

# Chapter 8

## Nanotechnology, Firm Innovation and University–Industry Networks: The Case of the UWS<sup>1</sup> Nanotechnology Network in Sydney

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### ABSTRACT

*Nanotechnology is becoming a transformative element for the manufacturing sector into the knowledge economy. Access to relevant knowledge is a critical factor in this transformation as manufacturing firms cluster in peripheral suburbs away from the knowledge intensive ring of central business districts. Results from a project conducted in South-West Sydney shows that informal university-industry networks raise the awareness of firms to the potential of nanotechnology applications, their willingness to invest in nanotechnology R&D and the number of university-industry cooperation initiatives and business-to-business partnerships. Results from the project also suggest that, despite the importance for firms of being involved in global networks, access to local knowledge and local networks is significant for the innovation process of small and medium enterprises (SMEs).*

### INTRODUCTION

Technological development is one of the critical factors on innovation and firm competitiveness (Maskell 2001; Smith 2000; OECD 1999) and the absorption of General Purpose Technologies (GPT) is a significant factor in the continued competitiveness of the firm (Shea, 2005). The impact of nanotechnology in innovation as a frontier

technology and a general-purpose technology is only starting to be analysed in detail. Many firms, from a broad variety of sectors, are unaware of the transformation effect nanotechnology might have in the competitiveness of their business. In this context of early path development of nanotechnology, access to specialised knowledge and to knowledge infrastructure is critical for firms to evaluate nanotechnology investments.

The significance of knowledge infrastructure

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for innovation is becoming increasingly acknowledged in the literature. Today, more research than ever is exploring the relationships of creation and diffusion of knowledge, the impact of knowledge and skills, the commercialisation of knowledge, knowledge flows and firm competitiveness, and new enablers of the knowledge society (OECD, 2005; OECD 1999; Maskell 2001; Smith 2000; AEGIS 2005; Audrestsch, 1995; TIAC, 2002; Turpin and Martinez, 2003; Acs, 2002; Martinez-Fernandez et al 2005a). It is now widely recognised that global competitiveness is dependent on the capacity of economies to acquire knowledge capital and to apply new knowledge through a highly trained and specialised workforce.

The role that universities and other knowledge institutions play in the generation, sharing and transferring of knowledge is being scrutinized by governing bodies of universities and other research organizations (AVCC, 2005; OECD 2005). In addition to training new talent and providing research outputs, 'Third Stream Activities' such as strategic engagement with industry and the community (Molas-Gallart, 2002) are becoming an important part of universities role in society. Universities are increasingly active in influencing regional competition and recent literature points to a conscious, robust strategy by some universities of driving regional knowledge development (Garlic, 2000; Faulkner & Senker, 1995; Sproats, 2003). While firms are increasingly embedded in global networks, access to local knowledge is still a determinant factor for firm innovation (Martinez-Fernandez & Potts, 2007).

It is generally agreed today that participation in networks, clusters and alliances proves a powerful learning mechanism for firms, especially if the relationships are in geographical proximity to enable extensive informal knowledge sharing (Martinez-Fernandez, 2004). It has also been discussed elsewhere that regions should maximise the value of their knowledge-generation institutions through linkages with the different actors in their innovation system (Maskell, 2001) to fa-

cilitate transfer of knowledge between knowledge providers and specialised industry users (Teece, 1987). However, there is still a lack of industry-university cooperation in many fields while at the same time the benefits of universities to their regions' knowledge intensity is firmly advocated (Acs 2002, Martinez-Fernandez & Leever 2004, Martinez-Fernandez 2004).

This paper discusses the effects of a university-industry network on the absorption of nanotechnology applications by SMEs in the region of South-West Sydney. A survey conducted among South Western Sydney firms shows that the role of universities in the dissemination and transfer of knowledge of frontier technologies such as nanotechnology is more significant than in established technologies such as ICT.

## **NANOTECHNOLOGY: DEFINITION, GENERAL POLICY AND INDUSTRY CONTEXT**

There is not just one definition of 'nanotechnology' although it is agreed that it has to do with the science of the very small. The OECD defines nanotechnology as the "range of new technologies that aim to manipulate individual atoms and molecules in order to create new products and processes: computers that fit on the head of a pin or structures that are built from the bottom up, atom by atom" (OECD 2003). Basically, nanotechnology is the design, characterization, production and application of structures, devices and systems that entails controlling the shape and size at the nanometer scale (Royal Society 2004). The size range of nanotechnology is often delimited to 100 nm down to the molecular level (approximately 0.2nm) because this is where materials have significantly different properties. Nanoscience refers to the scientific analysis of materials at atomic, molecular and macromolecular scales while nanotechnology applies scientific developments to commercialization (Shea, 2005). The field of

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