 2008) that has AUD$50 million a year for small business assistance targeted at manufacturing and innovation, and the *Small Business Advisory Service*, an AUD$46 million program offering low cost advisory services to small firms (OECD 2010a). In mid-2009 the Australian Federal Department of Innovation, Industry, Science and Research outlined a ten-year reform agenda designed to enhance national productivity and competitiveness through a more integrated approach to science and innovation with global linkages (OECD 2010c).

In France the 1990s saw a great national debate emerge over the state of the NIS with concerns raised over the need for enhancing the nexus between public research institutions such as the universities, and industry. The French NIS had evolved after 1945 on the back of national R&D projects such as France's nuclear industry. A key initiative in the development of the French NIS was the establishment of the *Agence Nationale de Valorisation de la Recherche* (ANVAR) in 1974, with the role of commercialising publicly funded R&D and supporting innovation amongst small firms. By the 1980s the need to coordinate and extend the public funding of R&D across all regions and gain more commercial benefit from public investment was a major focus. However, by the 1990s France's need to achieve more productivity and commercial spin-offs from public R&D funding was driving policy. During the last ten years the focus shifted to strengthening France's international competitiveness and a greater attention to the role of entrepreneurship and small firms (Fernez-Walch and Romon 2006).

During the period 1999 to 2003 a range of legislation was passed that established the framework for France's innovation policy (OECD 2010c). In 2005 ANVAR was merged with the SME Development Bank (BDPME) to form the OSEO Group, a public institution under the control of the Ministry of Finance and Ministry of Higher Education and Research. OSEO-Innovation has an annual budget of €560 million (OSEO 2009). Tax reforms offering R&D tax credits, originally introduced in 1983, were upgraded in 2004-2005 to better assist small firms. Further tax reforms in 2007 and 2008 have sought to enhance innovation for small companies. During 2004, the French Government also created the concept of *pôles de compétitivité* (competitiveness poles), designed to foster innovation and entrepreneurship amongst small firms. This is a network of enterprise associations, training centres and R&D institutions that seek to encourage innovation via joint projects and the emergence of industrial clusters. A total of €1.5 billion was budgeted for this scheme in 2006-2008. At time

of writing, 71 "poles" with over 300 projects had been funded with investment of €3 billion (OECD, 2010a).

Despite the many differences between Australia and France it can be seen from the above that both countries adopt similar policies in relation to their NIS and attempts to stimulate innovation within SMEs. To this end our first hypothesis is:

H1. Due to the common approaches being followed by most OECD countries in relation to their NIS, there is likely to be no significant differences between countries that will impact on the innovation performance of SMEs.

H1 was of interest as it is clear from the data in Table 1 that despite their differences Australia and France – like many other OECD countries – are both seeking to invest in their respective NIS, and to benchmark their key measures of performance. This can be seen from the similar statistics of percentage of GDP spent on R&D, GERD, BERD, proportion of full time researchers employed and venture capital intensity. Both countries also have policies designed to enhance innovation and commercialisation within SMEs.

INNOVATION WITHIN SMALL FIRMS

Innovation management and commercialisation in the small firm is a relatively new field of academic inquiry with its origins in the wider disciplines of entrepreneurship and strategic management, which are themselves closely aligned (Brush et.al. 2003). A key element of entrepreneurship is innovation, which provides the foundation of a future point of market entry and the ability for the entrepreneur to secure above average market rents from the appropriation and leveraging of intellectual property (Alvarez and Barney 2004). Entrepreneurs who own and manage small firms seek to exploit market opportunities by the configuration of both tangible and intangible assets and resources into new products and services that employ innovation to secure a competitive advantage within targeted markets (Alvarez and Busenitz 2001). A challenge facing such entrepreneurs is their ability to create

new value via innovation, and to ensure that they can appropriate this value in the face of high levels of risk and uncertainty. A particular challenge for entrepreneurial firms engaged in innovation is how to deal with uncertainty, where the value of future investments is unknown at the time they are commenced (Alvarez and Barney 2005). As Kimberly and Evanisko (1981) observed, much remains to be learnt about the conditions and process of innovation. Their observations from the early 1980s remain as true today.

