

INTELLECTUAL ASSETS IN URBAN REGIONS: UWS IN WESTERN SYDNEY

**M.CRISTINA MARTINEZ-FERNANDEZ
MARC RERCERETNAM, SAMANTHA SHARPE**

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The views expressed in this report are solely those of the authors and should not be attributed to the Office of Western Sydney or the Office of the Minister for Western Sydney.

For further information please contact:

Dr Cristina Martinez
Urban Research Centre
Parramatta Campus
University Western Sydney
Locked Bag 1797
Penrith South DC
NSW 1797, Australia
c.martinez@uws.edu.au

Telephone: + 61 9685 9067
Fax: +61 2 9685 9694

Website: www.uws.edu.au/urban

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Executive Summary

Universities are increasingly being recognised as knowledge hubs exercising strong influence in the intellectual vitality of the regions in which they are embedded. The details of how universities fit this role are not well known and although several efforts have been made to evaluate universities as an industry sector on their own right, much less is known of their contribution to intellectual life. Universities and research institutes are regarded as intellectual assets due to their societal role in the places where they are embedded and the position they have as crucial actors in urban and regional development. They are often in a central position as information and communication gatekeepers, and responsible for much of the intellectual vitality of the area where they are placed. A high proportion of staff working at these institutions are scientists with multiple connections to industry, government institutions, community groups and policy makers. These scientists are involved in knowledge intensive activities with other interest groups in the local area which generates, attracts, diffuses and transfers knowledge. The results of these knowledge activities impact the intensity of knowledge flows, the initiation of projects of economic development, innovation diffusion to other organisations and the developing of the 'place' where the university is embedded. Although the impact of intellectual assets in regions is intangible and difficult to measure with economic techniques, their influence can be projected years later in the adaptation of local industry to global changes, the attraction of knowledge workers, scientists and innovative industry and the development of a learning economy.

This study was conducted under a partnership between the University of Western Sydney (UWS) and the Office of Western Sydney to analyse the intellectual dynamics of UWS in knowledge-generation, transmission and transfer activities into the Western Sydney region. The question that lies behind this study is how UWS can best contribute to the intellectual vitality of Western Sydney. Evidence data draws upon published literature, secondary collected material, extensive consultation and discussions with regional stakeholders, university bureaucracy, local government bodies, various business enterprises and UWS researchers. Recent research into the GWS region such as 'Stocktake of NSW as a Potential Knowledge Hub' (Marceau, Martinez-Fernandez et al, 2005), the 'Innovation at the Edges' study (Martinez-Fernandez and Potts, 2005) and current research by the UWS Urban Research Centre into manufacturing networks, nanotechnology diffusion and industry innovation in Western Sydney also contribute to this study.

Western Sydney Industry Strengths

Greater Western Sydney is the fastest growing economy in Australia. The economic output for the region is more than \$71 billion per annum (2004-05) which makes it the third largest economy in Australia behind the Sydney Central Business District and Melbourne. It is home to approximately 241,976 business entities (June 2004, ABS Business Register). The major industry sectors in terms of Gross Regional Product are manufacturing, construction, property and business services, fiancés & insurance and wholesale trade. The largest industry in terms of business numbers was the construction industry, comprising 23.5 percent of total businesses. In relation to employment, the four largest employers of labour in the GWS (ABS 2001 census) were:

- manufacturing - 16 percent;
- retail trade - 14.5 percent;
- property and business - 10.5 percent, and
- construction - 8.2 percent.

Retail trade appeared to experience the fastest growing employment with an approximate

increase from 90,000 people in 1996 to around 110,000 in 2001. Western Sydney presents lower levels of knowledge workers than North and Inner Sydney, with some variation in these levels between sub-regions. Three characteristics stand out in relation to the industry strengths of GWS:

- Manufacturing hub with clusters of metals, furniture, plastics and chemicals in South-West Sydney;
- Property and business services are the second industry concentration serving the large manufacturing sector;
- Retail and construction industries are largely servicing the fast growing residential population.

UWS Knowledge Strengths

UWS has 6 campuses and 35,372 students which concentrate mainly in two fields of study: Management and Commerce (32%) and Society and Culture (20%). Around 73 percent of students live in the Greater Western Sydney region and more than 8,500 students graduate every year as qualified workers. In 2005 there were 6,119 postgraduate students at UWS, again clustering on 'Management & Commerce' and 'Society & Culture' disciplines. Disciplines such as 'Engineering & Technology' and 'Architecture & Building' have small numbers. In 2005, full-time staff numbered 2,637 with 1,289 academic and 1,348 general staff working across all six campuses. UWS has 8 university research concentrations and 31.30 percent of staff are research active. Publications per academic staff were 1.17 in 2004. UWS also produces patents and obtain licenses that could be released to entrepreneurial firms. UWS has 23 patents, more than half in the construction area (steel/concrete). Most patents have been licensed in 2006. UWS research expenditure concentrates in the category of 'Humanities and Social Sciences', while having low level of expenditure on 'Engineering & Technology' and 'Natural & Physical Sciences', and very low levels in 'Management & Commerce'.

UWS has the following knowledge strengths:

- *Transmission* of knowledge. Production of a qualified workforce clustering around the areas of Management and Commerce and Society and Culture. Areas related to the manufacturing and construction industries such as Engineering and Architecture and Building produce small numbers of graduates;
- *Generation* of knowledge. Research expenditure is concentrated in the Humanities. Low levels of expenditure go into Engineering and Technology and Management and Commerce;
- *Transfer* of knowledge. Strong release of patents in the Construction area. Knowledge intensive service activities lead by UWS seem significant in influencing new technology uptake by manufacturing SMEs in South-West Sydney.

Strategic and Policy Recommendations

The study has highlighted the critical importance of universities and research departments to foster intellectual vitality that results in local development. Specifically, the study has the following recommendations to support this process in Western Sydney:

1. Increase the potential of UWS to strengthen the teaching and research area of 'Technology and Engineering', in this way making UWS a direct contributor to the core competencies and knowledge transformation of the strong manufacturing industry in Western Sydney;

2. Increase the potential of UWS to strengthen the teaching, research and patenting capabilities its 'Architecture and Building' programs, as a direct contributor to innovation of the built environment at a time of strong current and projected growth in development in Western Sydney;
3. Increase the potential of UWS engagement strategies to provide incentives to researchers for participating in formal and informal knowledge networks with regional stakeholders so as to intensify the transfer of knowledge into Western Sydney;
4. Governments at all levels need to create policies and programs that support the mobility of researchers inter-state and internationally, producing a 'brain circulation' that will bring new and revitalized knowledge into Western Sydney;
5. Governments need to increase funding for research activity at universities, including basic research, in order that knowledge becomes a transformative tool for local development and that local industry partnerships can proliferate through this leverage;
6. Governments need to create programs to support participation of researchers in conference and research networks where new knowledge can be discussed and tested through presentations of peer-reviewed publications; this new knowledge can be distributed through local networks later on.

I. Intellectual Assets – An Introduction

1.1 Background

Modern western economies are increasingly realizing that the key to their future competitiveness lies in their success in generating and using new knowledge. International experience suggests that it is important for regions and nations to maximise the value of their public sector knowledge-generating institutions. The key to this is creating and improving links between knowledge producers and knowledge users, be the latter firms, other organisations or individuals needing leading edge training (see eg Louis, Tornatzky, Gray, and Waugaman, 2001:3). Regions have become increasingly important economic players (Porter 2001) and the relationships between actors in local areas have taken on especial significance (de la Mothe and Paquet 1998; Maskell 2001).

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 term ‘knowledge-based’ or ‘learning economy’ emerged to describe those economies in which the production, distribution and use of knowledge are the main drivers of growth, wealth creation and employment across all industrial sectors. The concept of a knowledge-based economy has sometimes been used to make a contrast between so called ‘new’ economies based on new technologies, from ‘old’ economies based on long established products and process.

In reality, both areas of an economy require new knowledge if they are to function competitively. A knowledge-based economy is not simply one that emphasises new technologies or even new knowledge. A knowledge-based economy is one in which all sectors are knowledge-intensive, are responsive to new ideas and technological change, are innovative, and employ highly skilled personnel engaged in on-going learning. In short, knowledge and skills have to be useable and used in the production of all manner of goods and services (OECD 2001:11). Universities are especially important in this transition but do not all develop similar local relationships (see eg Lawton Smith 1998).

As knowledge-economies have become more global they have become more independent of national institutions and processes. This is because knowledge is produced, transferred and diffused through organisational networks that are only partly dependent on proximity. On the other hand, much knowledge is ‘sticky’ and transfers well only within the region in which it was produced. Given that in a region such as Western Sydney, many knowledge users and producers are likely to be located not very far from each other geographically, it would seem important to bring them together in a systematic manner and create what has been called elsewhere a ‘knowledge hub’ (Turpin and Marceau 2002, Marceau et al 2005).

A knowledge hub is essentially a physical space such as a small region where an ensemble of knowledge-intensive organisations, both public and private and, increasingly, public-private ‘hybrids’, are located. Central to potential knowledge hubs are universities and other teaching and researching organisations, including CSIRO and the more industrial areas of TAFE. These institutions can be considered as ‘intellectual assets’ in a city or region. Within knowledge hubs knowledge-intensive organisations have three major functions: to generate knowledge; to transfer (diffuse) and to apply knowledge to users such as firms or governments; and to transmit knowledge to individuals in the community through education and training. Universities have an important part to play in all three functions and, therefore become a critical intellectual asset for the region where they operate.

Universities and research institutes are regarded as intellectual assets due to their societal role in the places where they are embedded and the position they have as crucial actors in urban and regional development (Martinez-Fernandez, 2001). They are often in a central position as information and communication gatekeepers, and responsible for much of the intellectual vitality of the area where they are embedded. A high proportion of staff working at these institutions are scientists with multiple connections to industry, government institutions, community groups and policy makers. These scientists are involved in knowledge intensive activities with other interest groups in the local area which generates, attracts, diffuses and transfers knowledge. The results of these knowledge activities impact the intensity of knowledge flows, the initiation of projects of economic development, innovation diffusion to other organisations and the developing of the 'place' where the university is embedded (Martinez-Fernandez, 2001; Martinez, 1998). Although the impact of intellectual assets in regions are intangibles and difficult to measure with economic techniques, their influence can be predicted years later in the adaptation of local industry to global changes, the attraction of knowledge workers, scientists and innovative industry and the development of a learning economy.

There is little doubt today that universities are 'producers' of human capital (especially in the form of knowledge workers); their contribution to network development and to the effectiveness of the Regional Innovation System from evolutionary approaches has been discussed elsewhere (eg Lambooy, 2006). Perhaps an important differentiation is how intellectual assets contribute to knowledge in cities and regions. 'Knowledge' can come from the local area through the different industry and research institutions competences or can come from outside; brought in by individuals or through migration processes (Hilpert, 2006). Individuals, particularly scientists, 'change' places because they are carriers of knowledge, they are actively involved in international research networks that provide an exchange of knowledge bringing 'knowledge in' and transferring relevant knowledge to the local network connections. Therefore, as Hilpert has suggested, 'knowledge' becomes the basis for development and the city as the location where knowledge is generated, merged and accumulated.

Knowledge produced by local industry is updated and transformed through the application of new knowledge generated by universities and research organisations and its application to traditional and new forms of production. As Hilpert (1992) noted, old industrial regions that foster strong research multiply their capabilities to transform into 'islands of innovation'. The way universities can foster economic development in 'old' industrial states is not yet well known and there is lack of consistent evidence but they are critical in the transmission of knowledge that is relevant for local industry; and therefore contribute to the specialisation of the region in a particular knowledge. As an example, this report presents a case study of knowledge transfer of frontier technologies to manufacturing companies as a pathway to transform the knowledge base of local companies.

A critical function of universities as intellectual assets is supplying knowledge to the city or region through the skills and expertise of students, graduates and academic professionals. There is no doubt today of the relevance of knowledge workers and knowledge occupations in transforming the knowledge base of an industry or a region (Martinez-Fernandez & Martinez-Solano, 2006; Sharpe & Martinez-Fernandez, 2006) but it is uncertain 'what' exactly is linked to structural change. Is the critical point the attraction of knowledge intensive industries? Or it is the generation and attraction of knowledge workers as residents of a certain area? The answer is not clear and it might be a mix of both strategies. What is clear is that bringing knowledge in the region is a strategy that, although requiring about 20 to 30 years to show significant effects, it has proven to be a successful pathway for change and restructuring (Hilpert 2006).

The question of which knowledge is relevant for the particular area or region might be a function of the traditional knowledge plus the kind of knowledge demanded for revitalisation of the industry. Therefore, understanding and caring for the traditional knowledge in the region becomes important for the transformation of the knowledge base of the region. Then, the issue is of which new knowledge is 'relevant'. Here, again, universities and research institutions play a critical role through their scientific personnel. Scientists are able to integrate new knowledge produced elsewhere into industries in need of revitalisation. Through their involvement in international networks, scientists are connected to knowledge produced miles away but that might have special relevance for the local industry. These scientists and their research departments also can stimulate the creation of new enterprises that bring a new stock of knowledge into the region. Scientists and research therefore have an important role to play in modernising the economy. Although measuring these effects requires much more time than traditional economic measures on GDP or employment growth, governments at all levels need to realise of the critical role universities play in economic transformation of cities and regions. Their value as intellectual assets needs to be nurture and multiply.

1.2 Aims and significance of study

The study focuses on the intellectual dynamics of UWS in knowledge-generation, transfer/diffusion and transmission activities as the basis for considering how it can best organise its activities to act as a knowledge hub for its region.

The question that lies behind this study is how UWS can best contribute to the intellectual vitality of Western Sydney. However, a prior question and the one it is proposed to investigate as a first step is how UWS is already performing in this respect.

This study draws on both local experience and international experiences to guide the audit. More specifically, the project would:

- Analyse the foci of research and the technologies produced by the University of Western Sydney and rates of take-up of new knowledge in the region as seen in real interactions between producers and users of knowledge in a selected field in Greater Western Sydney so as to assess 'fit' between the needs and interests of users and producers;
- Analysis of the postgraduate training provided by the University in relation to the provision of a skilled workforce for the region.

Recent work on clusters of business activity and the relationship between such clusters and 'knowledge hubs' centred on public sector research organisations has indicated that these relationships are a good deal more complex than was suggested by initial observers. Early studies often assumed a straightforward relationship such that more research and closer links between local industry and researchers were always 'better'.

Recent studies have shown that universities and similar public sector research institutions differ in their relationships with user organisations both in relation to the *type* of new knowledge concerned, in the transfer and to the *mechanisms* of such transfer. Both relationships and knowledge transfer are critically affected by the level of sophistication of the receiving companies. It now seems that universities generating leading edge research have a very broad 'footprint' in terms of the organizations interested in receiving the knowledge generated. This means that sophisticated companies located very far away in geographical terms may well be the most interested in 'breakthrough' research in basic sciences whereas companies located closer to the source of knowledge are unable to see value. This is because, for example, breakthrough research information can be readily absorbed by the high level R&D personnel working in the science-intensive firms, even though they are further away

spatially and/or by the product development teams in that segment of industry which may be located in many places. In other words, personnel in some firms may be ‘symbolically closer’ to the knowledge generators than others located geographically nearby. In this sense, the creation of a ‘knowledge hub’ has many dimensions which mean that spatial proximity to the sources of new knowledge does not *automatically* encourage firms to take advantage of what is on offer. These findings have implications for the strategies to be developed by UWS for engagement with the GWS region.

As the institutions in a knowledge hub develop and mature the challenge is to maximize local benefit for local stakeholders. Universities, through collaborative partnerships, are becoming more international and are involved in activities quite different from their role 20 or 30 years ago. There is thus a challenge to ensure that universities remain knowledge diffusers or transmitters as well as knowledge producers. Different universities in a region may perform these roles in different combinations and in different ways. Each can be very valuable.

Very little work has been done in Australia in terms of the analysis of the relationships between a university and other organisations in its immediate geographical area. There have been some studies of relationships between firms and the commercial arms of universities but these have not been systematic and have not taken account of the full potential of the transfer of technologies developed locally. There have been no studies of the complete range of technologies developed and the relationships between the differing technologies and the recipient organisations. We thus know almost nothing about the diverse ways in which different kinds of technologies are transferred, about whether and how local organisations bring in partners from other zones, such as venture capitalists from the Sydney CBD in the case of firms in western Sydney.

The task of mapping these highly differentiated relationships and hence the spread of technologies throughout a region is both critically important if knowledge organisations in a locality are to fulfil their potential, and highly complex. There is no model for doing it properly even in the international literature, although attempts have been made by the OECD to come to grips with the issue, attempts published in such works as *Cities and Regions in the New Learning Economy* (OECD 2001). The University of Western Sydney is of special interest because it has a strong strategic focus on engagement articulated on strategic plans and regional schemes:

‘Vigorous engagement with Greater Western Sydney is a primary aim of UWS. Mutual benefits can accrue to the University and its community of public services, private industries and regional groups through the exchange of knowledge, expertise, resources and experiences. Increasingly community expectation is for a university to be embedded in its region as a catalyst for innovation and a contributor to a region’s wellbeing, social capital and economic vitality. The University of Western Sydney aims to be at the centre of its region’s development and to be acknowledged nationally and internationally as a leader in the field of community engagement.’ (UWS Guidelines for the Regional and Community Grants Scheme 2002).

Fulfilling this aim requires a great deal of information about two elements: the needs and characteristics of the region concerned and the capability of the university to respond. Many attempts have been made over the last decade or so to seek information on both these elements, including at UWS, but they have remained piecemeal and without a proper framework for assessment of either needs or expertise available, let alone the flow of knowledge to and within the region. The aim of this study is thus to conduct an ‘audit’ of both apparent needs and apparent supply of expertise.

The study addresses the present role of UWS in relation to Western Sydney as a region. Unfortunately, ABS holds data only at the level of the State and not at sub-regions. For the purposes of UWS, which states that it wishes to engage more fully with the region, this level is not sufficient. The project thus has two major elements;

1. Industry Strengths

The analysis of all relevant local data on companies and their field of activity to gain a more detailed picture of the economic activity of the region. Much is claimed for the rise in technology-intensity in the region and the development of knowledge-based new industries. The aim of this segment would be to test those assumptions on the basis of regional data gathered through specific studies;

2. UWS Knowledge Strengths – Teaching and Research

The analysis of the specific knowledge strengths of UWS and the links between these strengths and activity in the region. This could be assessed in different ways: through the type and objectives of externally generated research income and perhaps publications, through the sales of technology through the commercial arm to external organizations, through internal research review documents and through evidence of knowledge transfer.

