The French National Innovation System: An International Comparison from the Small Firms' Perspective

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Abstract: This study examines the national innovation system of France and focuses on the innovation practices of small firms. It compares the perceptions of senior managers from small, innovator firms in France with those from Australia and Switzerland. The role of government in supporting small firms in their commercialisation was also highlighted as being important. Consistent with the findings from earlier studies the central role of leading customers in influencing the decision to proceed with an investment in an innovation was also highlighted.

Keywords: innovation management, small firms, national innovation systems, case studies.

1. National Innovation Systems

The concept of a National Innovation System (NIS) has emerged over the past thirty years as a response to the recognition that innovation within a national economy cannot be understood as a simple input-output process (OECD, 1997). Traditional measurements of innovation within a country focused on inputs such as expenditure on research and development (R&D) or the number of research scientists employed. With outputs being such things as the number of patents generated (OECD, 2001).
However, research into the nature of NIS since the 1980s has highlighted the importance of networking between public and private organisations located within the nation state that serve to generate and

diffuse new ideas, technologies and economic opportunities (Freeman, 1987; Nelson, 1993a; Patel & Pavitt, 1994a). An NIS may be defined as:

"…that set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies." (Metcalfe, 1995).

Academic study of NIS by various innovation scholars (e.g. Lundvall, 1992; Freeman, 1995; Edquist, 1997; Nelson, 1993b; Larédo & Mustar, 2002) can be seen as part of the neo-Schumpeterian challenge to neo-classical economics. This underlines the importance of specifying contexts in terms of time and space and argues that institutional differences can have an important influence on the rate and direction of innovative activity (Lundvall, 1998). Balzat and Hanusch (2004: 197) describe an NIS as: "…a historically grown subsystem of the national economy in which various organizations and institutions interact with and influence one another in the carrying out of innovative activity."

It is thus about a systemic approach to innovation in which the interaction between technology, institutions, and organizations is central. The focus of an NIS should be not only on high technology, but the application of technology and innovation across all industry sectors, with particular focus on intersectoral knowledge flows, and the role of the national education system to supply skilled labour (Lundvall, 2007).

An important aspect of the NIS is the role of the government in setting national policy that can enhance the generation and commercialisation of innovation (Trott, 2007). Much of the innovation is generated from publicly funded research within universities or other scientific R&D centres. Its commercialisation is fraught with risk and often requires collaboration between public and private institutions with numerous issues arising in relation to governance and cooperation. The NIS concept has resulted in a structurally different view of how governments can stimulate the innovation performance of a country (Patel & Pavitt, 1994b). For example, in France the government is known to be playing an important role in the French economy. And that influence can be shown by the fact that the share of private funding in R&D was 55 percent and is increasing year by year, but it remains considerably lower than most of the developed countries, where private funding for R&D in general account for 60 to 70 percent of total funding (Français dynamiques).

The concept of the NIS emerged in the 1980s as a move towards a systemic approach to innovation at the macro economic level (Nelson, 1993b). While individual actors and national framework conditions are of key significance, linkages between them are equally important (OECD, 1997). For example, there is evidence that economic growth and labour productivity are correlated with the level of innovation within a nation's industries (Crosby, 2000). Porter and Stern (1999; 2001) have defined what they call the "National Innovative Capacity Framework" which is comprised of three broad elements.

The first of these is the "Common Innovation Infrastructure", which in turn consists of three key components: i) the cumulative technological sophistication of the national economy; ii) the human capital and financial resources that are made available for R&D activity; and iii) the level of resources and policy commitments made by public authorities to innovation. The second element of the framework is the "Cluster-specific Environment for Innovation", which consists of the interrelationship between what Porter (1990) has identified as the diamond of competition (e.g. factor inputs, demand condi-

tions, firm strategy and rivalry and related and supporting industries) taking place within industries. The third element is the quality of the linkages that exist between the common innovation infrastructure and the industry clusters in which individual firms compete.

The interrelationship between the various elements of a national innovation system impacts upon the level of R&D and commercialisation taking place within the economy (Berger & Revilla Diez, 2006). For example, regions that are well supplied with physical and information infrastructure (e.g. transportation, information and communications technologies) are more likely to be economically prosperous and innovative. The quality of the education and training system within a region can also have a positive influence by ensuring a steady supply of skilled employees and managers. Innovation is also fostered by the presence of locally based research centres such as universities. Government can also assist R&D and commercialisation through regulations protecting intellectual property rights (IPR), as well as assisting small firms with establishment costs or tax concessions (Porter, 2001a).