A Review of the Literature on Small Firm Innovation

In seeking to understand the nature of innovation management in small firms we undertook a review of the literature, in particular recent published literature reviews. Several themes emerged. The first is that much of the theoretical and methodological foundations of entrepreneurship remain underdeveloped. For example, Bouckenooghe *et.al.* (2007) found weaknesses in the in the internal and external validity, construct validity and statistical conclusion validity of many studies published in the field of entrepreneurship over the period 1999 to 2003. The majority of studies were cross-sectional in nature and made little use of advanced analytical techniques and methodologies. Reviews of the small business management literature raised similar concerns, pointing to a lack of adequate definitions of what a small business is, inconsistent use of measures associated with small business management, and weaknesses in the underlying theory (Kraus *et.al.* 2005; Street and Cameron 2007; Tonge 2001a/b; Ratnatunga and Romano 1997).

A further important observation was the acknowledgement that small business management and entrepreneurship are often treated as part of the same paradigm, when they are distinctly different fields of study. Although it should be acknowledged that small business management has been the primary foundation upon which much of the entrepreneurship literature has been constructed (Tan, *et.al.* 2009). As with other areas of the entrepreneurship and small business literature, the field of innovation management in small

firms is characterised by a paucity of underlying theory. Most studies engage in theory testing using quantitative methodology rather than theory building using qualitative approaches (Tan, *et.al.* 2009). Much of the focus of past research has been on technological entrepreneurship; although this area also suffers from a lack of adequate definition and an over emphasis on high technology start-up ventures (Jones-Evans 1995).

To address the issues of definition we turned to the OECD and derived our definition of innovation from the *Oslo Manual* which identifies four types of innovation that encompass both technological and non-technological forms. Technological innovations include product and process innovations, while non-technological types encompass such things as business practice changes, business re-engineering and marketing systems (e.g. new forms of direct selling, retailing or pricing) (OECD 2001). The definition for small firm was derived from the OECD (2004) which identified such firms as having fewer than 250 employees, with annual turnover of less than €50 million, and an autonomous management and ownership structure.

Our review of the innovation management literature also highlighted at least four other issues and gaps. The first concerns the trend in most studies to examine a specific aspect of the innovation process in isolation rather than seeking to explore the firm as a system (Gudmundson *et.al.* 2003). However, Subramanian and Nikakanta (1996) demonstrated that innovation is a multi-dimensional concept that exhibits a complex relationship to the organisational factors and firm's performance. Damanpour (1996) held a similar view, stating that innovation theories that include only two or three variables may have limited predictive ability. A general consensus emerges that innovation refers to: *"... new ways of delivering an existing product or service to existing or new markets, different methods of communicating with the customer regarding a product and its promotion, or new ways or organising the company and managing relationships."* (Cummins *et.al.* 2000).

This broad conceptualisation confirms that innovation is multi-dimensional and complex, and research must integrate the entire innovative activity comprising the range of inputs, the variety of processes and their management. Furthermore, there is a lack of in-depth research data on the integration of invention, innovation and commercialisation (Braunerhjelm and Svensson 2010).

The second issue concerns the examination of innovation as a separate discipline, when the context in which it takes place calls for a multi-disciplinary approach incorporating theories from strategic management, marketing, entrepreneurship and small business management. The literature suggests a strong correlation between a firm's strategic decision making process and innovation (Kickul and Gundry 2002; Pratali 2003; Tanewski *et.al*. 2003). This suggests that innovation in organisations should not be examined in isolation outside its managerial and strategic context. There is an intuitive logic in this, and as noted above, entrepreneurship and entrepreneurial behaviour are closely associated with innovation through the identification of market opportunities and their exploitation with new products or services (Johnson 2001). This notion of entrepreneurship also encapsulates the role it plays in the generation of employment and wealth (Yamada 2004). Entrepreneurs are viewed as having a primary role of fostering innovation through risk taking, strategic management and new venture formation, a complex process that encompasses innovation as an integral not independent element (Velamuri 2002).