1.3 Methodology and Limitations

The analysis of UWS as an intellectual asset is pioneering among the higher education industry. Other studies, the most recent by the University of Strathclyde (2006) have focused on the economic impact of universities as an industry sector. This is important work and very valuable but does not capture those more intangible factors such as the contribution to intellectual life that universities are about. This study attempts to analyse intellectual contributions of universities.

The project aims to analyse the role of UWS in Western Sydney and the take-up rates of new knowledge in the region. This role has been assessed by examining interactions between producers and users of knowledge in selected fields in the GWS, notably in the field of nanotechnology. It also analysed postgraduate training provided by UWS and how this relates to feeding into the skills base of the regional workforce. Research figures have also been analysed to see the fields of knowledge generated.

Data draws upon published literature as well as internet-based material. Extensive consultation and discussions were held with regional stakeholders, university bureaucracy, local government bodies, various business enterprises and UWS researchers. Recent research into the GWS region such as “Stocktake of NSW as a potential Knowledge Hub” (Marceau, Martinez-Fernandez et al, 2005) and Martinez-Fernandez and Potts “Innovation at the Edges: The Role of Innovation Drivers in South West Sydney” (2005) and current research by the UWS Urban Research centre into manufacturing networks in South-West Sydney also contributed to this study.

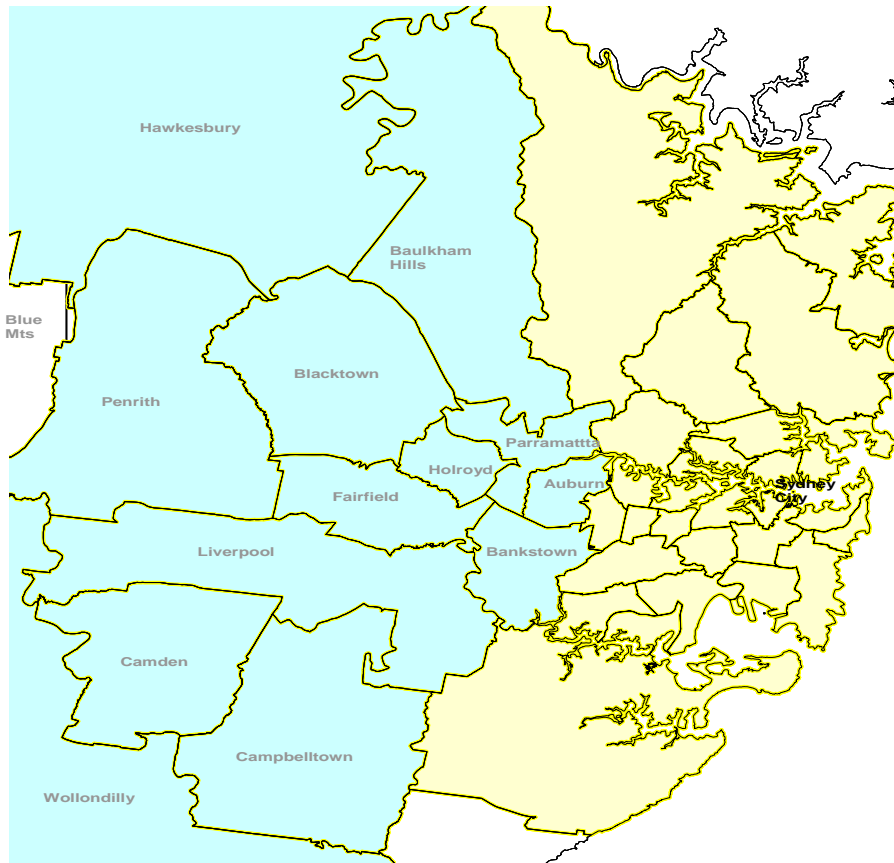
1.4 The Report

The report is structured in four sections. Section 1 introduces the concept of Intellectual Assets, knowledge hubs and the aims of the study. Section 2 looks at the industry strengths of the Western Sydney region. Section 3 discusses the knowledge strengths of UWS. Section 4 concludes the report discussing the contribution of UWS to intellectual vitality in Western Sydney and suggesting recommendations for the future.

II. Western Sydney Industry Strengths

The Greater Western Sydney region covers an area of 8,817.3 square metres and is one of the world's largest urban areas – larger than the combined areas of Tokyo, London and Chicago. It is made up by 14 LGAs, namely Auburn, Bankstown, Baulkham Hills, Blacktown, Blue Mountains, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith and Wollondilly (NSW DSRD, 2005).

Figure 1: Map of the Greater Western Sydney Region with LGAs



2.1 Demographic Features

The population of Greater Western Sydney (GWS) was 1.484 million in mid-2001 which is 38 percent of the Sydney Statistical Division. The largest Local Government Area (LGA) in the GWS is Blacktown with over 255,000 persons. Four of the five most populous LGAs in Sydney are located in the GWS region (Gleeson et al, 2002, p1). The population of the region today is 1,720,000.¹

GWS has a number of important characteristics:

- The total labour force for GWS is 797,911 persons (ABS, 2004, p13);

¹ NSW Department of State & Regional Development; www.business.nsw.gov.au (accessed 9 May 2006)

- A comparatively young population compared with Sydney Metropolitan region; 23 percent of population is aged under 15 years. Only 9 percent is aged over 65 years;
- Children under 15 years are associated with newer developments on the fringes of Sydney whereas older residents (over 65 years) are concentrated in older housing stock in the middle ring LGAs (Gleeson et al, 2002, p39);
- Population change is considerable in comparison with the rest of Sydney. From 1981 to 2001 the population increased by 38 percent compared to only 23 percent in the Sydney Statistical Division area;
- One in six households (16.7%) in Greater Western Sydney area earned less than \$400 per week in 2001. This is similar to Sydney as a whole, where 16 per cent of households earned less than \$400 per week, but lower than New South Wales as a whole, where almost one in five (19.8%) earn below this amount. (Randolph & Holloway, 2003, p15);
- Approximately 38 percent of persons living in the GWS region earned less than \$300 per week in comparison to 35 percent in the Sydney Statistical Division area (Gleeson et al, 2002, p62);
- In 2001 the unemployment rate in GWS for economically active adults was 7.4 percent, slightly higher than in Sydney which comes in at 6.1 percent (Randolph & Holloway, 2003, p35);
- Between 1981 and 2001 significant growth was experienced in the following LGAs; Camden (155%), Liverpool (66%), Hawkesbury (66%), Campbelltown (59%), and Penrith (58%) (Gleeson et al, 2002, p8);
- Almost 2 out of every 5 people or 41 percent of GWS residents were born overseas. Between 1981 and 2001, there was an 80 percent increase in the number of overseas born residents, this compares with only a 48 percent increase in the Sydney Statistical Division area. This is the equivalent to 34 percent of all overseas born persons living in New South Wales presently living in the GWS region (Gleeson et al, 2002, p45);
- The population is extremely mixed in terms of ethnic origin, levels of English language proficiency, educational and skill levels. School retention rates are some of the lowest in NSW (Marceau et al, 2005, p66);
- The number of persons attending university increased from 27 percent in 1991 to 30 percent in 2001 (Gleeson et al, 2002, p67);
- There is a high number of public housing tenants; 41,742 in the GWS region in comparison with 72,724 in the Sydney Statistical Division area (Gleeson et al, 2002, p55);
- The Australian Bureau of Statistics' "Index of Relative Socio-Economic Disadvantage Score" rates the GWS at 998, as opposed to the Sydney Statistical Division area which rates slightly higher at 1,027 (Gleeson et al, 2002, p74).

Some of the region highlights are presented in the table below.

Table 1: Western Sydney Highlights

- Economic output to grow by A\$8 million by 2005
- Fastest growing population and economy in Australia
- Third largest economy in Australia behind Sydney CBD and Melbourne
- Major industry sectors: telecommunications, IT, manufacturing, retail, tourism
- Over 72,000 enterprises; including almost 20% of Australia's top 500 exporters (3 in the top 10)
- A\$52 billion in economic output per annum
- Major transport projects include the A\$1.25 billion Western Sydney Orbital project (M7), the A\$1.2 billion Parramatta to Chatswood rail link and development of a A\$770 million network of bus-only transit way.

Source: NSW Department of State and Regional Development. www.busines.nsw.gov.au (9/5/06)

2.2 Industry Structure and Employment

The structure of the GWS economy has undergone massive change since the Second World War and especially following developments from the 1960s to the 1990s. The regions main asset was the availability of land to house a growing pool of a low and technically skilled labour force. This encouraged industries to the region keen to access a competitive and reliable pool of labour.

Today the region's economy is the fastest growing in Australia and the social and physical infrastructure needed to address this growth has not keeping pace (Dept of State and Regional Development, 2005; Dobinson, 31 May 2005, p7; Goodsir, 10 June 2005, p6). The economic output for the region is \$71 billion (AEC, 2006) which makes it the third largest economy in Australia behind the Sydney Central Business District and Melbourne. It is home to approximately 241,976 enterprises² (AEC, 2006), 20 percent of which includes the countries top 500 exporters. The major industry sectors are manufacturing, construction, property & business services, finance & insurance and wholesale trade (AEC, 2006; Dept of State and Regional Development, 2005).

According to the NSW government's 'Metropolitan Strategy', it projected job growth in the GWS to reach over 230,000 new jobs by 2031. In the North West (39.9 percent) and especially in the South West (62.6 percent) regions huge growth is expected (see Table 2). Much of this is also concentrated along a number of areas that include the Parramatta and Liverpool centres (along the M4 and M5) and in major 'employment lands' in the Villawood and Wetherill Park areas – see Figure 2 below (Metropolitan Strategy, 2005, p10).

² June 2004 – ABS Business Register

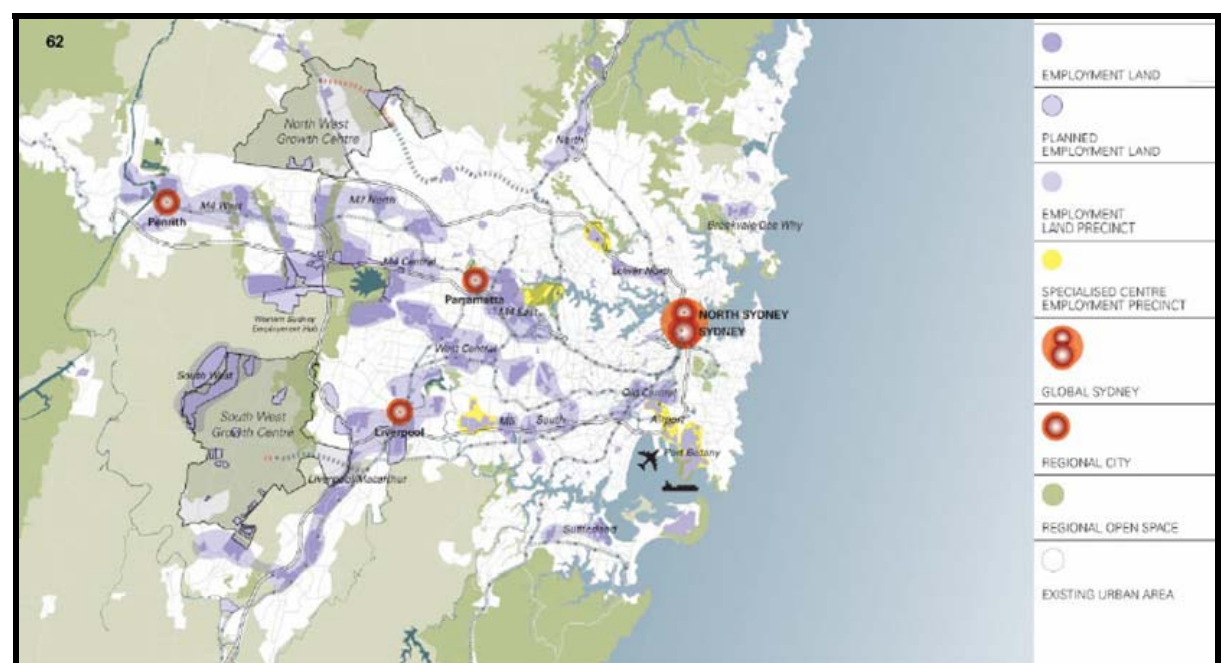
Table 2: Employment and Employment Capacity in Sydney by subregion

SUBREGION	1981	2004	2031 EMPLOYMENT CAPACITY TARGET	2004-31 GROWTH	2004-31 % GROWTH	2004 JOB SHARE	2031 JOB SHARE
SYDNEY CITY	366,835	406,755	465,000	58,245	14.3%	19.9%	18.6%
EAST	94,076	137,365	155,000	17,635	12.8%	6.7%	6.2%
SOUTH	143,637	190,940	212,000	21,060	11.0%	9.3%	8.5%
INNER NORTH	157,724	245,628	300,000	54,372	22.1%	12.0%	12.0%
NORTH	65,850	82,453	90,500	8,047	9.8%	4.0%	3.6%
NORTH EAST	57,666	87,237	103,500	16,263	18.6%	4.3%	4.1%
INNER WEST	96,159	102,090	112,000	9,910	9.7%	5.0%	4.5%
WEST CENTRAL	267,310	323,550	358,500	34,950	10.8%	15.8%	14.3%
NORTH WEST	118,639	247,736	346,500	98,764	39.9%	12.1%	13.9%
SOUTH WEST	62,604	127,281	207,000	79,719	62.6%	6.2%	8.3%
CENTRAL	45,008	94,952	150,000	55,048	58.0%	4.6%	6.0%
TOTAL	1,475,508	2,045,988	2,500,000	454,013	22.2%	100.0%	100.0%

Source: Metropolitan Strategy, Economy and Employment, 2005, p23.

In NSW alone, full-time skilled employment growth amounted to an 80 percent increase between 1991 and 2001. The Metropolitan Strategy claims most of these jobs will continue to be located in what it calls the ‘Global Economic Corridor’ largely based in the North Sydney, Sydney CBD and GWS area, particularly Penrith and Parramatta (Metropolitan Strategy, 2005, p13).

Figure 2: Strategic Employment Precincts



Source: Metropolitan Strategy, Economy and Employment, 2005, p26.

The manufacturing, transport and wholesale trade industries have a long association with the GWS region. Manufacturing and logistics employment appears to be moving towards

Wetherill Park, the area known as the ‘Western Sydney Employment Hub’ along the M7 highway and in Blacktown area. Manufacturing, transport and warehousing activity appear to be concentrating along highways and arterial roads such as the M7, M5 and Hume Highway (see Figure 3) (Metropolitan Strategy, 2005).

Figure 3: Strategic Centres and Employment Growth areas



Source: Metropolitan Strategy, Economy and Employment, 2005, p16.

The Gross Regional Product (2004-05) for the state of NSW was \$269,388 while the Sydney statistical district was \$177,093.4 and the Greater Western Sydney was \$71,484.4 (AEC, 2006). The GWS region contributed a sizable 41.3 percent towards the Gross Regional Product of the Sydney economy and 29.8 percent to the state of NSW. According to the ABS Business Register data, 241,976 business entities operated out of Greater Western Sydney in June 2004 (AEC, 2006) up 57,683 from the 2001 figure of 184,293 (Dept of State and Regional Development, 2005). The largest industry in terms of business numbers was the construction industry, comprising 23.5% of total businesses (AEC, 2004, p17). In terms of employment, manufacturing is the largest with 16.6% share.

Table 3 shows the *manufacturing industry* contributed approximately 20.5 percent of Greater Western Sydney’s Gross Regional Product in 2004 which is significant, taking note that this is higher than the industry average for Sydney and NSW. *Property and Business services* and *Finance and Insurance* industries follow closely behind. Even among the smaller industries such as agriculture, forestry, fishing, and mining, GWS brings in proportionately larger contributions to the GRP.

Dominant industries are expected to continue growing at a strong rate, with forecasts for the next 5 years indicating growth in line with national trends. Growth forecasts for 2008 predict that manufacturing will increase by 3.2 percent, property and business by 4.0 percent, finance and insurance by 3.0 percent, communication services by 5.5 percent and transport and storage services by 3.9 percent (GWS EDB, 2004, p4).

Table 3: Gross Regional Product, Industry Contribution in comparison with Sydney and NSW

Industry	GWS	Sydney	NSW	Avg. Ann. Forecast Growth 2004-08
Agriculture, Forestry & Fishing	0.6	0.4	2.0	3.6%
Mining	0.6	0.5	2.3	4.9%
Manufacturing	18.7	13.9	13.6	3.2%
Electricity, Gas & Water Supply	2.0	1.8	2.6	2.9%
Construction	7.7	6.3	7.2	2.2%
Wholesale Trade	9.0	7.8	6.8	2.9%
Retail Trade	5.9	5.4	6.1	2.4%
Accommodation, Cafes & Restaurants	2.2	2.6	2.8	2.2%
Transport & Storage	5.8	5.5	5.4	3.9%
Communication Services	4.1	4.0	3.4	5.5%
Finance & Insurance	11.8	14.2	11.3	3.0%
Property & Business Services	13.1	17.8	15.8	4.0%
Government Administration & Defence	3.9	3.6	4.1	2.6%
Education	4.1	4.5	4.8	3.0%
Health & Community Services	5.8	6.1	6.9	3.1%
Cultural & Recreational Services	1.7	2.6	2.5	3.3%
Personal & Other Services	2.5	2.4	2.5	3.1%
Non Classifiable industry	0.6	0.6	0.0	n.a.
Total GRP (\$m)	\$49,051	\$118,626	\$164,333	

Source: GWS EDB, 2004, p4.

According to ABS 2001 statistics in table 4, the four largest employers of labour in the GWS were *retail trade* with approximately 14.5 percent, *manufacturing* 16 percent, *construction* 8.2 percent and *property and business* amounted to 10.5 percent. Retail trade appeared to experience the fastest growing employer with an approximate increase from 90,000 people in 1996 to around 110,000 in 2001 (GWS EDB, 2004, p2).

