Innovation, Technology and Commercialisation in an SME Environment

Brian Gibson, University of New England, NSW, Australia
(Author for correspondence:
School of Business economics and Public Policy
Armidale NSW 2351
+61 2 6773 2838 brian.gibson@une.edu.au)

Dianne Wingham, University of Newcastle, NSW, Australia

Ramraini Ali Hassan, Murdoch University, WA, Australia

Introduction

This paper has a simple focus. It is based on the premise that innovation at its various levels is intertwined with the evolution of new technology and that the transfer of that technology (business to business or business to consumer) is achieved through the process of commercialisation. In taking a basic perspective the intention is to encourage those with an interest in these aspects of firm operations to not lose sight of the simplicity of the commercial arrangements that has seen humanity grow through technology transfer. It is also a reminder that a considerable proportion of the innovation that drives economic growth emerges from the activity of individuals or institutions and has done so successfully for many years without the intervention of governments and public research institutions.

The paper proceeds with an initial discussion of the nature and interrelatedness of innovation, technology and commercialisation. A critique of the policy focus on innovation and its consequences for SMEs is then provided.

Innovation

Innovation research has been characterised as falling into two major research streams, one at the macroeconomic level and the other with a microeconomic or organisational focus (see, for example, Brown and Eisenhardt, 1998; Dibrell, Davis and Craig, 2008). According to O'Neill, Pouder, and Buchholtz (1998) and Dibrell, Davis and Craig (2008) the first of these regards innovation as a technology, strategy, or management practice that a firm is using for the first time (whether other organisations or users have previously adopted it) or as a significant restructuring or improvement in a process. The principal focus of research in this stream is the diffusion of innovation through organisations, industries, and nations. The focus of the second stream is on the organisational development and marketing of new products (or services as discussed in Miles, 2008) with a focus on the influences of internal structures, strategic processes and people (Zahra, 1993; Dibrell and Craig, 2006; Dibrell, Davis and Craig, 2008). Innovation from this perspective represents the commercialisation of inventions (where invention includes any act of insight).

Regardless of perspective, innovation is often explored from a number of dimensions including radical, incremental, product, process and market. Radical innovation, as defined by Mole and Worrall (2001), refers to new technologies or new products that fill needs. Incremental innovation, however, improves what already exists including incremental changes in the organisational structures and moves to exploit new market (Avermaete, Viaene, Morgan, and Crawford, 2003). Further dimensions are provided by Johne (1999) who classifies innovation into three types - product (and service) innovation , process innovation and market innovation. These dimensions or domains of innovation are represented in Figure 1.

According to Avermaete, Viaene, Morgan, and Crawford (2003)., innovation occurs as a result of changes in these four domains of innovation as shown by the arrow between boxes in Figure 1. As these authors explain, product innovation occurs from any changes in the organisational structure. Process innovation is said to exist as a result of changes in current production lines as well as implementation of new infrastructure. Organisational innovation occurs when there are changes in marketing, purchasing and sales, administration, management and policy. Finally, market innovation is assumed to be as a result of the exploitation of new market area and segments in the existing market area.