The third issue concerns the relative paucity of studies on the sustainability of innovation and its ability to generate economic rents via commercialisation. Although several studies have examined the ways in which small and large firms can sustain their competitive advantage, the extant innovation literature has few studies (e.g. Audretsch 2004), that include or address such questions as how small firms can sustain innovations. Some studies have examined sustainability via succession planning in family owned firms, but not in innovation

(Tanewski *et.al.* 2003). While most start-ups are highly innovative, the majority fail to successfully commercialise their innovations, or at least sustain a competitive advantage. There is a significant gap between the high-tech "Silicon Valley Business Model" SME with rapid growth potential, and the vast majority of low to mid-tech SMEs that employ more incremental forms of innovation and conventional business models to maintain steady albeit uninspiring growth. Both types of ventures are important to the national economy, but academic and government policy attention has been given disproportionately to the former (OECD, 2010a).

The final issue concerns the debate over the most suitable method to investigate innovation. Recent years have seen an increase in the number of studies on innovation in small firms where innovation has been examined using quantitative methodology and innovation has been either the dependent variable, or one of the predictor or moderating variables. Perhaps this is a reflection of the preference in academic journals for quantitative studies, but given the relative lack of underlying theory and accepted measures, it is surprising that so few studies have sought a qualitative approach focusing on exploration rather than confirmation. A common finding that emerges from the literature is that innovation in organisations does not follow causal pathways, reflecting a non-linear behavioural pattern that is even more complex within small firms (McAdam and Keogh 2004). This appears to be due to the somewhat idiosyncratic nature of how small business owners and entrepreneurs approach innovation and new product development (Hovgaard and Hansen 2004). Within the small firm the innovation management process is defined as one that is fluid, untidy and iterative in nature, not conforming to well-defined stages (McAdam and Keogh 2004). As such a case study approach has been called for in order to better understand this environment (Adams and Lamont 2003). This would ideally foster a more in-depth analysis and systematic diagnosis of issues (Pratali, 2003).

According to Tan *et.al.,* (2009) research into innovation in small firms needs to focus on three levels. The first is at the individual view of the technopreneur or owner-manager seeking to innovate. The second is the organisational view, of the firm, including its management of the innovation process. Finally there is the systems view, or the external environment which incorporates the NIS. These three levels of analysis equate to those originally proposed by D'Amboise and Muldowney (1988) who proposed that future theory of the small firm should focus on the managerial characteristics of the firm's leadership, the organisational configuration of the business, and the task environment in which the firm seeks to operate.

Returns to R&D Investment

Commercialisation is the disciplined and coordinated process of transforming a new product from concept to market adoption (McCoy *et.al.* 2010). Successful commercialisation requires systematic attention to the market and the coordination of technical and marketing activities across the value chain (Cobbenhagen, 2000). For the purposes of this study it was it was decided to focus on manufacturing in order to control for any differences that might be found between industries as the literature suggests that innovation management and commercialisation differs between manufacturers and service firms (de Jong and Vermeulen 2006). Research undertaken into innovation, specifically new product development (NPD) and commercialisation, within manufacturing SMEs in Australia suggests that investment into R&D is not sufficient to guarantee competitive performance, and that a strong focus on the customer and market is required for successful commercialisation (Huang, Soutar and Brown 2002; Liao and Rice 2010). However, other research appears to offer a contrary view, suggesting that greater formality in customer or supplier relationships is less important to performance than formality in the NPD/Commercialisation process (Terziovski 2010).

The answer may lie somewhere between these two positions. For example, in a study of manufacturing firms in the European Union, Vaona and Pianta (2008) found that firm size appears to play a role in whether there is a concentration on product and process technologies and R&D, or market expansion and marketing strategies. While large firms are more marketing focused, SMEs tend to focus on product or process technologies. Finally, there is some evidence that differences existing between SMEs over whether they are high-tech or low to mid-tech. A study of SME manufacturing firms in Canada undertaken by Raymond and St-Pierre (2010) found that high-tech firms tend to invest more in product R&D while the low and mid-tech firms were more likely to invest in process R&D, suggesting that there may not be one "best practice" approach to innovation and R&D within SME manufacturing firms.

This suggests that firms with higher levels of investment in R&D, that are high-tech (e.g. >5% of annual turnover invested in R&D) will be more innovative and generate different types of innovation outcome than firms with low to medium levels of investment in R&D (e.g. <5% of annual turnover invested in R&D) leading to the following proposition:

H2. That the level of innovative activity amongst low to medium technology SMEs will be lower than that of the high tech firms.