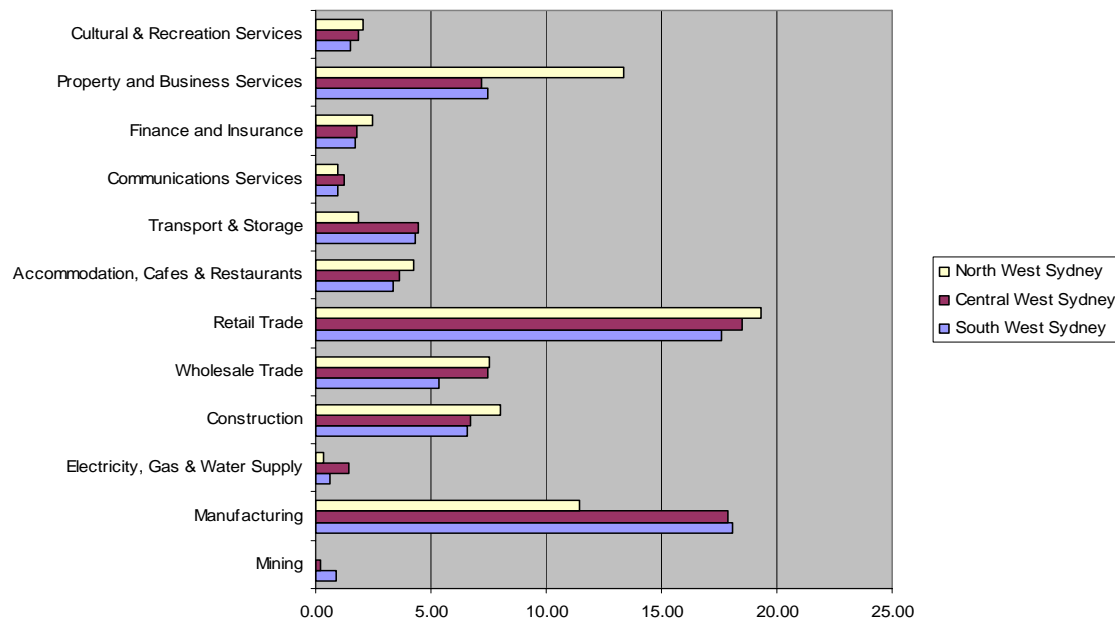
Table 4: Employment Profile of GWS in comparison to Sydney & NSW (2001)

Industry	GWS	Sydney	NSW
Agriculture, Forestry & Fishing	0.9	0.6	3.4
Mining	0.1	0.1	0.5
Manufacturing	16.0	12.2	11.5
Electricity, Gas & Water Supply	0.7	0.6	0.7
Construction	8.2	6.9	6.9
Wholesale Trade	6.9	6.1	5.6
Retail Trade	14.5	13.4	14.2
Accommodation, Cafes & Restaurants	3.9	4.8	5.2
Transport & Storage	5.1	5.0	4.6
Communication Services	2.4	2.4	2.0
Finance & Insurance	5.0	6.1	4.8
Property & Business Services	10.5	14.4	12.2
Government Administration & Defence	3.6	3.4	3.8
Education	5.8	6.4	6.8
Health & Community Services	8.3	8.9	9.4
Cultural & Recreational Services	1.8	2.8	2.5
Personal & Other Services	3.6	3.6	3.6
Non Classifiable industry	0.6	0.6	0.5
Not Stated	2.1	1.8	1.8

Source: GWS EDB, 2004, p3.

However, the distribution of industry is not homogeneous in the region. South-West and Central Sydney contains much of the manufacturing, transport and storage. North-West Sydney is ahead in Property & Business Services and retail trade (see Fig 4).

Figure 4: Industry Distribution in Western Sydney



Source: Sharpe & Martinez-Fernandez (2006)

2.3 Occupational Profile in Western Sydney

Another measure of urban development apart from industry and employment is the occupational characteristics of the area. These occupations are currently classified by the Australian standard classification of occupations (ASCO). This classification does not allow an analysis of the ‘knowledge intensity’ of occupations, which is an issue in this research. The following applied methodology is used to classify occupations in terms of a knowledge function. It is loosely based on the work of US economist Robert Reich (1991) and Cole (2004) and applied to the regional breakdown of the Sydney metropolitan area (Cole 2004; Sharpe, Martinez-Fernandez & Larcombe 2004). The breakdown categorises 340 occupational categories from the Australian Standard Classification of Occupations (ASCO) into three broad types of occupations which Reich refers to: Symbolic Analysts (knowledge workers in this case), In-person service workers and Routine Workers. A further description of these three categories is presented below. Within these three categories there are a number of further classifications. Specifically within the Symbolic Analyst category further classifications are made for Managers (General and Specialist) and Professionals (broad field of work including Business and Legal Professionals, Engineering and Building, Technical Professionals, Social Professionals, etc).

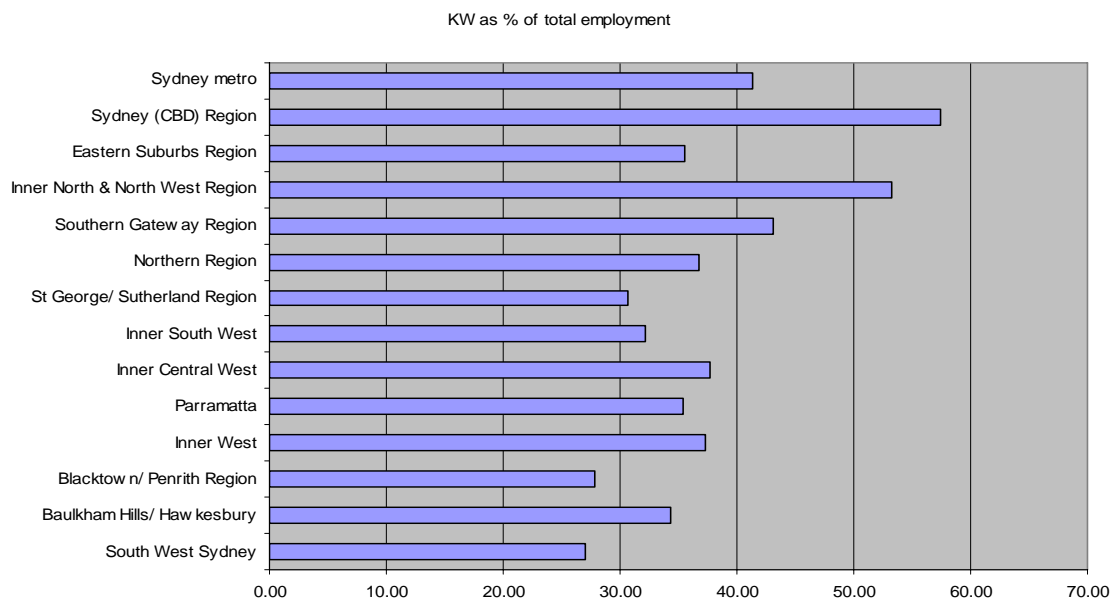
Routine Workers are those completing highly repetitive tasks in high volume enterprises, including production and assembly jobs, plus routine supervisory roles, clerical and sales. These occupations have been most harshly affected by the industrial restructuring and

changes in modes of production, or as referred to in similar work by Maglen (2001) also using Reich's concepts, threatened or more vulnerable because of globalisation (p.3).

In person service work refers to work that must be delivered in person. In the Reichian breakdown used in this analysis (Cole 2004) the distinction is made between high skill in person service workers (doctors, nurses, teachers) and low skill in person service workers (service attendants). Growth in these occupations is largely a function of population. However the distinction of skill allows these workers to be considered separately or together, as high skilled in person workers contribute to the knowledge base of regions.

Symbolic Analysts form the group of knowledge workers that Reich envisages in his categorisation of three jobs of the future. Workers in this group include occupations dealing with problem identification, analysis and solving. These services can be traded worldwide and have the distinct competitive advantage in the new economy in terms of income generating potential and quality of life, for these people globalisation has opened up opportunities (Maglen 2001). These are the occupations that could be classified as knowledge workers, involved in the processes of analysis and understanding of information to form knowledge. Therefore, mapping these occupations provides an understanding of the knowledge base of a region. The figure below shows the distribution of knowledge workers in Metropolitan Sydney. North and inner city have the highest concentration of knowledge workers. Outer Western Sydney presents lower levels of knowledge workers, with differences among sub-regions. Blacktown-Penrith presents the lowest levels of knowledge workers (see Fig 5).

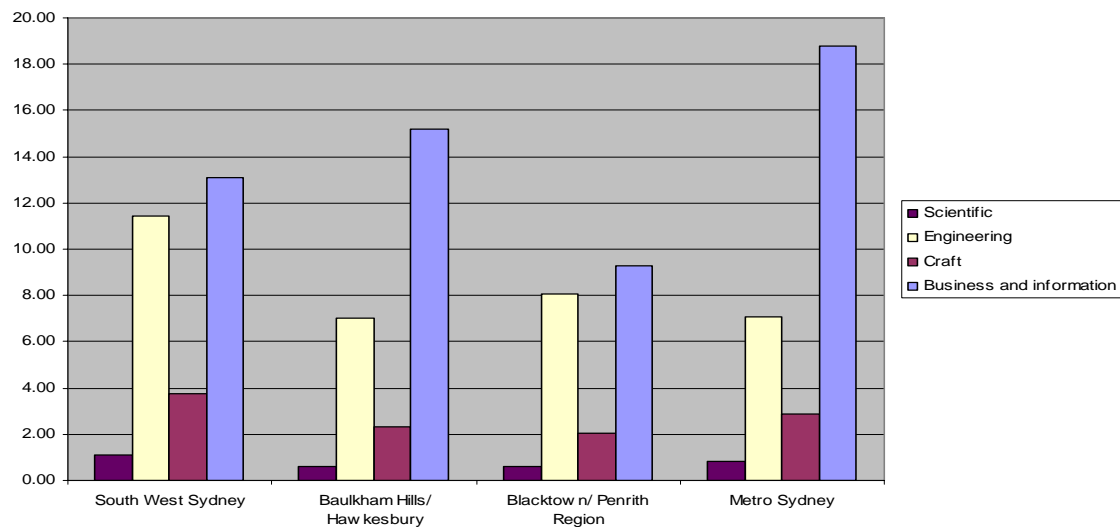
Figure 5: Knowledge workers in Sydney



Source: Sharpe & Martinez-Fernandez (2006)

Figure 6 shows a breakdown of knowledge workers employment by type (scientific, engineering, craft, business and information) and by region. South-West Sydney is ahead in 'engineering' occupations which are specially found in manufacturing (the strength in this region). They also have the highest levels of scientists and craft occupations. Business & Information related employment is ahead in the Baulkham Hills/Hawkesbury area where strong business parks as Northwest are located.

Figure 6: Knowledge workers by type in Outer Western Sydney, as % of total regional employment

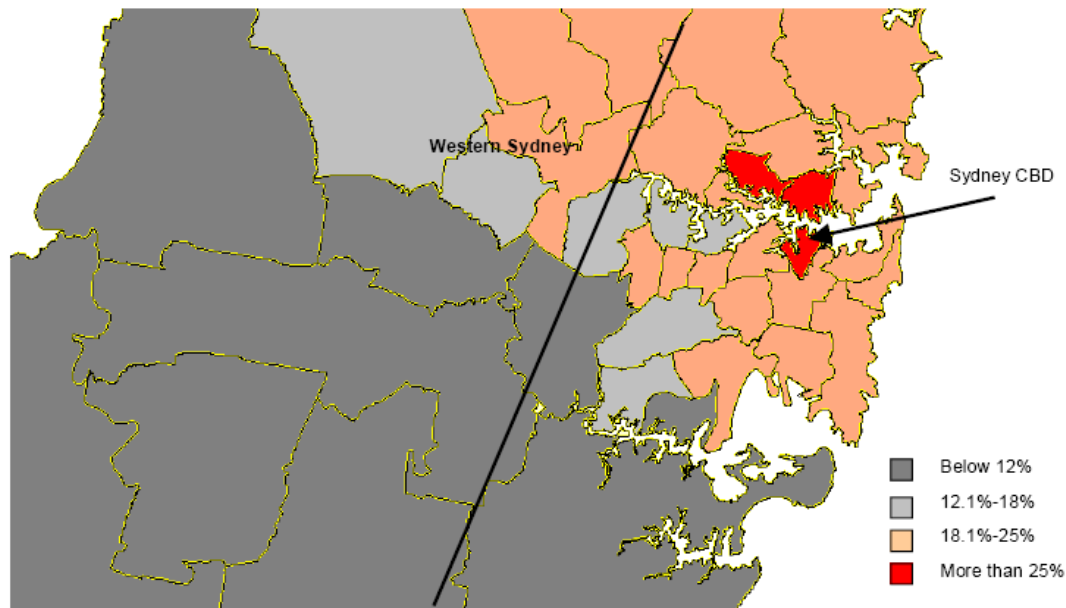


Source: Sharpe & Martinez-Fernandez (2006)

Figure 7 below shows the distribution of knowledge workers as a percentage of the total workers within each region. The regions that are coloured in grey had percentage levels of knowledge workers below that of the percentage level regional median for the metropolitan area.

The regions encompassing the CBD of Sydney and North Sydney have the highest concentrations of knowledge workers, with areas to the west and outskirts of the city with lower levels of knowledge levels. This result is unsurprising, considering the function of the central part of Sydney as the 'global hub' and many of the knowledge workers employed here would be associated with this global linkage, quite distinct from any of the metropolitan Sydney dynamics. The regions of Western Sydney, shown to the west of the black line has on average lower levels of knowledge professionals, but the area as a whole is far from homogenous.

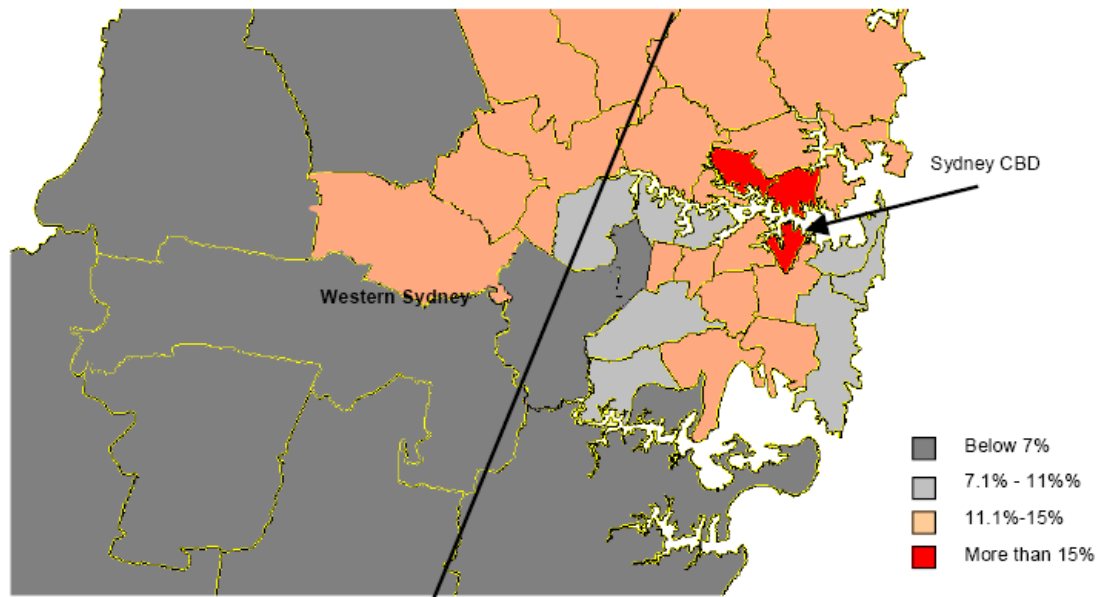
Figure 7: Sydney Metropolitan Area, breakdown by knowledge professionals 2001



Source: Sharpe & Martinez-Fernandez, 2006. ABS 2001 Census, Working Population Profile

Figure 8 below shows the distribution of a specific group of knowledge workers: the business and legal professionals. Similar to the first map, knowledge workers in the business and legal occupations are in their highest quantities in the CBD and surrounds. Throughout Western Sydney quantities also vary, ranging from above the median in the northern sections, to well below the median in the South Western sections. Acknowledging this distribution is important because as mentioned before there is a growing literature concerning the role of knowledge intensive business services (KIBS) and knowledge intensive service activities (KISA) have in innovation processes. KIBS are among the fastest growing and most dynamic sectors of modern economies. Recent economic studies have found higher levels of reported innovation and expenditures on innovation related activities among manufacturing SME who interacted with KIBS than among those who did not (Martinez-Fernandez, Potts et al. 2005; Muller & Zenker, 2001). The regions encompassing Western Sydney have a strong manufacturing industrial base, including metal manufacturing, plastics and wooden structural and furniture manufacturing. The quantities of professionals in business and legal occupation matches up with the occupations delivering these KIBS, and their distribution is divergent across the metropolitan area, but also across the Western Sydney area. This does not necessary mean that firms in these areas with lower levels of business and legal professional, are not able to access KIBS, but it does mean that in that particular region the localised knowledge base is less in terms of a key indicator capacity, competence and capability with regard to innovative capacity (Doloreux and Parto 2004 p.17).

Figure 8: Sydney Metropolitan Area, Business and Legal occupations 2001



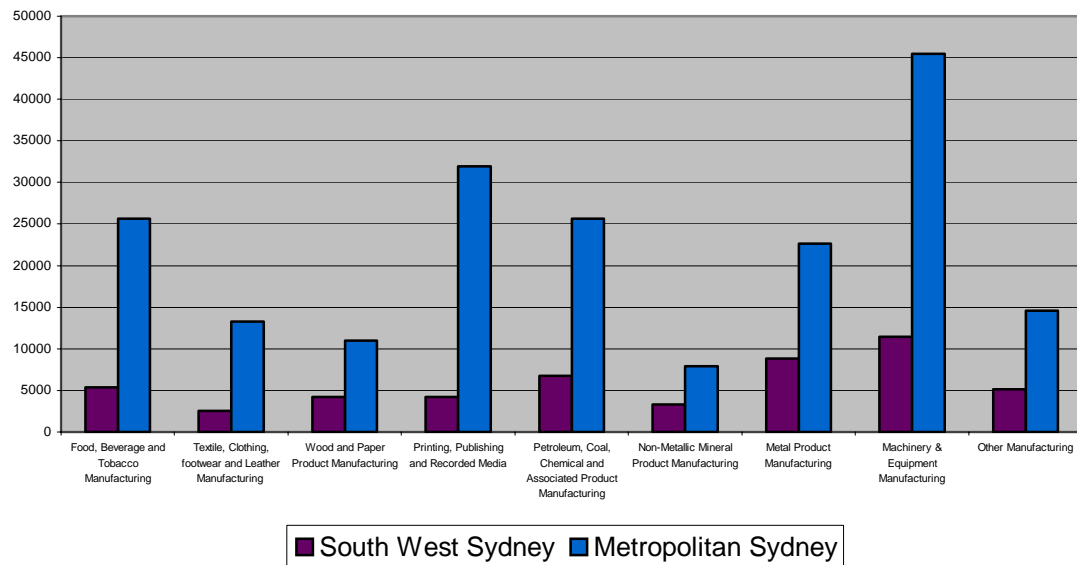
Source: Sharpe & Martinez-Fernandez, 2006. ABS 2001 Census, Working Population Profile

2.4 Evidence of Industry Manufacturing Clustering

South West Sydney, and specifically the areas surrounding the local government area of Liverpool, is one the most significant manufacturing areas in the global city of Sydney. Six local government areas in Western Sydney; Liverpool, Campbelltown, Camden, Fairfield, Bankstown and Penrith, account for 26.5% of Sydney's total manufacturing employment, and even higher percentage levels in individual manufacturing categories such as metal product manufacturing (39%), non-metallic mineral product manufacturing (41.3%) and wood and paper product manufacturing (38.6%)³. Figure 11 show the levels of manufacturing employment in these identified areas of South West Sydney in comparison with employment levels for the whole metropolitan area of Sydney.