The level of innovation found among firms is contingent in part on its internal structure and the nature of its managerial leadership. However, the firm's external environment also impacts on its level of innovation and how successful it is in undertaking commercialisation activities (Berkhout, Hartmann, van der Duin, & Ortt, 2006). Regional economies are shaped by their local firms and it is important to focus policy support upon the small firms in order to enhance the overall level of innovation with the economy (Sternberg & Arndt, 2001). 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, 1993b). The success of an NIS is thus 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.

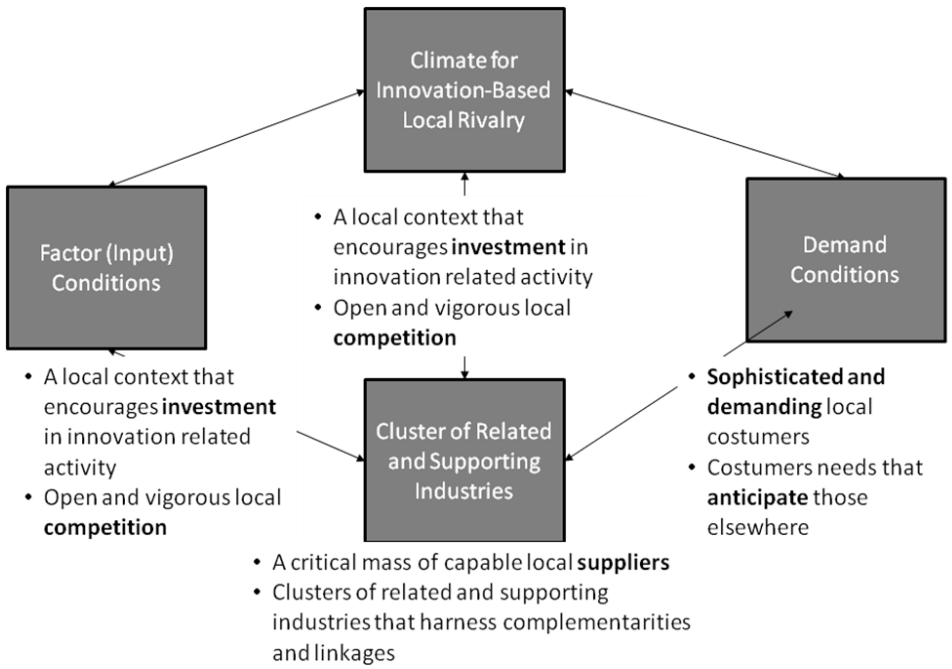
The first involves the failure to provide adequate infrastructure and investment, particularly the ability of governments to supply R&D or communications infrastructure, plus the availability of venture capital. The second is that of "transition failures" where there is a failure of new ideas or technologies 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).

2. Small Firms and the NIS

Small firms are those with fewer than 250 employees and an annual turnover of less than €50 million (OECD, 2004a). Most are micro-enterprises with less than 10 employees and in many of the world's economies they contribute to a significant proportion of the national investment in R&D (OECD, 2004b). As Porter and Stern (2001) suggest in their "National Innovative Capacity Framework", there must be good investment in the "Common Innovation Infrastructure" of the country, with attention given to education and the overall technological sophistication of the economy. However, there must be strong linkages between these elements and mechanisms to assist small firms to make such connec-

tions. This will avoid the risk of the failures highlighted above. The need to assist entrepreneurs to access external networks and to develop the strategic management skills for dealing with such networks is important. Other research has suggested that small business manufacturers shun collaborative alliances out of a fear of information leakage, the desire to remain independent, a distrust of other firms or difficulties in identifying suitable partners (Dean, Holmes & Smith, 1997). Building trust between entrepreneurs from small firms is therefore a key issue (Brunetto & Farr-Wharton, 2007).
Porter (2001b) has suggested that the key elements determining the overall competitiveness of a region or country are: i) the factor input conditions (e.g. supply of skilled labour, cost of raw materials and doing business); ii) the climate for innovation-based local rivalry between firms; iii) demand conditions (e.g. size, sophistication and proximity of markets); and iv) clustering of related and supporting industries. These four elements are illustrated in Figure 1. This model recognises that different countries can have different innovation systems and that some of these differences may have an impact on the capacity of firms to innovation.

Figure 1: Key elements of an Innovation-Oriented National Industrial Cluster



Source: Stern (2004).

3. The French NIS

According to Malerba (2005), one of the main challenges for the system of innovation literature is to explore the dynamics of the system, in particular how do new systems emerge and what is the link with the previous system. The French NIS has progressively evolved from an over centralised and planned stage, to a more decentralised and flexible system, looking for internal synergies. Since the

Second World War, the different political changes that occurred in France progressively shaped the current NIS.