H2 was of interest as it has become common to view the high-tech "Silicon Valley" business model SME as more innovative than their counterparts in the low to mid-tech sectors (OECD 2010a).

Measuring Innovation within Small Firms

A review of the literature undertaken by Adams, Bessant and Phelps (2006) identified a seven part framework for the measurement of innovation management. This encompasses; i) inputs (e.g. people, physical and financial resources); ii) knowledge management (e.g. idea generation, knowledge capture and information flows); iii) innovation strategy (e.g. strategic

orientation and leadership); iv) organisation and culture; v) portfolio management (e.g. risk/return assessments); vi) project management; and vii) commercialisation (e.g. market research, testing and sales). Of these the area of commercialisation is the least developed. As noted by Adams *et.al.* (2006: 38): *"We believe that this area of innovation is in urgent need of further development, from both theory and measurement viewpoints".*

Building on this innovation measurement framework, and the other elements of our literature review we developed the conceptual framework shown in Figure 1. This draws together the three primary elements of the "Systems View", "Organisational View" and "Individual View" noted by Tan et.al. (2009). It then embeds the NIS framework of Porter and Stern (2001) within the "Systems View", and the seven areas for measuring innovation management identified by Adams et.al. (2006). Finally, the four elements within the "Individual View" are derived from a variety of sources (e.g. D'Abmboise and Muldowney 1988; Jones-Evans 1995; Carland et. al. 1984; Mazzarol and Reboud 2009). The seven measures of innovation management (Adams et.al. 2006) were viewed as key units of analysis for our case studies.

< Insert Figure 1 Here >

Finally then we developed our third hypothesis H3, which was of interest a mechanism for measuring the innovation management behaviours of our Australian and French case study firms at the "Organisational View" level, but with a specific interest in whether these seven elements would be applicable to both low to mid-tech and high-tech firms:

H3. That the seven measures of innovation management as defined in the model of Adams et al (2006) provide an appropriate framework for understanding the innovation management behaviour of both low to mid-technology SMEs and their high-tech counterparts.

METHODOLOGY

This study draws on a case study survey of 54 SME manufacturers selected from Australia (29 cases) and France (25 cases). The case study survey methodology has been identified as a useful tool for the "*analysis of qualitative evidence in a reliable manner"* (Yin and Heald 1975). It enables the researcher to examine the details of each case study and aggregate the frequency of occurrence of each experience (Yin 1982). At least two independent reviewers examine the data to identify patterns of behaviour across the various cases. This analysis was also supported by the collection of quantitative data within each case that allowed for some statistical tests to be undertaken. Further, as proposed by Eisenhart (1991) a multiple case study approach was taken in order to provide replication and extension in the development of future theory.

Case Study Selection and Data Collection

Eisenhart (1989) suggests that the selection of cases is one of the most important steps in a case study analysis. The process used for undertaking this case study survey involved the use of a common case study protocol for both countries and a purposive sampling approach. Firms were identified through an investigation within each country of firm's that had a profile of NPD/Commercialisation and who were engaged in the commercialisation of at least one innovation. Use was made of government and industry databases that profiled such firms, technology incubators and simple networking by the investigators were all employed.

All firms were manufacturers and had fewer than 250 full time employees at the time of interview. The interviews were conducted with the firm's senior management, typically the owner-manager, Executive Director or CEO. Each interview was undertaken face-to-face and lasted around 1-2 hours, often with a tour of the firm's facilities. These interviews were guided by a case study protocol developed around a conceptual framework drawing on the works of Tan et al. (2009), Tidd (2001), Cooper et al. (2004) and Adams et al. (2006) for the

process of innovation management within firms, plus the NIS environment (Porter and Stern 2001) was employed. This involved a questionnaire comprising a range of items dealing with the respondent's perception of their NIS and how well this supported innovation in their firm; the perceived value of different outsiders who might assist them with commercialisation; past experiences of commercialisation, the nature of their current project and how formal their systems of innovation management were. Also, each firm was asked to indicate their level of R&D intensity by indicating how much of their annual turnover they invested into R&D. In conjunction with other questions associated with the type of technological product or process innovation they were working on, this enabled a classification of each firm into high-tech or low-tech categories.