³ Unless otherwise noted all statistical material is drawn from the ABS 2001 & 1996 Census, *Journey to Work*

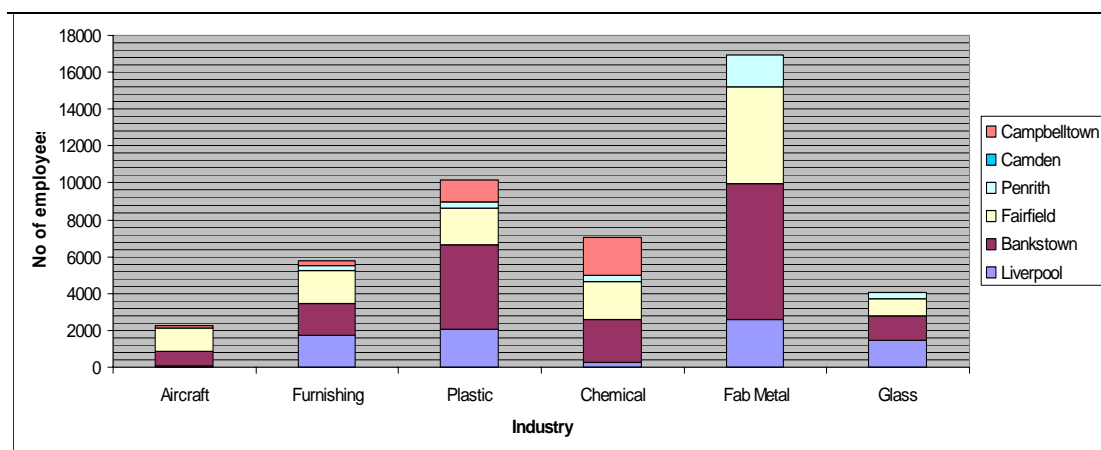
Figure 9: Manufacturing Employment South West Sydney and Metropolitan Sydney



Source: ABS, 2001 Census, *Journey to Work*

In relation to workforce, Bankstown appears to dominate manufacturing in the South Western Sydney region, followed by Fairfield and the Liverpool LGAs. The Fabricated Metals sector is the largest regional sector with approximately 16,962 employees followed by Plastics with 10,153, Chemicals with 7,058 and Furnishing with 5,753 employees. In comparison the Glass (4,077) and Aircraft (2,234) industries play a relatively minor role when taking into account the number of generated jobs. Figure 10 below shows employee concentration by industry sector.

Figure 10: Number of employees per industrial sector

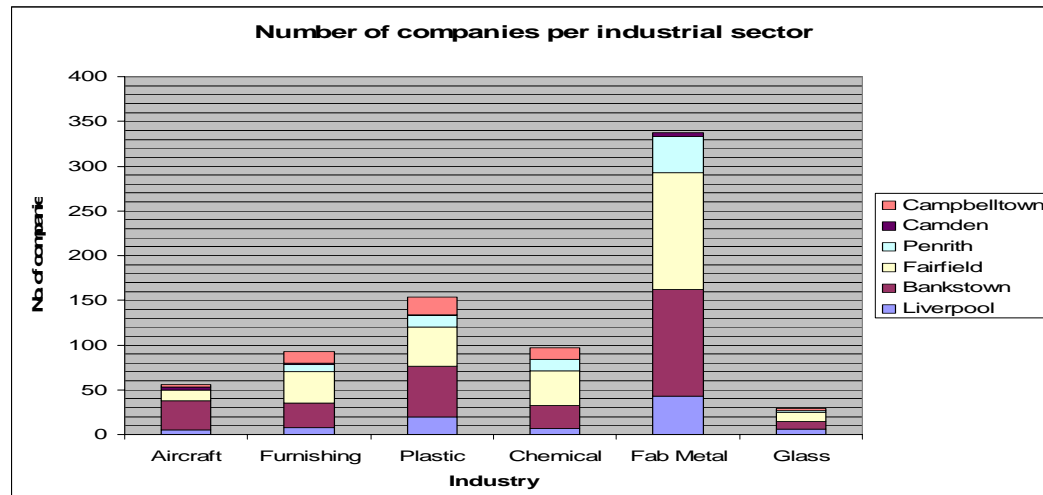


Source: Kompas Australia, 2004

The number of companies does not correlate with the number of employees in any sector or region. For example Bankstown's 33 aircraft-related firms only muster approximately 800 jobs in comparison to Fairfield's 12 firms which employ around 1,225 people. More often than not, this figure is often skewed by one or two large firms who hire a disproportionate number of people.

Again Fairfield and Bankstown dominate in all sectors particularly in the Fabricated Metals sector with 131 and 119 firms respectively. This is followed by the Plastics sector with 56 firms in Bankstown, 44 in Fairfield and 20 each in Liverpool and Campbelltown. Chemical-based companies have 38 firms in Fairfield, 26 in Bankstown, 13 for both Penrith and Campbelltown and 7 in Liverpool.

Figure 11: Number of companies per industrial sector



Source: Kompas Australia, 2004

Western Sydney, and in particular, South-West Sydney show a high concentration of manufacturing clusters, notably in the sectors of metals, furniture, plastics and chemicals. Very little is known of the level of knowledge intensity in these industries or their connectivity to the regional innovation system or to knowledge organisations.

2.5 Summary

Greater Western Sydney is the fastest growing economy in Australia. It is facing many social and physical challenges to address this growth. The economic output for the region is \$71 billion which makes it the third largest economy in Australia behind the Sydney Central Business District and Melbourne. It is home to approximately 241,976 enterprises, 20 percent of which includes the countries top 500 exporters. The major industry sectors are the manufacturing, construction, property & business services, finances & insurance and wholesale trade. The GWS region contributed a sizable 41.3 percent towards the Gross Regional Product of the Sydney economy and 29.8 percent to the state of NSW. The largest industry in terms of business numbers was the construction industry, comprising 23.5% of total businesses.

GWS is a *manufacturing hub* which contributed approximately 20.5 percent of Gross Regional Product which is significant, taking note that this is higher than the industry average for Sydney and NSW. Property and Business services and Finance and Insurance industries follow closely behind. Growth forecasts for 2008 predict that manufacturing will increase by 3.2 percent, property and business by 4.0 percent, finance and insurance by 3.0 percent, communication services by 5.5 percent and transport and storage services by 3.9 percent.

According to ABS 2001 census data, the four largest sectors of employment in the GWS were *manufacturing* 16 percent, *retail trade* with approximately 14.5 percent, *property and*

business amounted to 10.5 percent, and *construction* 8.2 percent and. Retail trade appeared to experience the fastest growing employment with an approximate increase from 90,000 people in 1996 to around 110,000 in 2001. However, the distribution of industry is not homogeneous in the region. South-West and Central Sydney contains much of the manufacturing, transport and storage. North-West Sydney is ahead in Property & Business Services and retail trade.

At the level of knowledge intensity, Outer Western Sydney presents lower levels of knowledge workers than North and Inner city, with differences among sub-regions. Blacktown-Penrith presents the lowest levels of knowledge workers. South-West Sydney is ahead in ‘engineering’ based occupations which are specially found in manufacturing (the strength in this region). They also have the highest levels of scientists and craft occupations. Business & Information related employment is ahead in the Baulkham Hills/Hawkesbury area where strong business parks as Northwest are located.

In relation to industry clusters, South West Sydney, and specifically the areas surrounding the local government area of Liverpool, is one the most significant manufacturing areas in Sydney’s metropolitan region. Six local government areas in Western Sydney; Liverpool, Campbelltown, Camden, Fairfield, Bankstown and Penrith, account for 26.5% of Sydney’s total manufacturing employment, and even higher percentage levels in individual manufacturing categories such as metal product manufacturing (39%), non-metallic mineral product manufacturing (41.3%) and wood and paper product manufacturing (38.6%)⁴. The highest concentration of activity is found in the ‘manufacturing triangle’ of Bankstown, Fairfield and Liverpool, notably in the sectors of metals, furniture, plastics and chemicals. Very little is known of the level of knowledge intensity in these industries or their connectivity to the regional innovation system or to university and research institutions.

Three characteristics stand out in relation to the industry strengths of GWS:

- Manufacturing Hub with clusters of metals, furniture, plastics and chemicals;
- Property and business services are the second industry concentration serving the large manufacturing sector;
- Retail and construction industries are largely servicing the fast growing population.

⁴ Unless otherwise noted all statistical material is drawn from the ABS 2001 & 1996 Census, *Journey to Work*

III. University of Western Sydney: Knowledge Strengths

“To be a University of international standing and outlook, achieving excellence through scholarship, teaching, learning, research and service to its regional, national and international communities, beginning with the people of Greater Western Sydney”

UWS Mission statement, 2004

3.1 UWS Vision

UWS has comprehensive aims but most noteworthy of its plans, is its aims for growth and engagement - capitalising on the diversity of the region, accessibility, internationalisation and providing educational alternatives for the GWS region.

UWS is pursuing a growth strategy which irrevocably ties it to the GWS region. In order for the university to extend current levels of participation it has to make new in-roads in educating the communities of GWS. Tertiary participation in this region is relatively low in comparison to other parts of Sydney – only 30 percent of university students live in the GWS region (Gleeson et al, 2002, p67).

UWS plans to increase student enrolments, not only from the GWS region but nationally and internationally. It is also strategically important for UWS to enhance the scale of its operations across all its campuses and “to achieve the level of sustained investment required to deliver high quality teaching, learning, research and community engagement”. UWS hopes to push enrolments, in line with increased population growth in the GWS, to around 50,000 students in five to ten years time. Presently 71 percent of its student body reside in the GWS region (UWS, 2004c, p11, 16).

A strong emphasis on internationalisation of the curricula ties in strongly with the stated aim to increase student numbers. This includes an increase of international students to the university, opening up opportunities for international study experiences for Australian students and incorporating an international outlook in the content and design of subjects and encouraging international partnerships, alliances and collaborations (UWS, 2004c, p18).

Engagement⁵ is another area UWS aims to excel. Steps are afoot to encourage and promote engagement and tie it in with UWS’ identity and culture involving both staff and students. UWS also plans to develop the regions intellectual and social capital through a student profile that mirrors the communities living in GWS. It also plans to foster nationally and internationally recognised research programs that address GWS issues and work with both communities and industry (UWS, 2004a, p8).

The university is also keen to promote the diversity and distinctiveness of each campus to maximise the visibility and standing of UWS in the GWS region. It plans to do so by promoting specific characteristics of each campus via academic programs, research profiles, size and unique community expression – encouraging each campus to become a portal for the university. UWS also sees the social diversity of its region as a tool to inform and enliven its teaching program, stimulate cultural life on campus and increase the influence of its alumni (UWS, 2004c, p20).

⁵ Collaboration between the University and a community

Accessibility to staff and student communities is also important since flexibility of teaching and service arrangements can increase the scale, quality and variety of opportunities for all involved (UWS, 2004c, p18-19). The university has also taken upon itself to address existing social disadvantages in the GWS region. It aims to be responsive to the needs of the region by providing alternative access to applicants who “may have been disadvantaged in their attempts to gain entry via traditional schemes”. UWS plans to target Aboriginal and Torres Strait Islander and other low socio-economic status groups in order to maximise their opportunities for entry into UWS (UWS, 2004c, p21).

The University of Western Sydney vision and mission statements cover a wide spectrum and also examines areas such as regional/community engagement, research and strategy. However UWS is placed in a difficult situation with regards to funding from federal government. Recent reforms have seen a decrease in government funding to UWS. In addition federal government proposals to link workplace relations to funding threaten non-compliant institutions with losses to the sum of \$404 million. (NTEU, 2004) In its 2004 Annual Report, UWS admits the federal government higher education reform package means that it faces an immediate cut to the government grant and a “period of financial stringency before a return to its current operating base by 2007, whilst at the same time most other universities will enjoy significant increases in their funding” (UWS, 2004c, p22).

Federal government funding has been largely on the decline since the late 1980s. The general message to institutions is not to expect increased government funding which forces universities to meet rising costs. In turn the federal government’s response to this fiscal shortfall is to increase the costs to students. However there are significant problems and inequities that arise from such a policy response.

- The basis on which insufficient university places are allocated will shift toward those who can meet the expense to pay rather than based on academic merit;
- Student debt having reached \$9 billion in 2003, will simply expand at a faster rate;
- Universities will be pressured to fund rising costs by intensifying their risky commercial ventures and by focussing on international students (NTEU, 2003).

This has brought about stringency measures which may challenge the objectives of UWS vision.

3.2 The University of Western Sydney: Campuses & Students⁶

The University of Western Sydney (UWS) was formed in 1989 through an amalgamation of Macarthur, Hawkesbury and Nepean Colleges of Advanced Education. UWS has six teaching campuses and is now the major provider of higher education for the Greater Western Sydney Region.

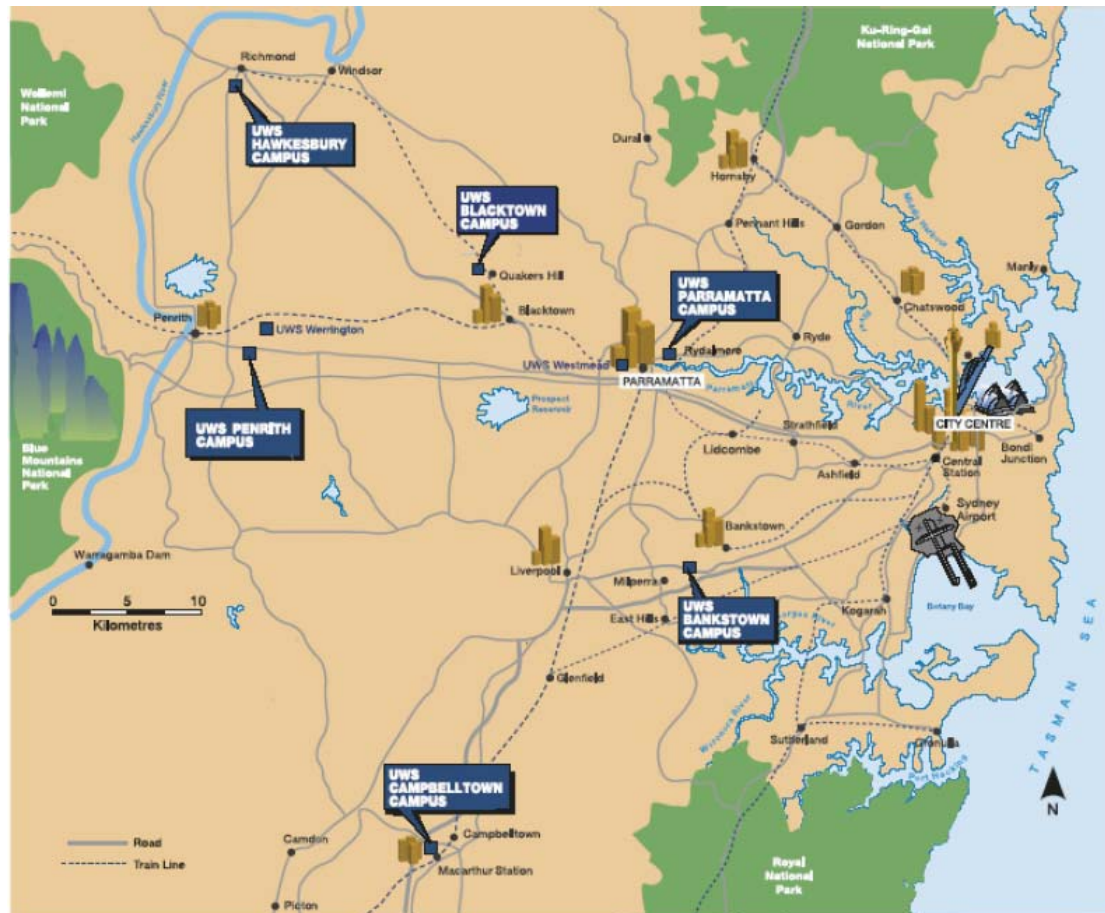
UWS has 36,419 students with 56 percent of enrolments being female and 44 percent male. Undergraduate students made up 77 percent of the student population. Students concentrate in mainly two fields of study: Management and Commerce (32%) and Society and Culture (20%). Around 73 percent of its students live in the Greater Western Sydney region.

In 2005, full-time staff numbered 2,637 with 1,289 academic and 1,348 general staff working across all six campuses. In 2004 UWS’ total income amounted to \$334.01m and its operating expenditure in 2005 was \$346m. It has net assets of \$609.15m.

⁶ Information for this section was extracted from the UWS Annual Report, 2004

The UWS campuses are located at six locations; Hawkesbury, Penrith, Campbelltown, Bankstown, Parramatta and Blacktown (see figure below).

Figure 12: Location of the 6 UWS campuses in Greater Western Sydney



Source: UWS website <http://www.uws.edu.au/about/locations>, accessed 29 June 2005

The Hawkesbury site has two campuses and was originally set up as an agricultural college in 1891. Many of its students largely come from Sydney's north-western suburbs as well as a significant number from country NSW. There are 2,738 students on this campus.

The Blacktown campus is co-located with the Western Sydney Institute of TAFE and two high schools. It is centrally located within central western Sydney. There are 2,891 students on this campus.

The Bankstown campus is located at Milperra. The site was originally the Milperra College of Advanced Education. Access is primarily via private transport, although special buses ferry students and staff from Bankstown, Fairfield and Liverpool train stations. There are 5,468 students at the Bankstown campus.

The Campbelltown campus is a large site and is highly accessible from the Macarthur train station. The Campbelltown TAFE is located adjacent to this campus. There are 4,917 students at the Campbelltown campus.