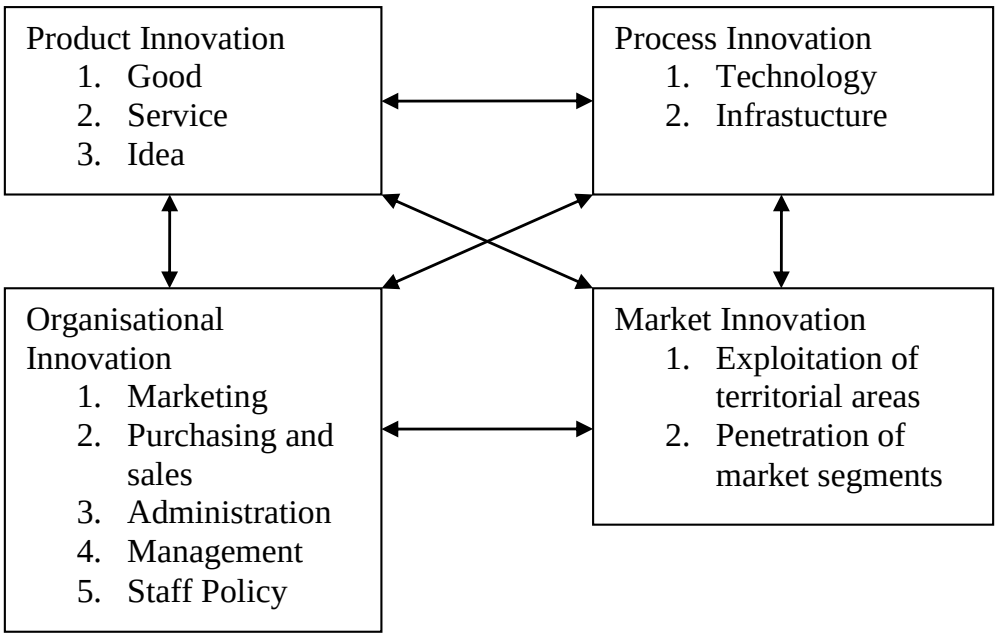

Figure 1 Domains of Innovation

Source: based on Avermaete, Viaene, Morgan, and Crawford, 2003

Technology and Commercialisation

Clear in the previous discussion is the importance of understanding technology in defining innovation. A simple definition of technology, which suggests it is little more than the most current collection of available innovations, is:

> … a collection of techniques. In this context, it is the current state of humanity's knowledge of how to combine resources to produce desired products, to solve problems, fulfill needs, or satisfy wants; it includes technical methods, skills, processes, techniques, tools and raw materials (Wikipedia, 2008)

The focus of much research (see, for example, Lipinski, Minutolo and Crothers, 2008) is on the transfer of technology – a concept that often has an information technology focus and more recently seems to have been identified as the domain of University and public research institutions. However the concept of technology transfer is also simple:

> Technology transfer is the process by which knowledge, intellectual property, and/or capabilities are transferred to any other entity, including private industry, academia, state and local governments, or other government entities, to meet public and private needs (Anon. 2007)

While not specifically mentioned it is implied in such a definition that this transfer is achieved with the intent of some individual or institutional gain (which may or may not be financial). In essence technology transfer represents the commercialisation aspect of innovation and while it may include academic or public research institutions it is not exclusively their domain.

The Policy Focus on Innovation

Innovation is widely recognized as a major contributor to nation's economic growth and both public and private sectors are considered to be key players in promoting innovation activities. Over time, increased activity in the fields of science and engineering by both public and private sector institutions has contributed largely to technological change at the national level (Salmenkaita and Salo, 2002). As a result, governments have developed specific policies which focus on the promotion of innovation activities carried out in both the public and private sectors. These 'innovation policies' according to Salmenkaita and Salo (2002) are developed with a sole purpose to encourage both private and public organisation in the development and commercialisation of new technologies. These policies also represent 'government intervention' through its influence on resource allocation decisions.

As further explained by Salmenkaita and Salo (2002), government intervention is usually based on four rationales: the market; systemic failure; structural rigidities; and anticipatory myopia. Market and systemic failure consider the institutional structure of the research and development (R&D) system as a given and attribute the production of non-optimal outputs to problems of appropriability and coordination. The structural rigidities rationale, however, examines the structure of the innovation system as a variable that is under limited political control. The other rationale for government intervention which is anticipatory myopia, proposes that individuals and organisations may underinvest in the generation and assimilation of innovation that contributes to their ability to act with foresight.

As also identified by Salmenkaita and Salo (2002), innovation is often developed from 'science-push' models to more complicated models that require interaction from various key players. This process or model of innovation which demands an interaction among key players is often called a National Innovation System (NIS). Wessner (2007) argues that an NIS is shaped by social norms and value systems including attitudes towards failure, social mobility and entrepreneurship, most of which cannot be changed quickly or easily. Public policy in an NIS environment needs to strengthen links within the system by aligning the actions of key players such as universities, laboratories and large companies with the self-interest of venture capitalists and entrepreneurs.

Government interventions are often based on a traditional economic perspective that acknowledges the influence of technological change but identifies it as a scientific process that operates outside the realms of economics and argues that long run economic growth is limited by progress in areas such as physics biology and engineering (Howitt, 2007). Newer perspectives of endogenous growth theories are built on the notion of creative destruction identified by Schumpeter. As Howitt (2007) points out, economic

growth is now recognised as being a social process that affects the incentive to create new knowledge and the willingness to adapt to change. Such an approach favours, according to Howitt (2007), policies that include a focus on:
generating more competitive (as opposed to restrictive) market conditions;
improving patent protection laws;
ensuring universities etc. can take advantage of opportunities to commercialise research and development without compromising their values of openness and information sharing;
encouraging national innovation (as opposed to importing innovation in a globalised economy);
acceptance of the dynamics of creative destruction (including the prospect that initial innovation can generate capital obsolescence that initially slows recorded growth); and,
the minimization of inequality in society by education in creativity and fundamental analytical and problem solving skills rather than narrow, technology specific skills.