DATA ANALYSIS AND DISCUSSION

Of the 54 cases selected for this study all but two had male owner-managers or CEOs. Their ages ranged from their early to mid-twenties through to one individual who was aged over 60 years. The most common description that they have of themselves was "owner-manager", followed by "Executive Manager/Managing Director" with shareholding. Only 7 were executive managers who held no equity in the business. No statistically significant differences were found in relation to these demographic variables associated with the firm's senior leadership and country of origin. The average age of these firms was 29 years with a range from 1 year to 105 years. On average these firms employed 112 people with an average annual turnover of €12.5 million. These firms had – on average – experience growth over the previous three years with annual turnover rising by an average €347,738 along with an average increase in the number of full time employees of 29 staff during the same time period.

Differences in Perception of NIS

To test H1 the results of the survey responses from the Australian and French firms were examined using 10 question items that were part of the survey. These items are listed in Table 2 along with the mean rating scores for the two countries and the p-values for a series of *t*-tests (2-tailed) that were undertaken on the data. It can be seen that there were no significant differences found between the two countries in relation to these items with the exception of two items. The first dealt with the perceived cost of doing business, while the second related to the ease of finding and recruiting high quality managerial staff.

It can be seen that Australian firms were significantly more positive than their French counterparts in relation to the perceived cost of doing business. Although on average they remained somewhat negative. The Australian firms were by contrast significantly more pessimistic over their ability to find and recruit managerial talent.

It is worth noting that this data for the cases was collected in the period 2007-2008 just prior to the GFC really beginning to take hold. At this time there was a strong economic boom taking place within the country and significant labour and skills shortages were a common feature of the industrial landscape. What had emerged was a "two-track" economy in which the mining and resources sector was booming, while the rest of the economy remained less buoyant. Manufacturers with links directly to the mining and resources sector would have benefitted in terms of contracts, but might also have suffered from competition for skilled employees and managers from the large mining and energy firms who typically offer high wages to attract the best managerial and technical talent. It is also worth acknowledging that Australia had also tended rank well ahead of France in the World Bank "Doing Business" global index of the ease of doing business. For example, in 2010 Australia ranked 10th and France 26th out of 183 nations (World Bank, 2010).

< Insert Table 2 Here >

Despite these differences in two of the 10 items used to measure perceptions of the NIS the overall impression is that there is support for H1, suggesting that SMEs in both countries view their NIS in broadly the same way.

Differences in Low and High R&D Intensity Firms

To test H2 an examination was made of the differences in commercialisation activity of firms with high or low R&D intensity, measured by use of the proportion of annual turnover invested in R&D. As noted above, firm's with R&D intensity levels above 5 per cent are generally viewed as high-tech while those with R&D intensity below 5 per cent are classified as low to mid-tech. Forty-four per cent of the sample were low R&D intensity firms while 56 per cent were high R&D intensity firms. Proportionally more Australian firms were high R&D or high-tech than their French counterparts.

< Insert Table 3 Here >

As shown in Table 3 there were no significant differences between high R&D intensity and low R&D intensity firms in relation to the number of innovations that they had commercialised in the previous three years. However, when this issue was investigated in more detail within the cases it was found that differences did exist between the high and low tech firms. For example, 72 per cent of the high R&D intensity firms had over 40 per cent of their commercialised innovations comprised of new product technologies. However, only 45 per cent of the low tech firms had such high output of new product technologies.

Amongst the low R&D intensity firms there was a much higher focus on process technology innovations with 30 per cent of such firms having commercialised such innovations in the previous three years compared to only 14 per cent of high R&D intensity firms. When asked to indicate then nature of an innovation that they had successfully commercialised 82 per cent of high R&D intensity firms identified technological product

innovations compared to 62 per cent of low R&D intensity firms. Further, 18 per cent of the high R&D intensity firms identified market development innovations compared to only 9.5 per cent of low R&D intensity firms. The low R&D intensity firms were also more prone to identifying process technology innovations with 24 per cent identifying this type of innovation while none of the high R&D intensity firms did so. H2 was therefore partially supported with the high-tech (high R&D intensive) firms displaying no significant differences in the number of innovations commercialised when compared to their low-tech counterparts, although the nature of the innovation activity was found to be different.