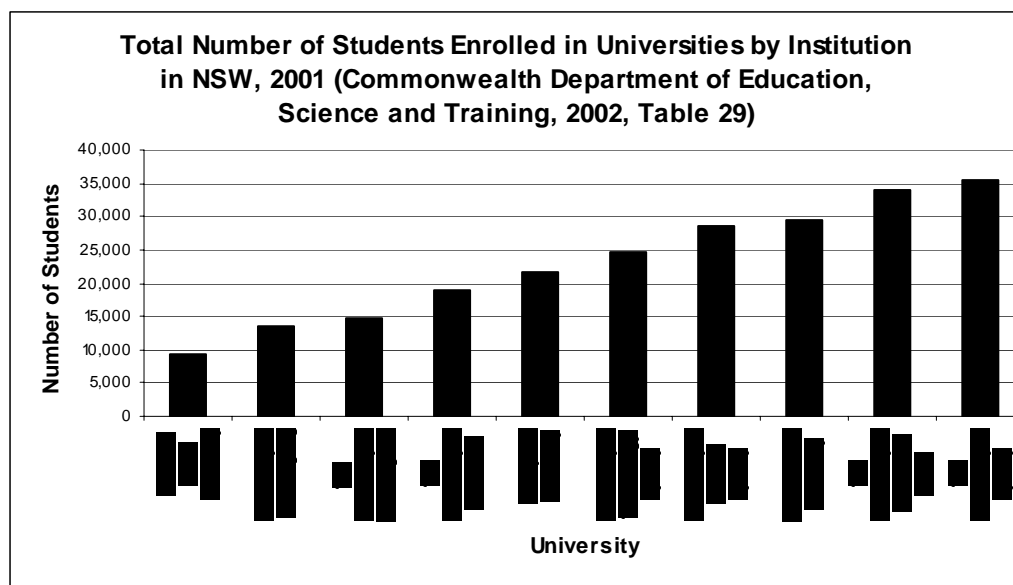
The Penrith campus has three sites, Kingswood, Werrington North and Werrington South. These sites are accessible via public transport and are also serviced by a shuttle bus service. There are 7,376 students on these campuses.

The Westmead campus is only located about two kilometres from the Parramatta CBD. And lastly, the new Parramatta campus is located in Rydalmere and is accessible via Parramatta, Auburn, Baulkham Hills and Ryde train stations. Over 50 percent of UWS students study at Parramatta (28%) and Penrith campuses (23%). There are 9,120 students at the Parramatta campus.

With the formation of UWS in 1989, Greater Western Sydney has witnessed significant advances in regional education and training. In 1992 the Institute of TAFE was formed with a regional rather than a local college focus. Arguably this has inadvertently contributed to the growing proportion of school students stay on at school until Year 12, improved competitiveness of private trainers, and enhanced the relationship between industry and providers in executing the National Training Agenda (National Economics, 1997, p1).

The University of Western Sydney provides 36,419 places for the Greater Western Sydney population of 1.673 million people, a ratio of one university place to every 46 residents without regard for age. This can be compared with the Sydney metropolitan ratio of one place to 22 residents and NSW state ratio of one place to 21 persons (ABS, 2005; DEST, 2004; WSROC, 2002, p1). However while 71 percent of UWS students live in the GWS area (UWS, 2004c, p11), only 30 percent of all university students lived in the GWS region and the majority of them live mainly in Baulkham Hills, Parramatta and Auburn (Gleeson et al, 2002, p67). UWS is comparatively a medium-sized university in NSW. It is only eclipsed by the University of Sydney, University of NSW and Charles Sturt University (see Figure below).

Figure 13: Student Enrolments in universities and institutions in NSW, 2001



3.3 Economic contribution

Universities are increasingly being recognised as independent business entities within an industry sector of significance for local and national economies (Kelly et al, 2006). The study conducted by Kelly et al for Universities UK shows that the economic impact of the higher education sector can be measured through the following indicators:

Table 5: Indicators of Universities' Economic Contribution

Indicator category	Indicators
Direct income, expenditure and employment	<ul style="list-style-type: none"> • Total revenue • Percentage of public sector funding of total income • Income from private sector sources • International sources income • Total expenditure, percentage in salaries • Number of people employed. Percentage of total employment in the region • Expenditure in goods and services
Secondary multiplier effects	<ul style="list-style-type: none"> • Employment generated through knock-on effects in the region • Revenue generated in other sectors of the economy as a results of university expenditure
Export earnings: International students and visitors	<ul style="list-style-type: none"> • Personal expenditure of international students (off-campus) • Personal (off-campus) expenditure of international business and recreational visitors • Multipliers on income and employment of international students expenditure • Multipliers on income and employment of international visitors expenditure

Source: Adapted from Kelly et al (2006)

While this report does not aim to provide a comprehensive analysis of the economic contribution of UWS, its economic contribution to the region of Western Sydney is largely based on the fact that it acts as a catalyst to attract students and visitors to region, is a large regional employer, produces a skilled workforce and provides direct and indirect expenditures associated with the provision of education and research services. According to a 1997 report, the gross value of output of UWS was approximately \$190m annually. In addition, the value of production in non-UWS companies located in the GWS generated as a result of UWS' presence was \$140m annually. UWS was therefore assessed to be approximately worth \$300m annually to the economy of Western Sydney (NEP, 1997, p38).

Provision of educational services in itself directly produces a range of expenditures which effects the GWS economy. The kinds of expenditure are:

- salaries to all university staff, most of whom leave in the GWS region;
- expenses by staff on goods and services;
- expenses by students on goods and services;
- expenses by visitors to UWS on goods and services;
- expenses by UWS on goods and services purchased from businesses operating in the GWS region;
- expenses by international students and overseas visitors.

In relation to employment, UWS does not only employ academics but provide jobs for a wide range of staff across a number of occupations from routine to more knowledge intensive: managers, academics, professionals, technicians, welfare workers, careers advisors, vocational instructors, media, public relations, marketing, library assistants, different trades, retail & customer service, drivers, cleaners, security officers and maintenance workers. During the fortnightly pay period dated 23rd February 2006, UWS paid out \$6,070,405 in salaries to all casual, limited term, permanent staff and scholarship students. Of this \$3,144,683 was paid out to women and \$2,925,721 to men⁷.

The number of UWS staff living in the GWS region amounted to 2,756 people or 71.4 percent of all UWS staff. Most live in Penrith (13.75 %), the Blue Mountains (12.63%), Hawkesbury (8.82%), Blacktown (7.98%) and Campbelltown (6.71%)⁸. Therefore it can be assumed that a large proportion of UWS paid salaries are spent within the GWS region. Expenditure by students and staff in all UWS cafes at all campus was A\$7.5 million in 2005.⁹

The number of international students in 2005 was 3,654 which has an impact in a wide range of goods and services off-campus, such as housing and accommodation, local retail, local pubs and entertainment venues and sports facilities. They also attract international visitors that would contribute further impact to the Tourism industry. This includes parents and relatives visiting students who live away from home. Also conferences held at UWS attract visitors, who in turn use services held in university facilities. Foreign¹⁰ students in Australia account for the highest percentage of students in higher education of most OECD countries and therefore their impact on universities' economic value is significant (CEC, 2006).

Table 6: Foreign Students as a percentage of students in higher education in 2003

	AUS	SWITZ	NZ	EU25	NORW	USA	JAPA	RUSS	KOR
Foreign students as a % of all studs in higher education	18.7	17.7	13.5	6.2	5.2	3.5	2.2	0.8	0.2

Source: CEC, 2006 (EUROSTAT and OECD)

UWS' expenditure on external goods and services vary widely. Depending on the types of expertise available in the area, goods and services may often be sourced from local businesses in the GWS region eg. security, foodstuffs, accounting and legal services (National Economics Pty Ltd, 1997, p21-22). No data is available on the output of UWS expenditure on other economic sectors. A study of UK higher education institutions found that major output of universities was found on the manufacturing, wholesale and retail trade and business activities sectors (Kell et al, 2006). However, controversial 'Voluntary Student Unionism' changes brought in by the Federal government in December 2005 is projected to reduce funding by \$10m¹¹ for student services, much of which would be supplied by local businesses.

⁷ Office of Human Resources, 2006

⁸ Information provided by Mr Bernard Jason, HR Information Systems, Office of Human Resources, UWS.

⁹ UWSconnect Ltd, email communication 11/04/06

¹⁰ According to citizenship

¹¹ (UWS, 2005,

<http://www.uws.edu.au/about/university/governance/boardoftrustees/boardmeetings/meetings2005/summary/12october2005> accessed 1 Feb 2006)

UWS has a commercial arm which undertake to transfer knowledge via staff consultancies, vocational training, e-learning, and Licences, Options and Assignments (LOA). UWS has approximately 13 commercial entities which provide a series of services from consultancies, teaching and other professional tasks. They are:

- CADRE Pty Ltd - e-Learning contact;
- Linkwest Ltd. - Vocational Education and training;
- Sydney Western International College Pty Ltd. (SWIC) – assistance in university admission;
- UWS Conferences and Residential Colleges Ltd - Conferences, venues and events
- UWSconnect – provides sports and leisure, retail, food and beverage to UWS community;
- Sydney Graduate School of Management Ltd (SGSM) – runs major business teaching programs such as the MBA.

Apart from these commercial entities UWS also pulls in money via overseas and local fee-paying students, research grants, leases, service fees, asset sales and investment income (UWS, 2004 vol. 2, p233). In 2004, UWS income was approximately \$325 million. In 2005, consolidated operating revenue was \$350.78m.; total assets \$855.17m and total expenditure \$346.09m (UWS, 2006).

3.4 Transmission of Knowledge

3.4.1 Graduate skilled workforce

In 2005, UWS had 35,372 students with undergraduates making up 77 percent of the student population. Around 73 percent of its students live in the Greater Western Sydney region (UWS, 2005). Students concentrate in two fields of study, Management and Commerce (32%) and Society and Culture (20%).

Table 7 shows that the Parramatta campus is the biggest in terms of student numbers, followed by Penrith, Bankstown and Campbelltown campuses.

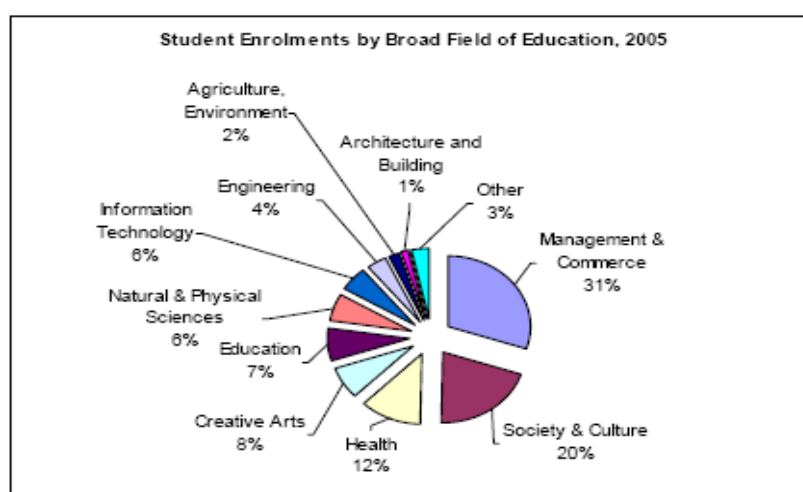
Table 7: UWS Student Enrolments by Campus 2003-2004

Campus	2003	2004	No. Change '03-04	%
Bankstown	5,125	5,468	343	6.7%
Blacktown	3,082	2,891	-191	-6.2%
Campbelltown	4,976	4,917	-59	-1.2%
Hawkesbury	2,521	2,738	217	8.6%
Parramatta	8,853	9,120	267	3.0%
Penrith	7,945	7,376	-569	-7.2%
Off campus and off shore	5,805	3,909	-1,896	-32.7%
TOTAL	38,307	36,419	-1,888	-4.9%

Source: UWS, 2004d, p77

The change in students' enrolment between 2003 and 2005 was -2,935, down 7.7 percent. Management and Commerce and Society and Culture still have strong enrolments while Engineering attracted only 4 percent. Figure 14 shows all students enrolment in 2005.

Figure 14: Students Enrolments 2005



Source: UWS, 2006

The table below shows in 2004, 11,217 students (30.79%) from all levels (domestic and international) were studying in the Management/Commerce field. Humanities-based 'Society & Culture' follows with 6,829 (18.75%) students, Health with 4,545 (12.47%) students and the Creative Arts with 2,677 (7.35%) students. By 2005, generally enrolments were down by 7.7 percent from 2003. Areas that experienced large declines were 'Information Technology', 'Engineering & Related Technologies' and 'Management & Commerce'. However there was good growth in the 'Natural & Physical Sciences' and the 'Agricultural, Environment & related studies' area as well as in 'Society & Culture'. The decline in IT enrolments reflects the decline of the industry in Australia and the latest outsourcing strategies to low-cost countries such as India. Declines in engineering disciplines and in management & commerce might have been the result of the impact of policy changes at UWS and colleges related strategies.

Table 8: Student Enrolments by Broad Field of Education, 2003-2005

Broad Field of Education	2003	2004	2005	Change '03-05	%
Management & Commerce	12,282	11,217	10,665	-1,617	-13.1
Society & Culture	6,346	6,829	7,167	821	12.9
Health	4,924	4,545	4,314	-610	-12.3
Creative Arts	3,014	2,677	2,639	-375	-11.44
Education	2,751	2,653	2,593	-158	-5.7
Information Technology	2,832	2,256	1,963	-869	-30.6
Natural & Physical Sciences	1,774	1,871	2,189	415	23.39
Engineering & related technologies	1,683	1,590	1,414	-269	-15.98
Agricultural, Environment & related studies	624	765	720	96	15.38
Architecture & Building	501	475	504	3	0.5
Other	1,571	1,537	1,204	-367	-23.3
TOTAL	38,307	36,419	35,372	-2,935	7.70%

Source: UWS, 2005, 2004

The next Table shows a breakdown of student enrolments by course level. The vast majority of students are enrolled as undergraduates, comprising 77 percent of the student population with the remaining 20 percent of the student body enrolled in postgraduate courses.

Table 9: Student Enrolments by Course Level, 2001-2004

	2002	%	2003	%	2004	%	2005	%
Undergraduate	28,868	76	29,173	76	27,921	77	27,605	78
Higher Degree Coursework	4,213	11	4,577	12	4,325	12	3,821	11
Higher Degree Research	982	3	301	2	898	3	820	2
Other postgraduate	1,988	5	2,030	5	1,695	5	1,478	4
Enabling & Non Award	1,740	5	1,626	4	1,580	4	1,648	5
TOTAL	37,791	100	38,307	100	36,419	100%	35,372	100

Source: UWS, 2004, p75

One of the pivotal roles an establishment like UWS fulfils is to train postgraduate students. A research career usually begins as a Honours student for many postgraduates, where a student gains their first exposure to academic research. Such research students, may work individually or in teams assisting a supervising researcher. Such ‘apprentice’ researchers often play a pivotal role in both knowledge transmission and knowledge generation within a knowledge hub. Honours and Coursework research students, while not classified as trainee or apprentice researchers, arguably extend and expand their area of expertise with many returning later to undertake more serious research degrees. UWS graduates have a better workforce participation than the average of the sector but are below the sector in pursuing postgraduate studies (see Table 10).

Table 10: Graduate Destinations 2001-2004 (Bachelor Degrees only) (Percentages)

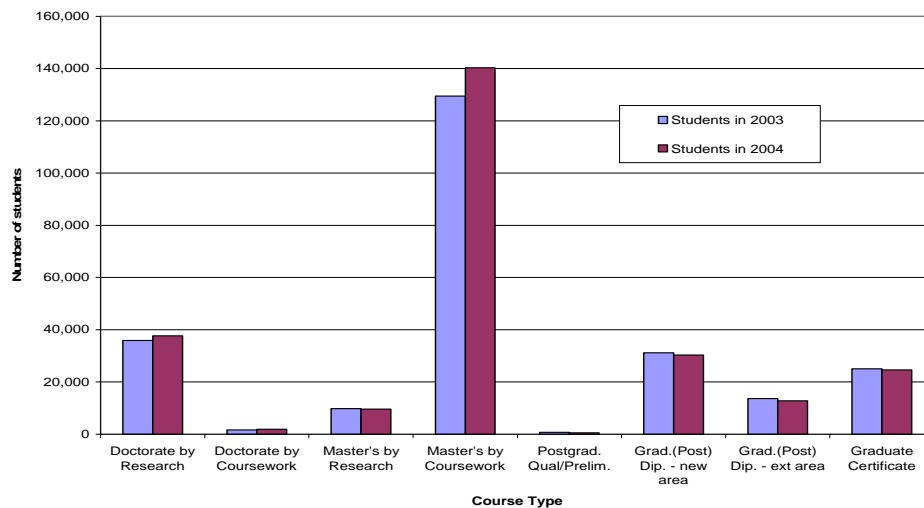
	2001		2002		2003		2004		2005	
% of Graduates	UWS	Sector	UWS	Sector	UWS	Sector	UWS	Sector	UWS	Sector
Working Full Time	54.5	55.7	51.3	53.2	56.8	53.7	53.2	52.9	53.1	54.6
Working Part Time	16	12.7	18.2	13.3	17.3	13.8	19.8	14.7	18.5	14.7
Sub Working Total	70.5	68.4	69.4	66.5	74	67.5	73	67.5	71.6	69.3
Seeking Work	7.1	5.3	8.2	5.5	7.6	5.8	7.3	5.5	9.3	5.2
Full Time Study	19.8	23.4	18.5	24.1	16.6	22.8	14.7	23.4	16.2	22.4
Unavailable or Unknown	2.5	2.9	2	3.9	1.8	3.9	5.1	3.6	2.8	3.1

Source: UWS, 2004d, p78.

3.4.2 Postgraduate training as a skilled workforce in GWS

Among all Australian universities, the majority of postgraduate students are enrolled in Masters by coursework degrees (see figure below). Doctorate by Research (PhD), Graduate Diplomas and Certificates play a much lesser role in comparison.