The fifth Republic was created in 1958 with Charles de Gaulle as President. Drawing heavily upon French culture, his notion of glory and grandeur were central to the process national unification and reconstruction. The State played a major role in formulating and implementing industrial policy (and this) thanks to a particularly rigid and highly centralised form of state control. Another characteristic has been the separation of large firms from major public sector research organisations with a lack of interaction between them. De Gaulle forged the French economic policy that still exists in France today as it employs a highly socialist and protectionist strategy. For example, the French continue to subsidize their own domestic industries, and place restrictive tariffs on imports while simultaneously seeking to open the international market to their exports. The central planning office still exists in Paris and continues to generate five-year plans for the government. (Harrison & Dockery, 2007)

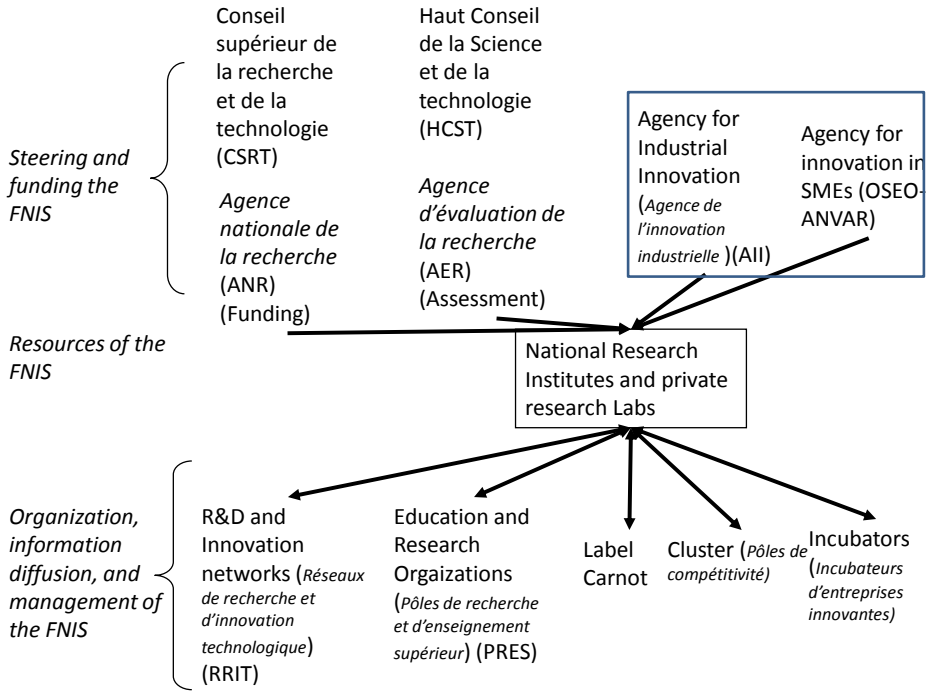
French politics is traditionally divided between right and left, which have opposing views for the direction or the national economy and therefore innovation. Under different governments, conservative and socialist, nationalisation allowed the state to act as an employer and producer of goods and services on a large scale. Even where firms were not taken into public ownership, France had and sometimes still has, a style of state involvement in individual company funding and strategy formulation, by building a consensus around a set of medium term priorities; promoting 'National Champions' to be competitive in global markets; and acting as entrepreneur itself in a series of government initiatives or 'Grands Projects', based largely upon industrial patriotism rather than commercial prospects. Those periods were a sort of "Golden Age" for French R&D (Walsh & Le Roux 2004).

The evolution of the French NIS is outlined in *Table 1 (see appendix)* where it can be seen that the period immediately following the Second World War until the 1980s was focused mainly on large national projects. By the 1980s greater attention was being given to the regions along with a desire to see enhanced linkages between industry and publicly funded research centres such as universities. Driven by the need for increased levels of international competitiveness and the integration of the French economy into the European Union (EU), the 1990s saw the emergence of the first of a series of great national debates over the state of the French NIS. A major part of this period was the recognition of the need to reform the French higher education system and publicly funded scientific research community. This was a debate being echoed in other EU countries (Slaughter & Rhodes, 2004). More recently the national debate on the state of the French NIS has continued with greater recognition of the role of small firms within the wider economy and their capacity to make a significant contribution to the level of innovation in the country.