Measuring Innovation

To test H3 we examined a range of issues with these firms in relation to the seven measures of innovation management identified by Adams et.al. (2006). Table 4 lists a cross-section of these as measured by key items within the case study survey protocol. It is worth noting that despite some apparent differences in the responses by these firms, further analysis of the cases using cross-case comparisons and statistical tests (chi-square) using response rates failed final any significant differences between the low R&D intensive and high R&D intensive firms for most items. The sole exception was in portfolio management where the high R&D intensive firms were found to have a greater focus on product innovations compared to their low R&D intensive counterparts. This provides partial support for H3 in that the behaviour of both types of firm appears broadly similar with the exception of the type of innovation being developed.

< Insert Table 4 Here >

While much has been made of the need for enhanced access to venture capital, government support schemes and publicly funded R&D centres, there was little evidence of these being of importance to the commercialisation strategies of our firms. While high-tech firms appeared to place more value on equity financing than their low-tech counterparts these

results were not significant. It has been suggested that technological entrepreneurship can be fostered if there is better access to university R&D, venture capital and role models of successful entrepreneurs (Venkataraman 2004). Undoubtedly this applies to the "Silicon Valley" business model. However it is less likely to apply to the average low to mid-technology small firm where commercialisation is contingent on the personal relationships forged between the entrepreneur and their customers.

CONCLUSIONS AND LIMITATIONS

The findings suggest that differences across OECD countries may be less in relation to the way SMEs view their respective NIS due to relatively uniform approaches to stimulating innovation by governments. These findings supported H1 and suggest that there may be more similarities than differences between SMEs throughout the world in relation to their ability to engage in innovation, particularly in advanced economies. For researchers this offers an opportunity to develop common measurements and benchmarks of how NIS may support SME innovation.

The findings also suggest that SMEs which may not be officially classified as high-tech can still engaged actively in innovation commercialisation practices. The partial support for H2 indicates that high or low R&D intensity may not influence the quantity of innovation activity taking place within the firm, but it may influence the nature of the innovation activity with a potential separation into product or process innovation foci, a finding broadly consistent with the extant literature (Liao and Rice 2010; Terziovski 2010; Raymond and St-Pierre 2010).

Finally, the study found partial support for H3 and as with H2 it suggests that innovation management in both low and high tech SMEs may be measured using similar tools, but that some of the outcomes (e.g. product or process innovations) may be different. However, it also highlights the rather idiosyncratic nature of innovation management, NPD

and commercialisation within SMEs. Government policy makers seeking to stimulate innovation in SMEs need to be aware of this more idiosyncratic approach to innovation and develop appropriate policy settings. Academics need to find new ways to examine the innovation process in SMEs that do not conform directly to the venture capital fuelled high-tech "Silicon Valley Business Model".

This study has limitations. It draws from a relatively small number of cases in only two countries. The findings should therefore be read and interpreted with caution. Future research needs to encompass a wider range of firms across multiple countries and to undertake more longitudinal analysis using both qualitative and quantitative methodologies.

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Table 1: Australia and France – A Comparison

	Australia	**France**
Land area	7.6 million km²	674,843 km²
Population	21 million	61.8 million
Population growth rates	1.5%	0.6%
Gross Domestic Product (GDP) US$	$831.2 billion	$2,121.7 billion
GDP per capita in US$	$36,637	$33,090
Real GDP growth (annual growth %)	2.3%	0.4%
Government deficit as % GDP	1.0%	-3.4%
ICT investment in fixed capital non-residential	13.3%	16.0%
Households with internet access	67.0%	62.3%
GDP % spent on R&D	2.06%	2.02%
Gross Expenditure on R&D (GERD)	1.97%	2%
Business Expenditure on R&D (BERD)	1.2%	1.3%
Researchers (full time) per '000 employed	8.5	8.4
Scientific articles per million population	1,448	800
% of world output of scientific articles	2%	3%
Tertiary education % of adult population	33.7%	26.8%
Venture capital intensity as % of GDP	0.13%	0.13%
Triadic patent families per million population	14.6	38
World share of triadic patent families	0.6%	5%
SMEs as % of all enterprises	99.9%	99.7%