Figure 15: Postgraduate students by Course Type in Australian universities, 2003-2004

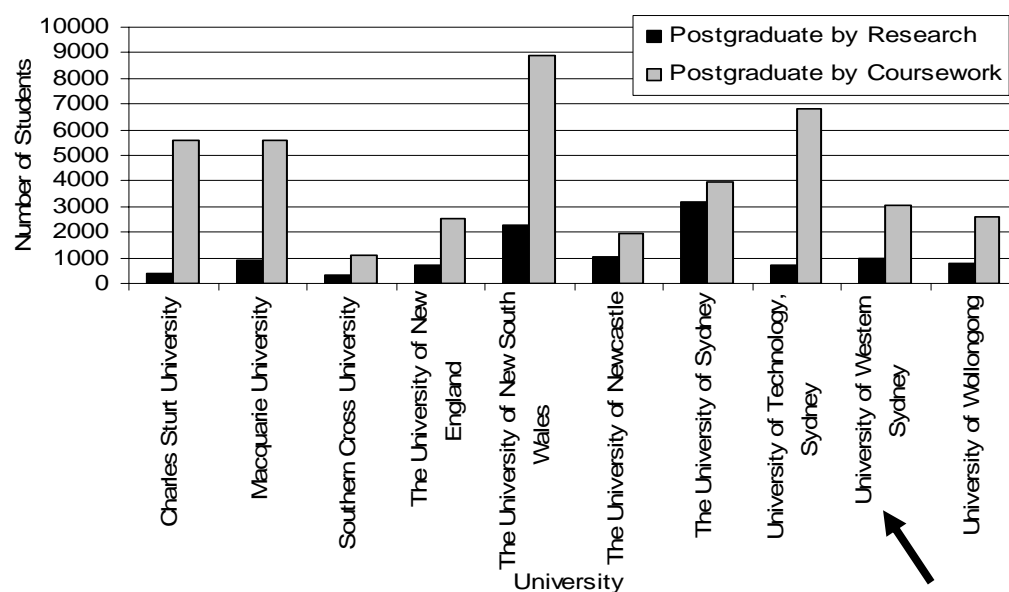


Source: Summary of Student Numbers, DEST, <http://www.dest.gov.au/> accessed 5 Aug 2005

In the figure below, all NSW-based universities are compared. By far the two universities that dominate are, the University of NSW and the University of Sydney. The UNSW has an impressive coursework element, probably associated with their various Masters courses. However their research degrees are eclipsed by the University of Sydney. In comparison with the remaining universities, not including Sydney and UNSW, UWS has a significant number of research postgraduates. UWS' research student population is higher than UTS, Wollongong, New England, Southern Cross, Charles Sturt universities and approximately at par with Macquarie. Only Newcastle had a slightly higher number of research students.

In 2005 there were 6,119 postgraduate students at UWS. Table 11 shows that the most popular postgraduate degree is the 'Master's by Coursework' option with a total of 4,319 students in 2004. This is followed by the 'Graduate Diploma/Postgraduate Diploma' with 1,227, the 'Doctorate by Research' with 733, 'Graduate Certificate' with 468, 'Master's by Research' with 165 and lastly the 'Doctorate by Coursework' with 6.

Figure 16: All Students Enrolled in Postgraduate Studies by Research and Coursework by Institution in NSW, 2001



Source: Commonwealth Department of Education, Science and Training, 2002, Table 29

For its size in terms of undergraduate enrolments, UWS has noticeably few coursework or research postgraduates. UWS had 6,918 postgraduate students in 2004; 2,406 in Parramatta and 850 in Bankstown (see Table 11).

Table 11: UWS Postgraduate Enrolments by Course Type and Campus, 2004

Course type	Banks town	Black town	Campbell town	Hawkes bury	Off-Campus	Off-shore	Parra matta	Penrith	Total
PhD Coursework			6						6
PhD Research	127	17	69	191		1	88	240	733
Master's Coursework	310	146	216	369	146	1100	1799	233	4319
Master's Research	12	8	22	40			31	52	165
Graduate Diploma/Postgraduate Diploma	390	85	111	47	87	52	303	152	1227
Graduate Certificate	11	6	18	33	113	44	185	58	468
Total	850	262	442	680	346	1197	2406	735	6918

Source: Information and Analysis Unit, Office of Planning and Quality, UWS . 2005

Postgraduate students cluster again on Management & Commerce and Society & Culture disciplines (see Table 12). Disciplines such as Engineering and Architecture and Building have small numbers.

Table 12: UWS Postgraduate Enrolments by Broad Field of Education and Course Type, 2004

Broad Field of Education	Doctorate by Course work	Doctorate by Research	Graduate Certificate	Graduate Diploma/Postgraduate Diploma	Master's by Coursework	Master's by Research	Total
Agriculture, Environmental & Related Studies	60	9	11	67	19		166
Architecture and Building	3	1	53	49	2		108
Creative Arts	55		40	126	12		233
Education	55	9	60	75	6		205
Engineering & Related Technologies	32	1	23	108	11		175
Health	51	15	262	383	18		729
Information Technology	18		37	215	8		278
Management & Commerce	58	337	178	2591	22		3186
Natural & Physical Sciences	80		0	95	10		185
Society & Culture	6	321	96	563	610	57	1653
Total	6	733	468	1227	4319	165	6918

Source: Information and Analysis Unit, Office of Planning and Quality, UWS

University students are a good source for a highly qualified workforce, increasing global competitiveness and, therefore, of maximum benefit for the region of Western Sydney.

3.5 Generation of Knowledge

UWS has 8 university research concentrations and 31.30% of staff is research active. Publications per academic staff were 1.17 in 2004 (UWS, 2006). The potential contribution of this research wealth to the region's capacity for innovation, entrepreneurship and partnerships with major stakeholders is, perhaps, the most important ingredient for successful development of regions (Singh & Allen, 2006). The attraction and retention of scientists that can leverage the research potential of universities is a difficult task. Urban areas have an advantage because they can offer life-style opportunities that are difficult to find in rural areas, but even so there are many differences within urban areas. In Sydney, the eastern suburbs attract significantly more knowledge workers than the western suburbs, as explained earlier, and therefore retention of researchers became an issue for the region's development if life-style issues are not addressed at the local level.

The generation of knowledge per se is not a sufficient condition for impacting the local economy. Singh & Allen (2006: 667) refer to three broad factors for this to happen:

1. The ability of the region to convert knowledge into economic activity and employment opportunities;
2. The intensity of knowledge sharing and general cooperation among regional actors;

3. A regional milieu characterised by a learning economy.

Therefore, although geographical proximity is not a necessary condition for the generation of new knowledge, it is important for the 'conversion' of knowledge into economic wealth and employment, and for the intensity of knowledge flows among regional networks. The 'clustering' of knowledge can also stimulate the development of industry clusters. SMEs in proximity to universities and research institutions are able to quickly adapt and incorporate relevant new knowledge (Muller & Zenker, 2001). University research is a major source of innovation and, regardless of the type of research, it can have a significant impact on jobs and wages in the region where it is embedded (Singh & Allen, 2006). The contribution of UWS to innovation and invention can be seen through different paths: one is publication of research results and sharing at local and international conferences; another way is through formal and informal consultation by industry, government and community. Finally UWS also produces patents and obtains licenses that could be released to entrepreneurial firms. Below are presented two measures of research intensity at UWS: expenditure and income.

3.5.1 Research expenditure

In 2002 Australian universities spent about \$3,429,597 million on research. Of this, NSW universities spent \$984,775 million, the largest share in Australia and just ahead of the national figure for the CSIRO (see figure below) (DEST, Research Expenditure, 2002).

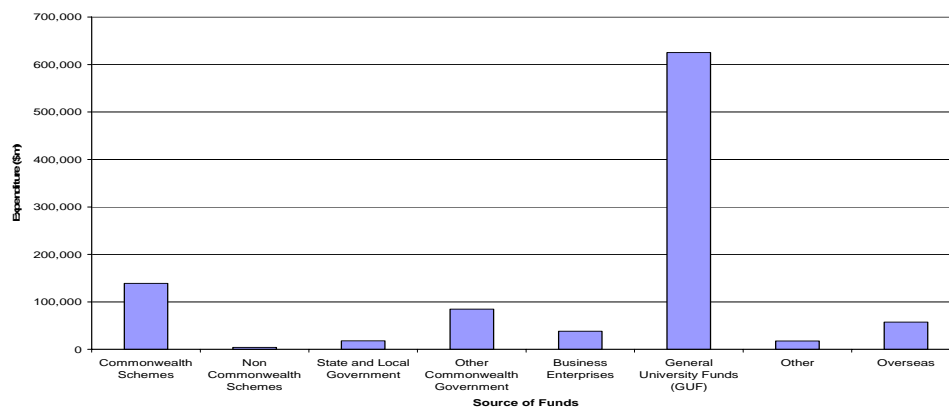
The statistics on research income, collected by the ABS, do not completely include staff time spent on research activity. Statistics on external research income can also be used to indicate comparative success in obtaining research grants, including Cooperative Research Centres (CRC). There are both advantages and disadvantages in this. External research income figures are more restricted by the fact they do not include staff research that was not externally funded. This definitely underestimates research activity. Therefore, in this report, we largely rely on research expenditure as the indicator.

The figure below shows a breakdown of sources for R&D expenditure in Australia. By far the largest source in 2002 comes from 'General University Funds' which accounted for \$625,208 million. This is followed to a lesser extent by 'Commonwealth schemes' and 'Other Commonwealth Government' monies which brought in \$139,147 million and \$4,308 million respectively. In total NSW universities received \$984,775 million in 2002 (DEST - Research Expenditure¹²).

12

http://www.dest.gov.au/sectors/higher_education/publications_resources/statistics/publications_higher_education_statistics_collections.htm, accessed 8 Aug 2005)

Figure 17: Expenditure on Research and Experimental Development by Source of Funds, NSW, 2002

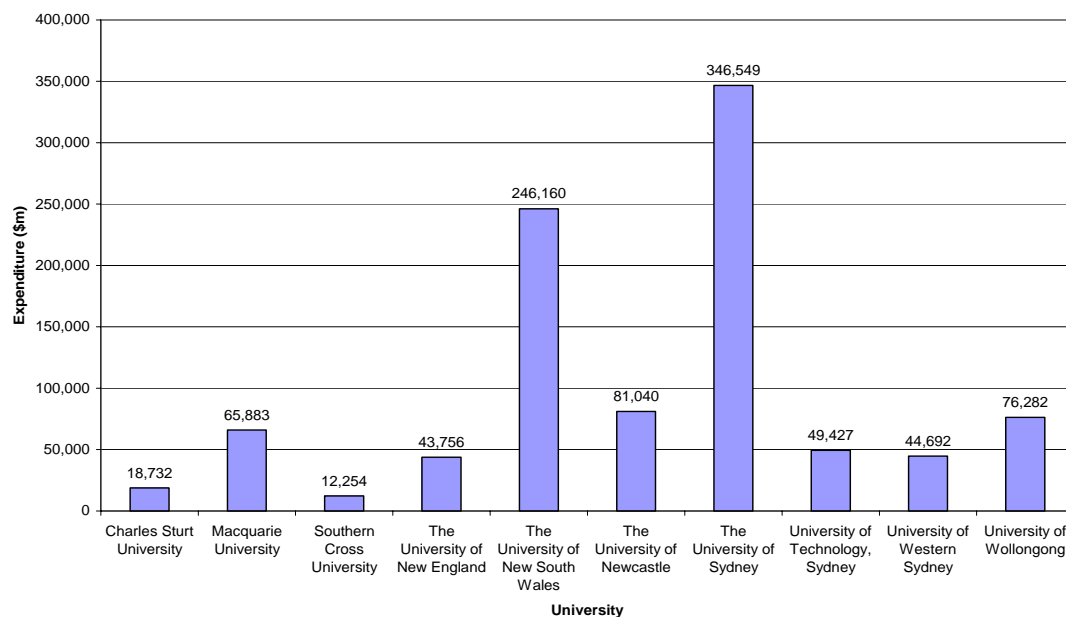


Source: Commonwealth Department of Education, Research Expenditure, 2002, p7.

The University of NSW and especially the University of Sydney again dominate the funding landscape of NSW state. The figure below shows UWS is strongly overshadowed by most institutions apart from Southern Cross, Charles Sturt and to a lesser extent New England universities.

Even universities such as Macquarie and UTS who have smaller student enrolments and research candidatures, appear to have larger research expenditure than UWS, and universities with smaller research student enrolments (2001) such as Wollongong and Newcastle took larger portions of the research expenditure pie in 2002.

Figure 18: Research Expenditure by university in NSW, 2002

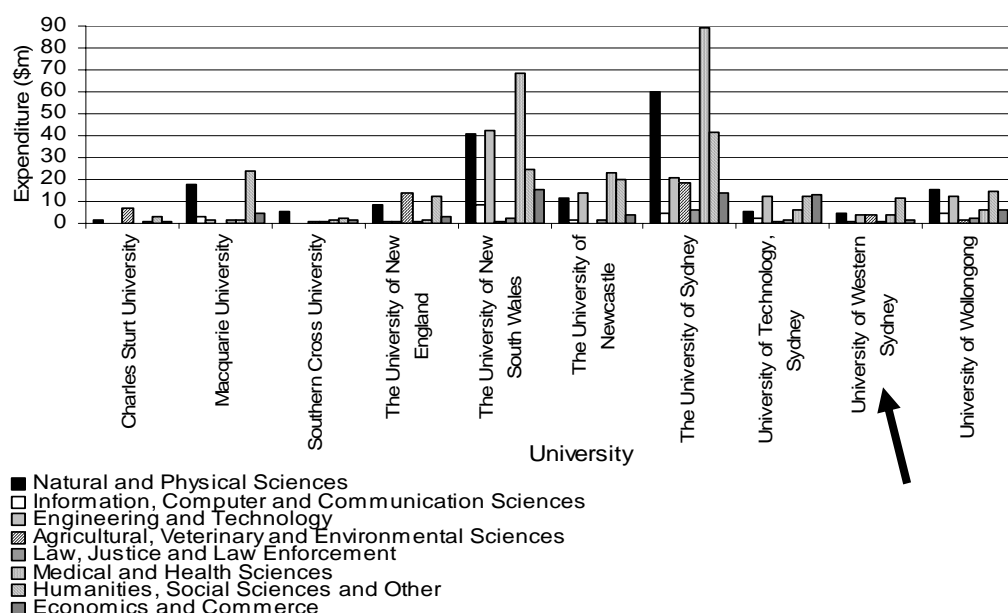


Source: Commonwealth Department of Education, Research Expenditure, 2002, <http://www.dest.gov.au/>, accessed 8 Aug 2005.

In NSW, universities demonstrate different patterns of research activity. UWS falls far behind the two major universities, the University of Sydney and the UNSW. At the moment only two of the other universities have medical schools, although health-related research is visible at most of them. Agriculture is the key expenditure field at UNE and Charles Sturt, with some at UWS.

The University of Sydney spends a large amount on Medical related research, followed by the Sciences and Economics and Commerce. Expenditure on Engineering and Technology research is much lower, receiving only three quarters of the funds spent on Economics and Commerce and more akin to Agriculture. At UNSW Health expenditure is clearly heads the list, while spending on pure sciences is much lower than at Sydney. In contrast, the amount money going to Engineering and Technology is much more important as this category receives a little more than the natural sciences. The University of Sydney and UNSW share a joint Graduate School of Business hence an appreciable segment of funding going to this area, similar to the University of Sydney. However the Humanities, Social Sciences and Other category at UNSW receive only half the expenditure of Sydney (See figure 19).

Figure 19: Expenditure on Research and Development by AEGIS grouping of RFCD and Institution in NSW 2000



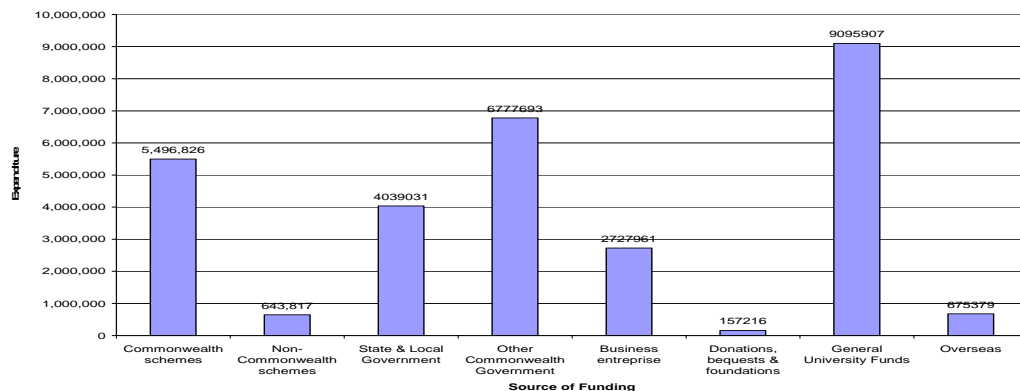
Source: AEGIS, 2005. Commonwealth Department of Education, Science and Training, 2000, Table 3

Medical and Health Sciences emerge strongly, in terms of research expenditure, receiving \$260,351 million in NSW and \$276,278 million in Victoria, a total of around \$863,816 million nationally. Biological sciences came in second with less than half with \$410,155 million, closely followed by Engineering and Technology at \$374,546 million. Taking into account the small proportion enrolments play in the agricultural and veterinary science areas, they did quite well attracting \$235,190 million.

UWS research expenditure concentrates in the categories of Humanities and social sciences, while having lower levels of expenditure on Engineering and Technology and Natural & Physical Sciences, and very low levels in Economics and Commerce.

UWS research expenditure by source of funds is detailed below.

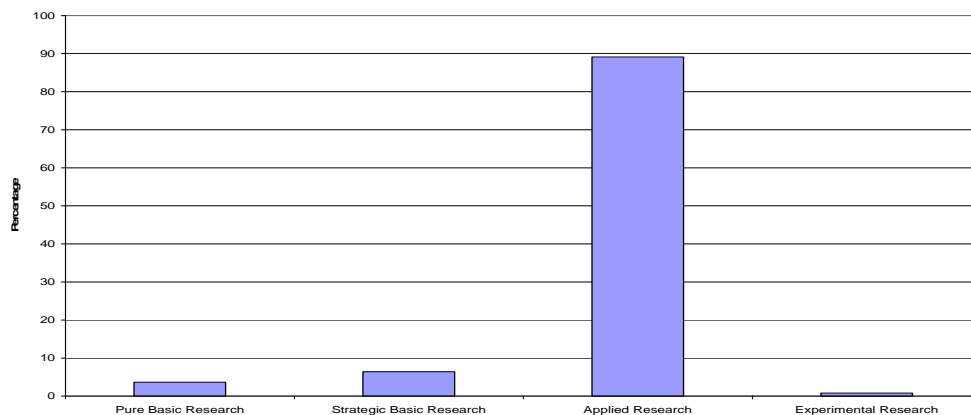
Figure 20: Expenditure on Research and Experimental Development by Source of Funds at UWS, 2003



Source: UWS Office of Research Services, Data and Finance Team, 2005.

General University Funds followed by Commonwealth Schemes are the biggest sources of expenditure followed by state and local government and a small amount from business enterprises. The majority of research expenditure is classified as ‘applied’ (see Fig 22).