Much research has focused on the resulting NIS system of France (Guermond 2001, Walsh & Le Roux 2004, Larédo & Sachwald 2005) and special attention was given to the importance of regional competencies, learning abilities and knowledge potentials for interregional competition and for the kind of innovation activity. There is a series of organisations aiming to bring together the (numerous) actors on the regional level, such as: i) technical centres; ii) regional centres of innovation and technology transfer (CRITT) and the Centre of Technological Resources (CRT) which offer scientific and technological services; iii) the national centres of research and technology (CNRT) which bring together public research laboratories and private research centres. The networks of technological development (RDT) which are networks of institutional actors such as OSEO, DRIRE, DRRT and the chambers of commerce, aiming to exchange and provide information for the benefit of small firms,

even the less 'innovation-aware' ones. Figure 2 illustrates the complexity of the system and the difficulty to establish a clear governance.

Figure 2: Structure and governance of the French NIS



(after Fernez-Walsh & Romon, 2006)[1]

4. Innovation in Australia, France and Switzerland

As previously discussed, France can defined as a centralised, bureaucratic country with a strong focus on publicly funded research, but a rather weak dynamism in its financial markets. In addition it has been viewed as experiencing a slow rate of evolution and only a weak entrepreneurial spirit. The antecedents leading to these characteristics in France are an accumulation of its history, culture and political organisation. Economic reform remains a major issue of political importance within France at time of writing. In this study we have sought to compare France with two other OECD countries: Australia and Switzerland with respect to their NIS and its likely impact on innovation in small firms.

Australia, France and Switzerland are all members of the Organisation for Economic Co-operation and Development (OECD) and all have advanced, affluent economies. However, there are also many differences to be found between them. Australia is an island continent located in the southern hemisphere adjacent to South East Asia and the Pacific a relatively young nation; it has a resource-based economy focusing on the export of minerals, natural gas, food and fibre. By contrast, France is in the northern hemisphere within Western Europe and is a founder member of the European Union (EU). The French economy has both a significant manufacturing base and a major agricultural sector, and is

[1] *The Agency for Industrial Innovation and OSEO merged in November 2007.*

the home of many major companies with significant R&D investment. Switzerland is a relatively small nation within the heart of Europe but not a member of the EU. The small size of Switzerland belies its strength as a centre of many world class companies in the financial services and manufacturing sectors.

Table 2 (*see appendix)* provides a comparison of these three countries drawing upon OECD statistics from 2005. It can be seen that France has three times the population of Australia and around six times that of Switzerland, with over twice the GDP of Australia and seven times that of Switzerland. However, Australia's real GDP growth rate is around 3 times that of France while Switzerland's is nearly double, and the per capita income of both Australia and Switzerland are higher. At the time this study was undertaken, the unemployment rate in France was double that of Australia and Switzerland while rates of hours worked during the year and self-employment levels were also lower in France.

An examination of the relative investments in R&D and education within the two countries shows that Switzerland invested more of its GDP on R&D. While expenditure on education was similar, in France and Australia, it was significantly higher in Switzerland. In the field of information and communications technologies (ICT), Australia had been investing more than France and more Australian households had access to both computers and the Internet. Nevertheless, Switzerland out performed both in terms of household ICT usage. Australia and France have major agriculture sectors and innovation has been a major driver for agriculture in Australia as commodity prices became increasingly squeezed and the need for more sustainable production techniques increased. The need to maintain the effectiveness of innovation adoption and diffusion within the agriculture sector was a concern within Australia (Marsh & Pannell, 2000).

In terms of patenting activity France has substantially more patent families than either Switzerland or Australia. The OECD uses the concept of patent families, defined as *"a set of patents (originating from the priority filing) taken in various countries (i.e. patent offices) to protect the same invention"* (Dernis & Khan, 2004 p.7). Triadic patent families are based on the notion of a patent lodged across the three principal Patent Offices in the United States, European Union and Japan. In 2003 Australia had just over 431 triadic patent families recorded by the OECD as compared with 894.5 from Switzerland and 2,356 from France. However, while the total number of such patent families had grown by around 24 percent in France over the period from 1990 to 2003, the growth rate in Australia over the same period was 133 percent and that from Switzerland 9 percent (OECD, 2007).

Innovation, particularly the commercialisation of new technology, has been a key feature of Australian Federal Government policy since at least the early 1990s (DCITA, 2004). Initiatives have involved increasing the level of funding for fundamental scientific research at universities and major research centres, grants for investment in R&D infrastructure, and funding for commercialisation of new technology across a wide range of sectors, but particularly ICT and biotechnology. A strong emphasis has been placed on inter-industry linkages and clustering activities, as well as strengthening the nexus between the universities and other publicly funded R&D centres, and industry (Molyneux, 2000). These public policies were in response to concerns raised in the late 1980s and 1990s over Australia's relatively poor track record on commercialisation despite having a strong track record in scientific research (Wood, 1992). The need for Australia to invest in R&D and commercialisation was seen as important to the nation's ability to maintain its international competitiveness (Roach, 2000; Ferris, 2001; Kerin, 2006). As a result of such policies, private sector investment in R&D since the early 1990s has risen within Australia (Garrett-Jones, 2004), and Australia's universities rank well

against their counterparts in Europe and North America in terms of technology transfer and commercialisation (Yenken & Gillin, 2006). Australia was ranked in seventh place against the European Union (EU) countries in terms of the level of innovation activity within its manufacturing industry, and ninth in terms of its services sector (ABS, 2003).