Source: OECD Statistics (2011) with most statistics dated from 2008

Figure 1: Conceptual Framework Employed in the Study

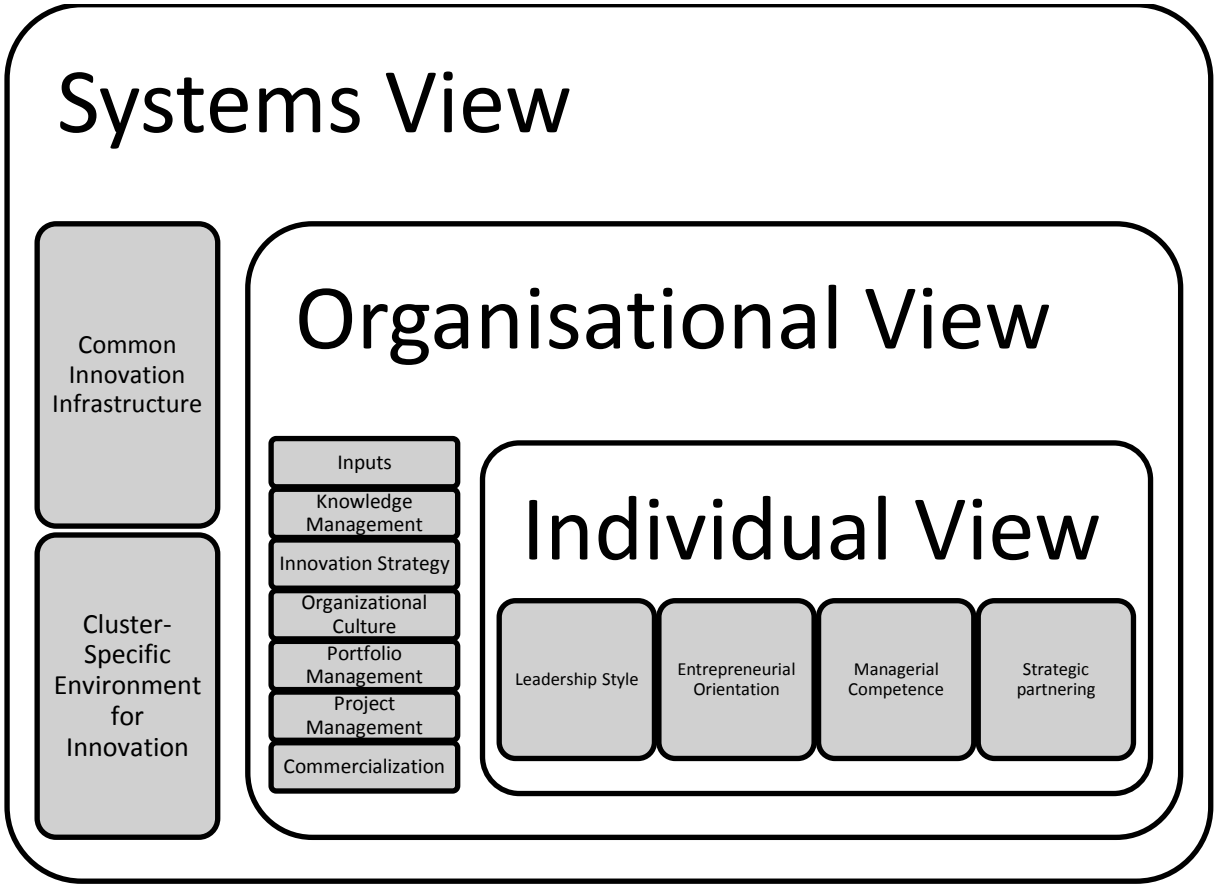

Table 2: Perceptions of the NIS – Australian and French Manufacturing SMEs

Rating scale: 1 = strongly disagree; 5 = strongly agree	Country	Mean	Std. Dev	*t*-test p-value
It is easy for our business to access a workforce with the necessary skills and education?	Australia	2.45	1.183	.072
	France	3.00	1.000	
The cost of doing business is low in comparison to other countries?	Australia	2.28	.882	.001
	France	1.52	.714	
Geographic distance to key markets is not a problem for our business?	Australia	2.79	1.320	.125
	France	3.36	1.350	
It is easy for a business such as ours to access external financing (e.g. banking or venture capital) to fund future growth?	Australia	2.97	1.180	.686
	France	2.84	1.068	
It is easy for a business such as ours to find and recruit high quality managerial staff to assist with future growth?	Australia	2.31	.850	.048
	France	2.84	1.068	
The lifestyle in this country enhances our business?	Australia	3.69	.930	.121
	France	3.28	.980	
It is easy for a business such as ours to access high quality research centres (e.g. universities) locally?	Australia	3.59	1.150	.487
	France	3.36	1.221	
Government support for local innovators is strong?	Australia	2.86	1.093	.758
	France	2.76	1.332	
The regulations governing business operations in this country (e.g. patent laws, taxation, corporate governance rules) are excellent for our business?	Australia	2.76	1.154	.622
	France	2.60	1.190	
The communications' infrastructure in this country (e.g. roads, telecommunications, internet services) are excellent for our business?	Australia	3.79	1.082	.218
	France	4.13	.797	

Table 3: How many innovations has your firm introduced on markets within the past three years? * R&D intensity

Pearson Chi-Square = 3.017; df = 3; Sig. (2-sided) .389			R&D intensity		
			R&D intensity <5%	R&D intensity >5%	Total
How many innovations has your firm introduced on markets within the past three years?	nil	Count	0	1	1
		% within R&D intensity	.0%	3.4%	1.9%
	1-5	Count	13	16	29
		% within R&D intensity	54.2%	55.2%	54.7%