Figure 21: Percentage of Expenditure on Research and Experimental Development by Type of Research Activity at UWS, 2003



Source: UWS Office of Research Services, Data and Finance Team, 2005.

3.5.2 Research Income

In 2004, UWS achieved its best year so far in terms of research performance. Grants from the *Australian Research Council* (ARC) totalled over \$5 million. This included 15 ARC Discovery Grants and a prestigious *Australian Professorial Fellowship*.

The success rate for applications for ARC Discovery Grants from UWS was particularly high. In 2004 it managed a figure of 32.6 percent as opposed to a national average of 30.8 percent. For Linkage Grants the success rate was 66.7 percent, again well above the division average, and showed a healthy level of involvement by industry partners (UWS, 2004, p10).

UWS research centers play a pivotal role in the university's research profile with their pursuit of specialized research. The various centers contribute 49 percent of the university's research income and won 62.5 percent of UWS funding declared by the ARC in November 2004 (UWS, 2004, p10). Table 12 summarises UWS research income 2002-2004.

Table 13: Research Income 2002-2004

	2002	2003	2004
External Research Grants	10.7M	10.8M	9.8M
IGS/RIBG	3.9M	4.4M	4.9M
TOTAL	14.6M	15.2M	14.7M

Source: UWS, 2006

The Department of Education, Science and Training (DEST) funding to UWS between 2001 and 2004 increased marginally each year (see Table 13 below). This type of funding is dependent on the several performance indicators such as number of successful national competitive grant applications and the amount of research and higher degree completions.

Table 14: DEST Block Funding – UWS allocations 2002-2005

UWS Allocation	2001	2002	2003	2004
Research Training Scheme (RTS)	\$8,360,097	\$8,300,998	\$8,301,897	\$8,286,660
Institutional Grants Scheme (IGS)	\$3,021,589	\$3,172,669	\$3,331,302	\$3,539,908
Research Infrastructure Block Grant (RIBG)	\$1,018,984	\$1,241,359	\$1,390,435	\$1,358,959
TOTAL	\$12,400,670	\$12,715,026	\$13,023,634	\$13,185,527

Source: UWS Annual Report 2004, p84

The Table below shows UWS DEST External Research Income, which includes external returns from industry partners, governments, international or national competitive grants. Like the DEST Block Funding, the total amount for each year has risen only marginally.

Table 15: UWS DEST Declared External Research Income 2001-2003

	2001	2002	2003
Australian Competitive Research Grants	\$4,717,000	\$4,572,000	\$4,271,907
Other Public Sector	\$3,967,000	\$3,844,000	\$4,664,777
Industry and Other funding	\$1,291,000	\$2,251,000	\$1,881,078
TOTAL	\$9,975,000	\$10,667,000	\$10,817,762

Source: UWS Annual Report 2004, p85

Funds for research in the higher education sector fluctuate considerably in importance. In most SEO groupings as measured by the ABS, the dominant source of funds is "universities' own funds". This is largely due to the fact the ABS typically includes staff time in its assessment of expenditure on research by universities. Following much further behind are the 'national competitive research grants' which include funds given out by the Australian Research Council (ARC), the NH&MRC and other Commonwealth-funded special scheme. These sources of funds are very important to Health and other 'Non-Oriented' research. Research income from business enterprises is small.

While the level of applied research is the highest at UWS, funding from private business is very low, as well as research on economics and commerce. Highest level of research is on humanities and social sciences, disciplines traditionally not intensively engaged with manufacturing business.

3.6 Transfer of Knowledge

The proximity of firms to universities facilitates participation in knowledge networks that can provide opportunities for more commercial oriented activities. Small firms benefit from association with universities and research institutions because it is cost-effective to participate in partnerships that can later on result in patents or licenses for commercial activity. Larger firms often benefit from new ideas that university scientists are able to provide from their basic, many times non-commercial oriented research. It is this characteristic of 'searching for basic knowledge' which provides scientists at universities with a capacity for invention and innovation that is difficult to find elsewhere. Firms can get university scientists to provide opinions, to 'think' about industry situations that might arise in the future; and this might be more important than to seek the value in an immediate product development (Cowan, 2005). It is in the outputs of basic research where it lies the level of general understanding about a phenomenon that influences successful innovations later in the future. Neither industry or governments seems to be very interested in basic research, thus the role of universities in providing basic research results becomes ever more important for innovation systems. Industry sponsors of research (government and private) are often found 'attempting to buy the results they want, or at least suppress the results they don't want' (Cowan, 2005) which means that up to some extent, Universities still have an environment able to pursue basic 'non-directed' discoveries. Transfer of knowledge is a knowledge intensive activity difficult to measure and there are not defined indicators for data collection. However, patents, trademarks and other Intellectual Property Rights can be quantified. University Engagement Activities can also be quantified and used as a proxy of knowledge transfer. These activities are discussed below.

3.6.1 Patents and IPRs¹³

The UWS IP Portfolio consists of patents, trademarks, plant breeders' rights, and software.

The patent portfolio consisting of 23 patent applications (when taken as families becomes over 100 patent applications in the various jurisdictions) is the focus of the commercialisation efforts at UWS and represents the greatest investment. Most of our patent families seek to obtain registration in Australia, New Zealand, USA, Europe, China and Japan which represents an investment of approx \$200,000 over the life of the patent.

The patent portfolio can be divided into broad categories of technology and this is indicative of the research concentrations at UWS over the past 5+ years:

- Food Processing - 4 patent applications (two of which have been allowed to lapse due to insufficient commercial potential). 2 patents are currently being drafted and may be lodged as provisional applications early in 2006.
- Construction - 12 patent applications in the specialist area of steel/concrete construction.
- Horticulture - 2 plant breeding methodology patents.
- Engineering - 2 patents in the area of improvements to human powered drive systems (bicycles)
- Chemistry - 2 patents in chemistry developments for anti-cancer drug treatments
- Biotech General - 1 patent in the area of hormone therapy for pigs.
- Potential patent applications in 2006 include a patent for anti-microbial meat packaging, nanotechnology enhanced polymers, chromatography column improvements and food extrusion method.

¹³ Information provided by the UWS Office of Business Development.

Licence revenue derived from patents in 2004 was below \$10,000 Australian. However, in 2005 we estimate licence revenue over \$350,000 (this is not the full amount that UWS will receive as a percentage of this income will be divided amongst industry partners).

The Construction Technology patent group, the biggest UWS patent strength, will have the majority of the construction patents licenced or assigned in 2006.

3.6.2 University Engagement and Service

The issue of university engagement is presently very topical in Europe. In the United Kingdom alone, there have been a large number of university local economic impact reports, a few national reviews of regional engagement (Charles 2004, Goddard et al 1994, Charles and Benneworth 2001, Campbell et al, 1999), a government examination into university business relations (Lambert Review) and an annual higher education business interaction survey. All in all there has been a significant increase in government funding for such projects (Charles, 2004).

At the moment there is a widespread view that the role of higher education in society has shifted to an increasingly instrumentalist position. This is a considerable change from the more idealistic stance and its focus on the pure creation of knowledge. David Charles clearly illustrates this refocussing as a move towards vocational training and the new emphasis on 'employability' skills within non-vocational curricula. This has been epitomised by universities reliance on contract research and relations with industrial sponsors, and "a perceived erosion of the autonomy and authority of academic governance". Hence while some observers have viewed this move away from the university as a national institution negatively, Charles prefers to see this change in an alternative light. He prefers to see the university as an "adaptable institution that has always changed in response to and with implications for the development of society" (Charles, 2004).

The University of Western Sydney appears to have adopted Charles's perspective of the "adaptable institution". According to various vision and mission statements, UWS places a strong emphasis on engagement with its immediate socio-economic region. It wishes to capitalise on the strengths of its region and so places a priority on participating with the social diversity of the region, addressing accessibility issues, internationalising the curricula, research, student body and campus and providing relevant educational alternatives for the people of the GWS which in turn also services the development of the urban region (UWS, 2004c, p11, 16, 18) (UWS, 2004a, p8).

Scott and Jackson describe UWS' Engagement stand more succinctly viewing it from a wider perspective. They emphasise the importance of clearly delineating whether engagement is a one-way (service orientation) and operating outside mainstream activity, or if it is to be a two-way process. If two-way, then engagement should become 'embedded in the core activities of the university in a reciprocal way'. University research is therefore generated from and conveyed through partnerships with targeted community and professional groups. It is largely problem orientated and action-based and justified on the basis of its successful implementation of its results and practice (Scott & Jackson, 2005, p1) – this is UWS' ultimate goal.

However before any deeper analysis of 'Engagement' is looked at, it is important to be clear on just what this essentially entails. The concept of engagement is a broad one. While the breath of this issue fosters wide diversity of activity, there is a risk that the term can say everything and nothing at the same time. The ensuing lack of clarity can leave some disciplines with the idea that they are 'engaging' when they actually are not.

Definition of Engagement

So, how can 'engagement' be defined? According to the *American Association of State Colleges and Universities* (AASCU) 2002 report "Stepping Forward as Stewards of Place", it sees community/public engagement happening at different levels:

- **Place-Related.** The expectations of the economy and society have pushed universities to be conscious of nationally and global activities. Universities are also inextricably linked with the communities and regions in which they are located. In turn the universities' worldview should not only have meaning to itself but also be relevant to its neighbours. This will ensure the region will be consistent and reliable advocates for the university (AASCU, 2002, p9).
- **Interactive.** Interactivity and engagement refers to "a spirit of give and take by the university and its partners". For a university, this means occupying the role of learner and at the same time, teacher. Community and regional communities and partners should therefore see a university as a resource, not necessarily as "the answer" (AASCU, 2002, p9).
- **Mutually Beneficial.** Engagement should benefit both the community and university. It should expand the learning and discovery functions of the university while improving community capacity to recognise and overcome issues they may face. The university should be responsive to community needs while the community must cultivate greater public understanding of and support for the role of a university as a knowledge asset and resource (AASCU, 2002, p9).
- **Integrated.** The university should be at every level and, pro-active community engagement policies should be integrated into its policies, incentive structures and priorities (AASCU, 2002, p9).

UWS defines 'engagement' as the collaboration between the University and a community (regional, national or global) for the mutually beneficial exchange of knowledge and resources in a context of partnership and reciprocity. It is the interaction between UWS and its external communities that enhances the research and learning functions of the University while simultaneously building community capacity and opportunity. With this definition, engaged research and engaged teaching and learning become embedded in the core academic activities of UWS.

Implementing Community Engagement initiatives, according to the *American Association of State Colleges and Universities* (AASCU, 2002) can yield benefits to all involved parties. The following advantages accrue from the ensuing relationships.

Community and regional entities, engaging with universities:

- Enlarges resources available to undertake local issues and problems;
- Supports local solutions to local challenges;
- Offers the possibility of "neutral ground" for dialogue and resolution of contentious issues; and
- Gives a chance to address short- and long-term priorities and concerns with a key area.

Students working on community and regional issues:

- Gives a more extensive connection between theory and practice than might otherwise exist in a traditional setting;

- Keeps the curriculum more current and receptive;
- Facilitates critical analysis and problem solving, making the classroom experience interesting;
- Permits for effective and long-term integration of skills such as leadership, which can contribute to “competitive advantage” in the workplace;
- Introduces ethical issues into the classroom environment;
- Gives a basis for discussion about the responsibilities of society and the dynamics and nature of a successful community;
- Sustains service learning initiatives; and
- Gets students ready for a lifetime of knowledgeable and participatory citizenship.

University faculties and Colleges engaging community and regional concerns:

- Allows opportunities to augment and update curriculum and classroom content;
- Legitimizes and sustains the “scholarship of engagement, which focuses on the application of knowledge rather than its discovery”;
- Accentuates meaning and measurable content to their “public service” role;
- Creates new and potentially fruitful interdisciplinary linkages, with the cross-fertilization of ideas,
- fresh perspectives, intellectual enthusiasm, and interpersonal stimulation introduced by such linkages;
- Energizes faculty work by raising new questions and topics for research and teaching; and
- Becomes a vehicle for exercising civic responsibility.

In Australia, at the University of Technology, Sydney (UTS), Community Engagement initiatives benefits to different segments of the university community:

For Staff:

- Increased job satisfaction derived from knowing one’s job has positive and practical impact beyond the university a range of defined equity groups;
- Gives staff the capacity to apply practical experiences derived from Community Engagement within courses.

For the University:

- Generates positive publicity for the University;
- Publicly demonstrates the University’s commitment to equity and diversity.
- By portraying itself as a caring community player, it improves its student recruitment program.
- Possible flow-on effects from Community Engagement initiatives to collaborative research.

For various communities served by UTS:

- Benefits derived from University expertise directly applied to needs of community.
- Cost savings passed on to community due to free application of University expertise.
- Possible enhancement of community life as a result of university cultural activities.
- The use of university expertise for public policy critique and enhancement in area of public importance.

(UTS Planning & Quality Unit, 2003, p5)

UWS Engagement Initiatives and Challenges

Apart from engaging with local communities, UWS has developed and continues to enhance corporate or business liaison offices, with an explicit responsibility to act as intermediaries with business. These offices develop networks of businesses, market the research expertise of

UWS, provide advice on consultancy agreements and contract research and arrange complex collaborative agreements or joint ventures.

UWS departments, projects or initiatives that engaged with local industry or business were as follows in 2004-2005 (see more details in Appendix 1):

- UWS Office of Regional Development (ORD)
- UWS Business and Industry Advisory Panel (B&IAP)
- Greater Western Sydney Infrastructure Forum
- UWS Innovative Technology Network
- UWS Nanotechnology Project
- Cooperative Programs
- UWS Regional and Community Grants Scheme
- UWS Regional Partnerships Awards
- UWS Regional Council
- UWS Arts Consultative Panel
- Academic Service Learning Grants Scheme
- Australian Universities Community Engagement Alliance
- Visiting Scholars Program
- UWS Directory of Community Engagement
- Maximising Potential in Macarthur (MPM)
- Membership of regional organisations

The programs run by UWS appear relatively evenly spread out between industry and community engagement. In 2004 a total of 17 programs were operating, 7 for industry and 10 for community. The extensive programs run by UWS, show how the issue of engagement is deeply embedded in the institutional structure. There appears to be public policy that actively promotes the engagement of colleges and disciplines with the community and business interests of their regions, rather than passively permitting or implicitly discouraging this. A coordinated and integrated approach to engagement issues appear to be pursued at local, state and federal governments and resources made available so engagement can be more than just a cost for universities.

In spite of their ambitious vision for the university, UWS is encountering several problems which could hamper their aims. Funding deficiencies and resultant operational shortcomings make it difficult for UWS to actively compete with its larger cousins particularly the University of NSW and the University of Sydney. Other domestic limitations exist largely as a result of the relatively depressed socio-economic conditions prevalent in the GWS region that can hamper opportunities for GWS communities who may not recognise the important role the university can play in enhancing their opportunities. For example, the number of GWS residents attending any UWS campus presently stands at only 30 percent (2001), a very modest increase of 3 percent since 1991. (Gleeson et al, 2002, p62, 67, 74) Therefore for any significant increases in regional-based enrolments or interaction there should be a corresponding increase in educational and employment expectations and probably living and

income standards.¹⁴ Unfortunately this aspect is not within the control of UWS and is dependent on state and federal government initiatives and also reliant on the national and international economic climate.

In 2004 GWS-based current school leavers nominating UWS as their first preference for enrolment amounted to only 31.2 percent, a slight climb from 25 percent in 2002. Therefore a large number of GWS students prefer attending other universities, probably based closer to Sydney CBD area. However applications made by non-school leavers, the majority mature aged students, nominated UWS as their first preference 45.9 percent of the time indicating their recognition of the important educational role played by UWS in the GWS region (UWS, 2004, p81).

The indigenous population in the GWS region amounted to 1.3 percent of the total GWS population (Randolph et al, 2003, p20). Out of the 36,419 enrolled students in 2004 only 5 students spoke an Australian Indigenous language at home, 3 of whom lived in the GWS region, 1 outside of the GWS region and another interstate (DEST, 2004). Among academic staff there was a representational drop from 1.2 percent to zero in 2004. Indigenous representation in the general staff population stood at 1 percent only. The UWS benchmark for both academic and general staff is 2 percent (UWS, 2004, p82). In this respect UWS appears to be falling behind, taking into account an absolute increase in the indigenous population of the GWS region between 1981 and 2001. In 1997 there was a sudden fall in indigenous participation. This has been attributed to governmental changes in Aboriginal support (DEST, undated). The majority of which live in the Blacktown, Penrith and Campbelltown areas (Randolph et al, 2003, p20).

A large number of GWS residents come from non-English speaking backgrounds or were born overseas. For example most parts of Western Sydney hold approximately 33 percent overseas born residents with 31 percent speaking a language other than English at home.¹⁵ The number of domestic students speaking a language other than the English language at home stands at 29,210 out of a total student population of 36,419 – slightly over 80 percent of the UWS student population therefore speak a language at home other than English. Out of this number 20,016 or 54.9 percent of these students lived in the GWS region, 8,654 or 23.7 percent lived outside the GWS region and 540 lived interstate (DEST, 2004).

Taking into account the large non-English language background students at UWS, it is therefore important for the university to attempt to make in-roads, with the eventual aim to cater to the needs of local émigré communities. Many of these communities are isolated from the overall benefits UWS, largely due to insufficient language skills and the inability of respective parties to recognise the advantages of a tertiary education or appreciate the potential of socio-economic diversity in the GWS region.

3.6.3 A case study of knowledge transfer

Knowledge transfer in practice refers to those knowledge intensive activities of engagement with partners or communities in order to develop and promote their own knowledge. Knowledge transfer implies the adoption and implementation of knowledge generated by UWS staff or in a co-production fashion with industry partners. While patents are a way to measure transfer, it does not offer insights in how it is done. University engagement activities

¹⁴ According to 2001 ABS statistics, approximately 38 per cent of individuals in the GWS region (and WSROC) earned less than \$300 per week, compared to 35 per cent in the Sydney Statistical Division area.

¹⁵ (WSROC, 2001, http://www.wsroc.com.au/downloads/WSROC_Demographic_Data_1.xls, accessed 2 Feb 2006)

are other indicator of knowledge transfer thought each activity needs to be evaluated separately. This section presents one of these activities, the case of the UWS Nanotechnology network as an example of knowledge transfer through research and industry engagement.

The University of Western Sydney Nanotechnology Network Project was established in 2003 funded by the Department of Transport and Regional Services (DoTaRS) Sustainable Regions Programme with \$255,000 in 2003 and further funding in 2006 for a specific focus on nanotechnology careers, specifically for the Campbelltown/Camden Local Government Areas in South-West Sydney.