By comparison France ranked twelfth within the EU in terms of manufacturing and fifteenth for service firms (ABS, 2003). This type of innovation ranking has generated some anguish within France over its international performance, leading many analysts and commentators to suggest that it is a reflection of economic decline (CPCI, 2006). Growth and innovation within smaller French firms (e.g. under 100 employees) has been significantly less than for medium sized firms (e.g. 100 to 500 employees) (OSEO, 2006). Initiatives targeting innovation and growth in small firms have been launched in recent years by the French Government (Ministère délégué à la Recherche, 2003, Lesourne & Randet, 2007) and the French Managers Association (MEDEF, 2002), as will be seen in next paragraphs.

Switzerland performs very well in terms of nearly all available indicators of science, technology and innovation, often holding with a leading international position (OECD, 2006). At the European level, Switzerland is among the leading countries in terms of innovation and is ranked in second place out of 33 countries, according to the 2005 European Innovation Scorebord (European Communities, 2006). In most of the innovation indicators Switzerland is well above the EU average (e.g. lifelong learning, intellectual property output, and value added in high-tech manufacturing). Only two indicators (science and engineering graduates and public funding innovation) fall below the EU25 average.

5. Methodology

5.1. Questionnaire

The questionnaire used in the study was developed as a diagnostic tool designed to assist managers from small firms to evaluate the risk and return of future investment in a particular innovation, and to assess their managerial practices in relation to commercialisation, considered as critical points for a small firm, as mentioned in the introduction of the paper. It includes also a set of questions on the perception of the national environment. Ten items measured the small firm manager's perceptions of the national environment. These included the elements of the "National Innovative Capacity Framework" as defined by Porter and Stern (2001), with attention given to the access to a skilled and educated labour force, to the cost of doing business, to the access to key markets and financial resources, to the access to research centres and to government support for innovation. Also canvassed were opinions of the quality of lifestyle within the country. Lifestyle within a country or region has been associated with enhanced levels of innovation due to its ability to attract and retain creative, entrepreneurial people who bring their skills, talents and expertise (Florida, 2002).

5.2 Sample

The study drew a sample of 143 small firms comprising 39 French, 40 Swiss and 64 Australian companies. The selection of the sample was undertaken on the basis of size and level of innovation. The OECD (2004) definition of small firms was used to define the parameters for firm selection. There-

fore, the units of analysis in this study are firms with 10 to 250 employees and a turnover below €50 million. As there were no reliable databases of innovative small firms, the research team made use of some held by government agencies, listings in technology parks, and their personal networks within the business communities of their home countries, in order to boost the size of the sample.

Data collection was undertaken via face-to-face interviews after an initial contact letter was sent to the CEO of the company explaining the study and seeking their participation. Each interview lasted around 2 hours and involved the respondent completing a questionnaire, used for the quantitative part of the survey, as well as a discussion of its outcomes.

The sample firms were drawn from a variety of industries, although the largest proportion (31%) was manufacturers, which is explained by the desire to find firms that had clearly identifiable innovations. No significant differences were found between the three countries in terms of industry type. The average length of time the firms had been in operation was 24 years. ANOVA tests showed that Australian firms were on average younger than those from France and Switzerland. The firms from Australia had a mean age of 12 years while the French firms were an average of 39 years old and the Swiss firms 29 years old.

In terms of size, the firms had annual turnovers ranging from less than US $50,000 to just over US $40 million, with an average of US $15.5 million. The average size of the firms was 59 full time employees. The Australian firms were found to be significantly smaller than their French counterparts with an average of 32 full time employees as compared to 95 employees in the French firms. The Swiss firms, with an average of 68 employees, were in the middle.

5.3. Data Analysis

The survey data was subsequently examined using a discriminant analysis procedure, which is useful for building predictive models of group membership based on the characteristics of individual cases. The group membership used for this analysis was country (e.g. Australia, France or Switzerland), and the predictor variables were the ten items relating to the respondents' perceptions of the external environment as conducive for innovative small firms, and the items from the four indices relating to market, innovation, resources and strategy.