	6-10	Count	7	4	11
		% within R&D intensity	29.2%	13.8%	20.8%
	>10	Count	4	8	12
		% within R&D intensity	16.7%	27.6%	22.6%
Total		Count	24	29	53
		% within R&D intensity	100.0%	100.0%	100.0%

Table 4: Innovation Measures – Low and High R&D Intensity Firms

	R&D Intensity	1-5	6-10	>10
Number of innovations commercialised within past three years.	Low (<5%)	54%	29%	17%
	High (>5%)	58%	14%	28%
Inputs		Little	Some	Important
How important are retained profits to successful commercialisation in your business?	Low (<5%)	17%	%	83%
	High (>5%)	13%	10%	77%
How important is debt financing to successful commercialisation in your business?	Low (<5%)	33%	13%	54%
	High (>5%)	23%	30%	47%
How important is equity financing to successful commercialisation in your business?	Low (<5%)	70%	9%	22%
	High (>5%)	44%	23%	33%
How important is government sponsored support to successful commercialisation in your business?	Low (<5%)	57%	17%	26%
	High (>5%)	55%	31%	14%
Knowledge Management		No	Not sure	Yes
Do you have a formal process for new product development?	Low (<5%)	25%	8%	67%
	High (>5%)	27%	13%	60%
Innovation Strategy		No	Not sure	Yes
Do you feel that the generation of new innovations is a major focus of your firm?	Low (<5%)	17%	0%	83%
	High (>5%)	3%	10%	87%
Organisational Culture		No	Not sure	Yes
Do you actively involve customers in developing your new innovations?	Low (<5%)	8%	17%	75%
	High (>5%)	6%	17%	77%
Do you actively involved employees in developing new innovations?	Low (<5%)	4%	17%	79%
	High (>5%)	17%	14%	69%
Portfolio Management		Product	Process	Other
What type of innovation are you seeking to commercialise?*	Low (<5%)	54%	21%	25%
	High (>5%)	80%	7%	13%
Project Management		No	Not sure	Yes
Do you have an experience project management team to work on the idea?	Low (<5%)	8%	8%	84%
	High (>5%)	13%	23%	64%
Commercialisation		No	No sure	Yes
Do you have the competencies to fully commercialise the innovation alone?	Low (<5%)	25%	4%	71%
	High (>5%)	17%	17%	66%
Have you fully researched if there is a customer ready to adopt this innovation?	Low (<5%)	8%	8%	84%
	High (>5%)	3%	7%	90%

*Significant differences were found between High & Low R&D intensive firms on these measures.