Regardless of its theoretical foundation, the NIS approach in many countries is designed to ensure all key players are able to develop and commercialise technological innovation. While there is sound reasoning behind the approach and a clear imperative in many countries to encourage greater commercialisation of R&D from university and other public research institutions, the extension of the intervention to SMEs is often problematic.

SME's involvement in a NIS

One of the problematic issues in involving SMEs in a broader innovation policy is a tendency to attempt prescriptive solutions. As Quaddus and Hofmeyer (2007) suggest, small businesses are often slow in their uptake of modern technologies. A response by governments in many countries is to introduce programs to support entrepreneurial activity and the birth and growth of new firms by either lowering the cost of entrepreneurial activity or stimulating entrepreneurship through teaching and encouragement (Svensson, 2007).

It is generally accepted that resource barriers to innovation force private sector firms to access knowledge from outside of their firms. Dickson and Hadjimanolis (1998) suggest that those innovative firms that are unable to rely on their own internal capabilities and resources will often go to external organisations that have the needed resources and perform formal and informal links and network with other organisations to source for a new knowledge. The knowledge which is gathered from the outside usually is treated as something crucial to the innovation process (Cohen and Levinthal, 1990). These authors also stress that one of the key components of innovative capabilities is by being able to exploit firms' external knowledge or absorptive capacity. Absorptive capacity as according to Cohen and Levinthal (1990) the ability to value, assimilate and apply new knowledge. In relation to the firm's absorptive capacity, Zahra and George (2002) suggest absorptive capacity as a dynamic capability pertaining to knowledge creation and utilization. This capability enhances a firm's ability to gain and sustain a competitive advantage which is also very crucial for firm's innovativeness.

Often, most outside knowledge is obtained from public research institutions (PRIs) which include universities and public research institutes. PRIs which are often regarded as the main knowledge provider assumed to be able to provide a good source of knowledge in promoting innovative activities among firms (European Commission and Eurostat, 2000). However, for the knowledge to be accessed by the public particularly private sectors, it then has to be commercialised. As a result, the commercialisation of PRIs research is assumed to be important particularly in providing a good source of innovative ideas.

So the rationale for intervention is sound but interventions often become prescriptive. For example at a recent international forum (Tarabishy, Gibson, Yoon, Jennings and Foord, 2008), participants identified that SMEs need special attention and assistance in areas such as:
collection, *evaluation* and *diffusion* of technical, product and market information,
acquisition, adaptation and operation of new technologies
access to external R & D facilities and R & D know-how,
training of personnel,
acquisition of organizational and management know-how
financing of R & D activities and other high-risk investments.

While participants acknowledged that informal channels of technology transfer seem to keep playing an important role for SMEs and that many SMEs do in fact maintain a broader search for technology transfer opportunities than might otherwise be acknowledged, there was still very much a prescriptive approach focused on all SMEs.

The other consideration is that there is not strong support for the success of these interventions. For example Svennson (2007) indicates that in countries such as Sweden the poor performance of projects financed by the government is a consequence of bad financing options rather than poor choice of projects.

Further concern about the need for government intervention is raised when the history of technology transfer is considered. For example, in discussing the Lyon silk industry of the eighteenth century, Hilaire-Perez and Verna (2006) suggest "technical knowledge regularly circulated". They suggest it was shared through multiple private and public networks and involved a great diversity of strategies and varying degrees of openness within families, partnerships, and guilds. "Diverse media were used: verbal or nonverbal (for example, products and artifacts conveying prescriptive knowledge such as prototypes, patterns, models, and molds), oral (speech contact), and written (including all sorts of drawings, from plates to sketches)" (Hilair-Perez and Verna, 2006). Similarly, Coppola (2006) suggests that "technology transfer and technical communication have been intertwined since the time when homo erectus created tools and needed to talk about their use." Technology transfer is not a new phenomenon and it has existed for centuries often without government intervention.

Conclusion

While generated from somewhat eclectic sources, the ideas presented in this paper support a simpler focus on the issues of innovation and technology transfer especially as they influence small firms. Innovation is, and always has been, part of economic progress and SMEs have always been involved. There are clear imperatives to develop National Innovation Systems that will facilitate desired outcomes just as there is a need to have strong entrepreneurship (or at least SME) policies that support innovation and its commercialisation. But not all SMEs are, or will be, significantly innovative to an extent that will generate economic growth. Consequently, much of the prescriptive identification of necessary processes in small firms is not applicable and policy focused on making all small firms innovative need to be discouraged.