The CEO in each firm was asked to comment on their perceptions as to the general climate of innovation within their country. This perception is mentioned by the literature as having strong influence over the small business manager's strategic decision making (Gagnon, et al, 2000). This was explored with a series of questions that examined how easy or difficult they felt it was to manage a competitive, innovative firm within their country. Key issues examined were access to a skilled and educated workforce, the cost of doing business, the geographic distance to key markets, access to external financing, ability to find and recruit high quality management staff, lifestyle, access to university and other research centres, government support for innovation, compliance costs and regulations, and the quality of the communications infrastructure.

The discriminant analysis models were run using the step-wise procedure in the SPSS statistical software program. In each case a varimax rotation procedure was employed in order to provide clear separation of the functions. A hold out sample was not employed as the predictive accuracy of the final model was not the paramount objective of this analysis (Birley & Westhead, 1993). For each model Wilk's Lambda statistics were used to determine if the discriminant models as a whole were significant (Wilks & Thompson, 1937). Rao's V was used to determine the inclusion of the items in the

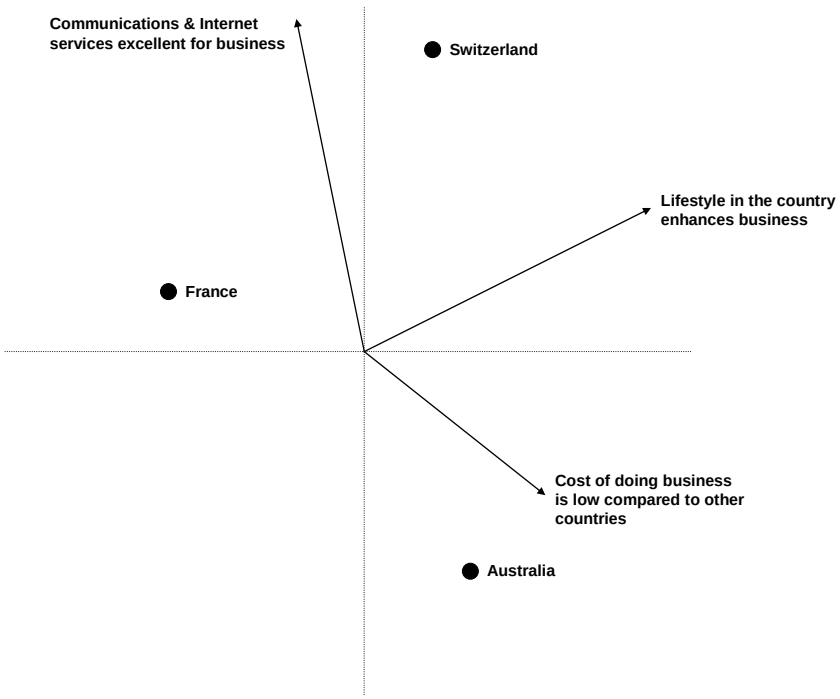
models with a range from 0.05 to 0.10 significance levels of the F-statistics determining entry or removal. The minimum Rao's V for entry was 0.

A discriminant analysis was undertaken with the ten items relating to how the external environment supported innovation for small firms as independent variables, and the three countries as grouping variables. The Wilks Lambda measure was 0.903 with its chi-square significant at the 0.001 level. The model used 135 of the 143 cases in the sample (94.4%), and correctly classified 64 percent of the cases. Two standardized canonical discriminant functions were generated after the varimax rotation identifying three of the original ten items as significant within the model. The first function accounted for 76.4 percent of the variance in the model, and the second function for the remaining 23.6 percent.

6. Findings

The results from the discriminant analysis are shown in Table 3 *(see appendix)*. In addition, Figure 3 illustrates the findings using a diagram to plot the relationship between the three country sub-populations and these descriptors. The rotated standardised canonical discriminant function coefficients for the significant independent items within each model were then used in conjunction with the group centroid functions for the grouping variables to estimate visual plots illustrating the relationships between these variables.

Figure 3: Discriminant analysis plot of external environment



As shown in Figure 3, the Australian managers were more likely to view the cost of doing business in their country as a positive for small firms seeking to commercialise new innovations than did those

from France or Switzerland. The Swiss managers were more likely to express a positive view in relation to their national infrastructure with the Australian managers being more negative about their national transportation and communications infrastructure. The managers from all three countries indicated a strong, positive perception of the lifestyle in their country. However, the Swiss were significantly more positive than the French over this issue. Both Swiss and Australian managers were more likely than their French counterparts to express a positive view of lifestyle as being an enhancement to business. The details for 5 more critical items are given below.

6.1 Access to a Skilled and Educated Workforce

An analysis using ANOVA tests (one-way) also found Australian and Swiss managers more negative over their ability to access skilled employees than their French counterparts. This may be explained by the low levels of unemployment found in these two countries at the time of the study as compared to France where unemployment levels were double. It highlights the problem faced by small firms engaged in growth who have to compete for employees within the wider labour market, typically competing against larger firms that can frequently offer better wages and conditions.

6.2. The Cost of Doing Business

French managers were also found to be significantly more negative in relation to the cost of doing business than Australian or Swiss. The negative view of the French firms toward the cost of doing business may be explained in terms of the general feeling of French managers that firms are overtaxed in France. This feeling was generally stronger among French small business managers, especially since the implementation of the Law recommending the 35 hours working week.

6.3. Access to key Marketing and Financial Resources

Swiss firms were also found to be significantly more likely than Australian firms to agree with the view that geographic distance to markets was not a problem for them. This is a reflection of Switzerland's central location within the heart of Europe, and Australia's relative geographic isolation from major northern hemisphere markets. Swiss firms were also found to be significantly more positive over the availability of external financing than were the Australian firms. This may reflect the presence within Switzerland of many strong international banking and financial services organisations, and it's relatively more sophisticated financial market when compared to Australia. It should be noted that 63 percent of the Australian and 79 percent of the Swiss firms indicated that they considered equity financing as being important to the future growth of their business. By comparison only 24 percent of the French firms held this view.

6.4. Access to Research Centres

The Swiss were significantly more positive than the Australian or French firms in relation to their ability to access high quality research centres such as universities. This feeling of the French firms can probably be linked with the generally difficult relationships that exist between French universities and French firms. The actual level of sentiment across the region might also be even higher because of the specificity of the Bourgogne region in contrast with other more dynamic French regions. The Bourgogne region suffers from a lack of research institutions and universities that can partly explain this appreciation.

6.5. Government Support for Innovation

No differences were found between the countries in terms of how they viewed the level of government support for innovation, with most being either negative or equivocal. However, the Swiss firms were found to be significantly more positive over the regulations and laws governing business operations than were the Australian and French. Finally, the three countries were found to be quite different from each other in relation to the perception that the communications infrastructure in the country was excellent for business. The Swiss firms were the most positive, followed by the French and then the Australians. This may reflect the problems facing Australia as a geographically very large country with a fast growing economy that has begun to place pressure on the national telecommunications, rail, road, sea and air transportations systems. At the time the data was being collected, there was a strong debated within political circles of the need for greater investment in infrastructure.

7. Discussion of the Findings

What do these findings tell us about the nature of innovation management in small firms? With respect to the four research questions initially raised by this study, the findings suggest that the national innovation infrastructure within a country is viewed as potentially important to small innovator firms. All three of the countries examined in this study are advanced western economies, yet the differences found between them in relation to the responses from these firms indicates that government investment in infrastructure, the cost of doing business, the geographical proximity or isolation of the country and the overall economic conditions it is experiencing all may impact upon the capacity of small innovator firms to do business.

While measuring the impact of the relationship between the national innovation system and the success or failure of the commercialisation within small firms is difficult to determine from the data available, the results suggest that managers from small innovator firms do view their external environment as having an impact on their ability to manage innovation and commercialisation activities. Although government support was treated with some negativity or indifference, direct assistance in the form of R&D grants or commercialisation support can be beneficial and many of the smaller firms, particularly those in Australia, were positive about this. The role of government policy and compliance issues also loomed large in the responses of the Swiss firms, suggesting that this is an area where innovation can be enhanced or impeded. The cost of doing business was an issue for French firms, suggesting that government taxation and labour market reforms can play a role in influencing innovation activity amongst small firms. Also important can be the ability of small firms to access R&D centres such as universities, or infrastructure such as telecommunications, road, rail and air transportation, financial and physical resources. As highlighted in the findings, Swiss firms seemed the most positive about such issues.

The findings suggest that the recent reforms to the French NIS are yet to have a major impact on small firms. As illustrated by the responses from the Australian and Swiss firms, government support for commercialisation can have positive impacts and is an area that the French Government should continue to pursue.

8. Conclusion

The French NIS has experienced many changes over the past 60 years with a move from large, national projects to a more diverse, regionally focused approach with greater attention given to the role of small firms. Unlike their larger counterparts the small firm is generally unable to find the time and resources to engage in long term R&D projects with universities. Investments in innovation need to be generate quick returns that can boost the firm's cash flow (Mazzarol & Reboud, 2006). As Lundvall (2007) has observed, the focus within an NIS should not only be upon the high technology sectors and the direct engagement of universities with industry for R&D projects. Also of importance are the low technology sectors and how the NIS enhances the diffusion of innovation into the firms that comprise these industries. Such innovation adoption by less high technology sectors is likely to have a significant impact on the overall productivity of the economy.