References

Anonymous. 2007. New Resource for Technology Commercialization. *The Journal of Nuclear Medicine*. 48(9): 32

Avermaete, T., Viaene, J., Morgan, E. J. and Crawford, N. 2003. Determinants of innovation in small food firms. *European Journal of Innovation Management*, 6(1): 8-17.

Brown, S.L. and Eisenhardt, K.M. 1998. *Competing on the Edge: Strategy as Structured Chaos*. Boston, Harvard Business School Press.

Cohen, W. M. and Levinthal, D. A. 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1): 128-152.

Cohen, W. M., Nelson, R. R. and Walsh, J. P. 2002. Links and impacts: The influence of public research on industrial R&D. *Management Science*, 48(1): 1-23.

Coppola, N.W. 2006. Guest Editor's Introduction: Communication in Technology Transfer and Diffusion: Defining the Field. *Technical Communication Quarterly*.15(3): 285-293.

Dibrell, C. and Craig, J. 2006. The Natural Environment, Innovation, and Firm Performance: A Comparative Study. *Family Business Review*. 19(4): 275-288.

Dibrell, C., Davis, P.S. and Craig, J. 2008. Fueling Innovation Through Information Technology in SMEs. *Journal of Small Business Management*. 46(2): 203-218.

Dickson, K. E. and Hadjimanolis, A. 1998. Innovation and networking amongst small manufacturing firms in Cyprus. *International Journal of Entrepreneurial Behaviour & Research*, 4(1): 5-17.

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

European Commission and Eurostat. 2000. Statistics on innovation in Europe: Data 1996-1997, 2000 ed.

Freeman, C. 1982. *The economics of industrial innovation*: Frances Pinter. London.

Hilaire-Perez, L. and Verna, C. 2006. Dissemination of Technical Knowledge in the Middle Ages and the Early Modern Era: New Approaches and Methodological Issues.. *Technology and Culture*. 47(3): 536-586.

Howitt, P. 2007. Innovation, Competition and Growth: A Schumpeterian Perspective on Canada's Economy. *C.D. Howe Institute Commentary*. 246: 1-14.

Johne, A. 1999. Successful market innovation. *European Journal of Innovation Management*, 2(1): 6-11.

Lipinski, J., Minutolo, M.C. and Crothers, L.M. 2008. The Complex Relationship Driving Technology Transfer: The Potential Opportunities Missed by Universities**.** *Journal of Behavioral and Applied Management.* 9(2), 112-135

Miles, I. 2008. Patterns of Innovation in Service Industries. *IBM Systems Journal*. 47(1): 115-128.

Mole, K., & Worrall, L. 2001. Innovation, business performance and regional competitiveness in the west Midlands Business Survey. *European Business Review*, 13(6): 353-364.

O'Neill, H.M., Pouder, R.W. and Buchhotz, A.K. 1998. "Patterns of Diffusion of Strategies Across Organisations: Insights from the Innovation Diffusion Literature. *Academy of Management Review*. 23: 98-114.

Quaddus, M. and Hofmeyer, G. 2007. An investigation into the factors influencing the adoption of B2B trading exchanges in small business. *European Journal of Information Systems*. 16: 202-2154.

Salmenkaita, J.P. and Salo, A. 2002. Rationales for government intervention in the commercialization of new technologies. *Technology Analysis & Strategic Management*, 14(2): 183.

Salter, A. J. and Martin, B. R. 2001. The economic benefits of publicly funded basic research: A critical review. *Research Policy*, 30: 509-532.

Sensis. 2007. Sensis eBusiness Report - The online experience of Small and Medium Enterprises, Sensis, Melbourne

Svensson, R. 2007. Innovation Performance and Government Financing. *Journal of Small Business and Entrepreneurship*. 21(1): 95-116.

Tarabishy, A.E., Gibson, B., Yoon, H., Jennings, B. and Foord, D. 2008. Technology Transfer and its Impact on SMEs World-Wide Knowledge from the ICSB Global Community, Workshop at the 53rd ICSB Conference, June, Halifax, Canada.

Wessner, C.W. 2007. The Global Tour of Innovation Policy. *Issues in Science and Technology*. 24(1): 43-44.

Wikipedia 2008. http://en.wikipedia.org/wiki/Technology#Definition_and_usage

Zahra, S. 1993. New Product Innovation in established Companies: Associations with Industry and Strategy Variables. Entrepreneurship Theory and Practice. 18(2): 47-69.

Zahra, S. A. and George, G. 2002. Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management. The Academy of Management Review*, 27(2): 185.