This paper has drawn upon the findings of a small scale study of small innovator firms in France, Australia and Switzerland in order to examine aspects of the impact on such firms of the NIS. The French NIS has been examined as a particular point of focus and the results suggest that the national environment and government policy does impact on these firms, with some inter-country differences. Future research should draw a larger sample from a wider range of countries to evaluate the extent of cross-national differences in innovation policy and the impact that this has on the business activity of small firms.

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Table 1: Four steps in the construction of the French NIS

Main reports and key words	Aims and objectives of the policy
1945-1980: "Colbertiste", "trente glorieuses" "Big Programs", "National Champions", creation of ANRT* (1953)	France's position as the global leader in specific sectors, which requires substantial financial investments and extensive use of scientific research and technological innovation.
1980s: Attempts to decompartmen-talize public research	
1982: creation of CSRT*, BCRD*	Coordinating the public funding for R&D, the principle of intervention of regions in the FNIS, the principle of extending the mission of personnel and public research institutions in the use of research results
1990s: First great national debate	
1998: Guillaume[1]'s report (about the weaknesses of the FNIS), July 1999: New law of orientation of the research and innovation.	Growing involvement of institutions of higher education and research in applied research, and growing role of regional institutions and European research and innovation. Better situation for the public institutions in science and technology (Especially universities). Public researchers will be able to work as consultants or to set up a business.
2000s: Second great national debate	
2001 Creation of FUTURIS* 2003, the researchers protest. Beffa's report (2005) thus creation of AER* & ANR*, and 67 projects of "pôles de compétitivité" (jul 2005), AII* (aug 2005), HCST (nov 2005), « Carnot* » (mar 2006) }	Previous laws (1982, 1999) did not prevent France of losing grounds on the international scene. According to studies conducted by FUTURIS (1-Unproductive expenditure R & D, 2-Misdirecting public expenditure) => The launch of major structuring programmes.

* ANRT: Association nationale de la recherche technique
CSRT: Conseil supérieur de la recherche et de la technologie
BCRD: Budget civil de R&D
FUTURIS: Futur, Recherche, Innovation, Société
HCST: Haut Conseil de la science et de la technologie
ANR: Agence nationale de la recherche
AER: Agence d'évaluation de la recherche
AII: Agence de l'innovation industrielle
HCST: Haut Conseil de la science et de la technologie
Carnot: First twenty groups of public research centres

(based on Fernez-Walch & Romon, 2006)

[1] *CEO of the National Agency for Research Valorization (ANVAR), which was then renamed as OSEO when it merged with the Bank for SMEs (BDPME) at the beginning of the 2000s.*

Table 2: A Comparison of Australia, France and Switzerland (2005)

Country	Australia	France	Switzerland
Total population (millions)	20.3 m	60.9 m	7.4 m
GDP (US $ billions)	$701 bn	$1,897 bn	$267.4 bn
Real GDP growth rate	2.8%	1.2%	1.9%
Per capita GDP (US $)	$34,239	$30,266	$35,649
Proportion of manufacturers that are small firms	94%	90%	88%
Unemployment rate	5%	10%	4.5%
Self-employment rate	13%	9%	11%
GDP expenditure on R&D per annum	1.64%	2.16%	2.94%
Investment in ICT as a % of total non-residential fixed capital formation	21.5%	16.4%	n/a
Proportion of households with access to home computers	67%	50%	71%
Proportion of households with access to the internet	56%	34%	73.5%
Proportion of age group 25 to 64 years with tertiary level education	31%	24%	28%
Expenditure per student in tertiary education: 2003 constant prices (US $)	$12,405	$10,704	$25,900
Total expenditure as % of GDP on education institutions for all levels of education	5.8%	6.3%	6.5%

Source: OECD Statistics (http://stats.oecd.org)

Table 3: Results of the Discriminant Analysis

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.347(a)	76.4	76.4	.508
2	.107(a)	23.6	100.0	.311

a First 2 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 2	.670	52.376	6	.000
2	.903	13.348	2	.001

Rotated Standardized Canonical Discriminant Function Coefficients(a)

	Function	
	1	2
The cost of doing business is low in comparison to other countries?	-.386	.492
The lifestyle in this country enhances our business?	.372	.756
The communicaitons infrastructure in this country (e.g. roads, telecommunications, internet services) are excellent for our business?	.872	-.180

Coefficients are based on rotated structure matrix.
a % of variance by function 1 = 72.8, function 2 = 27.2

Functions at Group Centroids

Country	Function	
	1	2
Australia	-.550	.252
France	.167	-.551
Switzerland	.832	.150

Unstandardized canonical discriminant functions evaluated at group means