The objective of the project was to identify and build nanotechnology business potential in the Campbelltown/Camden Region, specifically in the area of nano-materials. The University aim was to work with existing organisations including local and regional peak industry associations to:

- Identify existing enterprises with potential for application of nano-materials technology;
- Facilitate and support development of networks and new enterprises applying nano-materials technology; and to
- Enable access to funding opportunities for industry and product development with concomitant research and training, including research and development granting schemes.

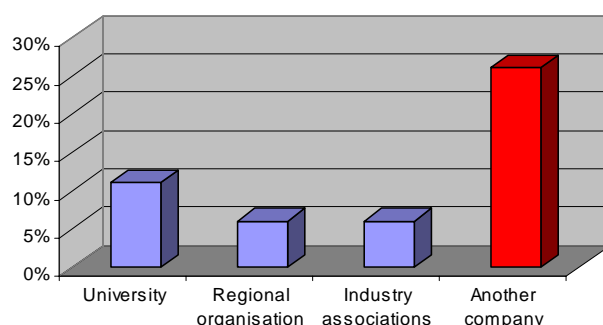
The project was designed as a 'Knowledge Intensive Service Activity' (KISA) where the UWS Office of Regional Development would organise activities providing specific knowledge, specialised information and opportunities to discuss nanotechnology and possible applications to manufacturing processes. The UWS Nanotechnology Network is formed by an informal group of academics, students, industry, business people, government representatives and community groups that meet quarterly to discuss, attend lectures or seminars and showcase products. Attendance is around 50 people at each meeting. The UWS Nanotechnology Network has a part-time facilitator that compiles a newsletter, maintains the mailing list with over 300 members and the website. Networking at the quarterly meetings is carefully planned carefully with quality catering and preparation to provide opportunities for people to meet and discuss in an informal setting. The mix of private, public and community sector is also strategically planned so as to facilitate emergence of partnerships.

To ensure the project positively contributed to the region there was a strong emphasis placed upon identifying and evaluating the opportunities that arise from the network activities and the soft infrastructure developed. There was also the consideration that if this particular model of university/industry collaboration proved to be successful the initiative could be expanded or replicated in other regions. As this is a new initiative in an emerging science field there is also the opportunity to evaluate the development of the enterprises, the relationship between the university and industry, and the effects of the project focus on the broader community of the region.

The industry responses to the UWS Nanotechnology Network and its effects were measured via two small surveys in 2003 and 2005 and three in-depth case studies in 2005. The industry break up in the 2003 survey of the network (279 members) shows that the majority of business are in manufacturing (32%), followed by business services (19%), government (17%), university and research and education organisations (29%) and other businesses in the area of biotechnology, ICT, health or packaging (3%). Of the responses to the 2003 survey, only 27 percent of these firms new about nanotechnology and only 6 percent were using nanotechnology. Six percent had plans to introduce nanotechnology, 24 percent were in partnership with a university conducting a particular project and 42 percent of the firms wanted to network with other members of the network.

Of the responses to the 2005 survey, 46 percent has participated regularly in the network activities and 51 percent had gained significant new knowledge as a result of their participation. Of the respondents, 26 percent had plans to introduce nanotechnology into their companies and 14 percent had already invested funds on nanotechnology R&D. Up to 26 percent of the companies have initiated new partnerships during their participation in the network. These partnerships were significantly more frequent with other companies rather than with universities, regional organisations or industry associations (see Figure below).

Figure 22: Partnerships for Nanotechnology Development/Applications



Source: Martinez-Fernandez & Leever, 2006

Although partnerships appear to be more frequent among companies than with universities or other public or non-for-profit organisations, universities and research and technology organisations are top providers of knowledge and information for nanotechnology (see Table below).

Table 16: Source of Nanotechnology Knowledge (No Firms; n=38)

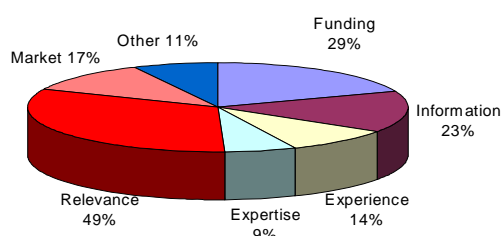
Sources of Knowledge	Not relevant/small importance	Medium/Great Importance
UWS	8	20
Other Universities	10	14
RTOs	10	13
Internet, databases	8	17
Business networks	9	15
Suppliers	12	13
DSRD	11	12
Customers	13	11
Industry associations	14	10
Within the firm	16	8
Other firms within same industry group	15	8
Competitors	16	7
KIBS	16	8
Conferences, journals	16	8
Fairs & exhibitions	16	7

Source: Martinez-Fernandez & Leever, 2006

Companies applying frontier technologies seem to rely more in scientific knowledge produced by universities and public/private research institutions (RTOs). In-house knowledge has small relevance for frontier technologies but is the greatest source of knowledge for established technologies (Martinez-Fernandez et al, 2005b). Consultancy firms (KIBS), industry associations and government departments have only a small role in the co-production of knowledge in both cases. The survey of South-West Sydney firms found that firms applying nanotechnology were more reluctant to trust in-house sources of knowledge and information while in the case of software, tourism or mining technology services internal sources of knowledge were more important for the firm (Martinez-Fernandez et al, 2005b,c,d; Martinez-Fernandez & Leever, 2004). This difference might relate to the early path creation of nanotechnology if compared with more established technologies.

An interesting result of the survey is that the perceived barriers for the introduction of nanotechnology in the firm's product development have more to do with issues of 'relevance and information' than with the market or the expertise (see Figure below).

Figure 23: Perceived barriers to the introduction of nanotechnology



Source: Martinez-Fernandez & Leever, 2006

While funding is seen as a barrier to the introduction of nanotechnology by 29 percent of the respondents, issues of relevance for the firm and of information seen to be far more important (72% of respondents). The success of network approaches by the UWS dissemination of nanotechnology information is addressing this point because companies are able to have a quality well planned context where they are confident to discuss nanotechnology with other interested parties and they are also able to see applications by others and new prospects and are exposed to discoveries by university researchers. The case studies further confirmed this argument.

Case Studies

Three of the UWS Nanotechnology Network companies from the Campbelltown-Camden area of South-West Sydney were selected for in-depth case studies. The analysis focused on the firm's innovative activity, the type of nanotechnology knowledge intensive service activities (KISA) undertaken and the transforming internal processes used by the firm for the adoption of nanotechnology.

R.J.Walsh & Son Ltd is a 45 year old company which main product are animal powered vehicles. The company has 8 staff, approximately AU\$ 1 million annual revenue and is currently in expansion. The company is characterised by incremental innovations (products/services and organisational). Recently the company has introduced 'Nanoflex', a new steel that is stronger but lighter which constitute an incremental change to the materials used before in their sulkies. Nanoflex enables lighter products of equivalent strength therefore influencing harness racing and dog carting buggy development because they are easier to lift

and move. A lighter dog-carting buggy is especially important because 80 percent of this market is composed of women. So far the barriers the company has encountered when innovating are the legislative burden in Australia for introduction of the modified buggy and the lack of information or collaboration related for the application of Nanoflex to its buggies. The most significant barrier has been access to the material itself and the patent which has delayed production for about 18 months.

Knowledge intensive service activities associated with nanotechnology are not very frequent; most of them are undertaken in-house, with other consulting businesses or with UWS, industry associations and government departments. Financing the technology has been an issue, with the owner investing 10 percent of his time on related nanotechnology R&D. The participation in the UWS Nanotechnology Network has provided a reference point for assistance and also has facilitated the introduction to other companies and their products. The company considered it important to link to UWS for their innovation processes because of UWS's diffusion of knowledge of new technologies and facilitation of meetings with other companies looking for similar solutions.

In relation to how nanotechnology is transforming the internal processes of the firm, this is happening in small, opportunistic and informal bases and mostly led by the owner of the business. One constrain is lack of expertise so at least one engineer with nanotechnology knowledge will be needed for further developments. Collaboration partners in the innovation process are found locally, in a radius of 20 kilometres, especially with UWS, suppliers and clients.

Broens Industries is a 25-year-old company specialising in technology development and special purpose machinery to be used in the automotive, aerospace and biotechnology industries. The company has 132 fulltime employees, currently in expansion and with total annual revenue of more than AU\$ 25 million. The innovative activity of the firm is regarded as incremental at the product/service and organisational level. Latest innovations for the Australian market are new machines for the aerospace and automotive industries. Barriers to innovation were mainly the cost or availability of finance and the changing currency conditions. The management of cash flow is difficult when venture capital is scarce and there is not much government assistance leaving limited margins for investment in technology developments.

The use of nanotechnology KISA is limited to research & product development with other businesses and UWS. The application of nanotechnology is also limited and will be guided by client demand. The investment in nanotechnology is small at the moment, mostly in-kind by the owner, as it is hard to see the short-term benefits. The company is participating with 3 other companies and UWS on a proposal for a technology roadmapping project on toolmaking to improve understanding of the market and focus areas for a more comprehensive applied research project.

The transforming internal processes are patents, seminars and meetings between different sections and a continuous training, mostly customer driven. There is also a mix of people working together; for example a group of designers or engineers work together with a group of tradespeople to work out ideas. As the firm thinks innovation is necessary to survive, it must be commercialised, so these teams are very focused on product development and manufacturing. The firm will need at least one person (part-time) with nanotechnology specific knowledge for the future. Collaboration partners are all from the local area, within 20 kilometres.

KIRK Group is a 32-year-old firm specialising in high resolution printing for corporate plans. The firm has 90 staff members, the business structure is in expansion and the annual revenue is more than AU\$ 2 million. The types of innovations are mostly incremental (product/service

and organisational) but they also have a radical process innovation when they standardised international brand colours circular plates for their printing cylinders.

The use of nanotechnology KISA is small and limited to industry development, business planning advice and information sharing and new knowledge. These activities are mainly performed in-house, with other businesses and UWS. They have also gained access to government funding for nanotechnology R&D through an Australian Research Council Linkage grant with UWS. This project provides for the development of the technology needed by the firm and it will constitute a radical innovation. Transforming internal processes are through project folders that can be consulted by all employees, feedback from employees on particular aspects of the project and from allocating current staff to new projects. In the case of the nanotechnology being developed with UWS, current staff will move into the new technology instead of hiring new specialised people. The critical aspect is that technology moves too fast and the time in getting the technology (sooner better than later) is an important competitive advantage. Collaboration partners are found in the local area within 20 kilometres.

The surveys conducted on the UWS Nanotechnology Network over a 2 year period suggest that scientific knowledge is driving nanotechnology agendas and that knowledge intensive service activities facilitated by local universities might have a high impact on firms' competitiveness as universities are partners in co-production of innovation. It also suggests that suburbs/regions with manufacturing business have the potential to apply nanotechnology in the medium term as nanotechnology greatly applies to many manufacturing processes related to fabrics, cosmetics, coatings, metals etc.

The project also shows that nanotechnology research and industry engagement is fragmented in South-West Sydney; the focus of research specialisation and KISA in certain sectors such as plastics, electronics, nanomaterials, nanomedicine, and medical technologies offer good prospects for the future, especially with a new centre for nuclear magnetic resonance (NMR) to be opened at the UWS Campbelltown Campus in mid 2006.

The case studies show that partners in the innovation process of nanotechnology are from the local area therefore policies and programs to develop networked nanotechnology innovation systems need to also have a focus at the regional and local level. Local engagement strategies and especially those linking industry and university research departments are needed to advance the field in the medium to long term in a way that is relevant for industry.

3.7 Summary

UWS has 6 campuses and 35,372 students with 56 percent of enrolments being female and 44 percent male. Undergraduate students made up 77 percent of the student population. Students concentrate mainly in two fields of study: Management and Commerce (32%) and Society and Culture (20%). Around 73 percent of students live in the Greater Western Sydney region. UWS provides 36,419 places for the Greater Western Sydney population of 1.673 million people, a ratio of one university place to every 46 residents without regard for age. This can be compared with the Sydney metropolitan ratio of one place to 22 residents and NSW state ratio of one place to 21 persons. Despite this ratio of places, enrolments were down by 7.7 percent at the end of the period 2003-2005. Areas that experience large declines were 'Information Technology', Engineering & Related Technologies' and 'Management & Commerce'. However there was good growth in the 'Natural & Physical Sciences' and the 'Agricultural, Environment & related studies' area as well as in 'Society & Culture'. The decline in IT enrolments probably reflects the decline of the industry in Australia and the latest outsourcing strategies to low-cost countries such as India. Declines in Engineering

disciplines and in Management & Commerce might have the impact of policy changes at UWS and colleges related strategies. In 2005 there were 6,119 postgraduate students at UWS, again clustering on 'Management & Commerce' and 'Society & Culture' disciplines. Disciplines such as Engineering and Architecture & Building have small numbers.

In 2005, full-time staff numbered 2,637 with 1,289 academic and 1,348 general staff working across all six campuses. In 2004 UWS' total income amounted to \$334.01m and its operating expenditure in 2005 was \$346m. It has net assets of \$609.15m. UWS has 8 university research concentrations and 31.30 percent of staff is research active. Publications per academic staff were 1.17 in 2004. The contribution of this research wealth into the region's capacity for innovation, entrepreneurship and partnership with major stakeholders is, perhaps, the most important ingredient for successful development of regions. The contribution of UWS staff to innovation and invention can be seen through different paths: one is publication of research results and the sharing at local and international conferences; another way is through formal and informal consultation by industry, government and community. Publications are an instrument of dialogue and discussion of ideas at the global level; and an effective way to bring new knowledge into the region, especially relevant knowledge that can be applied locally. Finally UWS also produces patents and obtain licenses that could be released to entrepreneurial firms. UWS has 23 patents, more than half in the construction area (steel/concrete). Most patents have been licensed in 2006. UWS research expenditure concentrates in the category of Humanities and social sciences, while having low level of expenditure on Engineering and Technology and Natural & Physical Sciences, and very low levels in Economics and Commerce.

Generation of knowledge per se is not enough for transfer of knowledge to happen. In fact, although geographical proximity is not a necessary condition for the generation of new knowledge, it is important for the 'conversion' of knowledge into economic wealth and employment and for the intensity of knowledge flows among regional networks. The 'clustering' of knowledge also stimulates the development of industry clusters because SMEs in proximity to universities and research institutions are able to quickly adapt relevant new knowledge. Therefore, University research is a major source of innovation and, regardless of the type of research, it can have a significant impact on jobs and wages in the region where it is embedded. Knowledge transfer implies the adoption and implementation of knowledge generated by UWS staff or in a co-production fashion with industry partners. An example of successful knowledge transfer is the UWS Nanotechnology Network, operating in South-West Sydney since 2003. Industry surveys conducted in 2003 and 2005 show that companies applying frontier technologies seem to rely more on scientific knowledge produced by universities and public/private research institutions (RTOs) than on in-house knowledge or consultancy firms. An interesting result of the survey is that the perceived barriers for the introduction of nanotechnology in the firm's product development have more to do with issues of 'relevance and information' than with the market or the expertise. The success of network approaches by the UWS dissemination of nanotechnology information is addressing this point because companies are able to have a quality well planned context where they are confident to discuss nanotechnology with other interested parties and they are also able to see applications by others, new prospects and are exposed to discoveries by university researchers.

UWS knowledge strengths in relation to *transmission* of knowledge with the production of a qualified workforce cluster around the areas of Management & Commerce and Society & Culture. Areas related to manufacturing & construction industries such as Engineering and Architecture & Building produce small numbers of graduates. In relation to *generation* of knowledge, research expenditure concentrates in the area of Humanities. Low levels go into areas of Engineering & Technology or Management & Commerce. Strong release of patents in the Construction area releases knowledge in an area of industry strength in the region. In relation to *transfer* of knowledge the role of UWS seems significant in influencing new

technology uptake by manufacturing SMEs. The proximity of firms to universities facilitates participation in knowledge networks that can provide opportunities for more commercial oriented activities. Small manufacturing firms benefit from association with UWS because it is cost-effective to engage on knowledge intensive service activities that can later on result in patents or licenses for commercial activity.

IV. Conclusions: Contribution of UWS to Intellectual Vitality in Western Sydney

It is now widely recognised that international competitiveness is reliant on the ability of economies to acquire knowledge capital and to apply new knowledge through a highly trained and specialised workforce. The terms ‘knowledge-based’ or ‘learning economy’ arose to explain economies in which the production, distribution and use of knowledge are the main drivers of economic growth and employment. The concept of a knowledge-based economy has sometimes been used to make a contrast between so called ‘new’ economies based on new technologies, from ‘old’ economies based on long established products and process. A knowledge-based economy must possess knowledge-intensity, be responsive to new ideas and processes, be innovative and be centred on a highly skilled workforce engaged in on-going learning. All of these prerequisites must be incorporated into all manner of goods and services, of which institutions such as universities are recognised as playing a pivotal role in the process.

Universities, however, are increasingly being recognised as knowledge hubs exercising strong influence in the intellectual vitality of the region where they are embedded. The detail of how universities fit this role are not well known and although several efforts have been made on the evaluation of universities as an industry sector on its own right, much less is known of their intangible contribution to intellectual life in the region where they are embedded. The problem so far has been the lack of ‘intellectual indicators’ and the uncoordinated efforts to measure this in a university context. Most of the work has been done as isolated case studies in different countries which make it very difficult to provide any meaningful comparison. Although global forces might have similar impacts in the high education sector in developed countries and the mobility of students and scientists is an important part of the equation elsewhere, national policies and local industrial and social conditions remain strong determinants of the role of universities on local/regional intellectual life.

The study presented in this report provides an analysis of a University embedded in a highly urbanised region of the Sydney Metropolis. The purpose of the study was to analyse the knowledge strengths of the University of Western Sydney and how ‘relevant’ that knowledge was for the Greater Western Sydney region. One of the first conclusions of the study is the difficulty of producing a stocktake of ‘knowledge’ in an organisation where 1,289 academics and close to 9,000 graduating students are about the business of knowledge every day. The knowledge-net of universities is highly sophisticated with ramifications into industry, government organisations, international networks of research and teaching, and community organisations. While databases of ‘who is doing what’ can be built to provide the executive body of the university an understanding of the extent of knowledge production and connections, it is much more difficult to ‘measure’ the impact knowledge activities have in areas of geographical or cognitive proximity. To overcome this difficulty the study differentiated three components of ‘knowledge’: transmission (students), generation (research output) and transfer (adoption by industry). These components were analysed and contrasted with the industry strengths and possible needs of the region of Western Sydney. Other impacts on cultural and social activities or on other national or international communities were not analysed.

UWS was initiated in 1988 and only officially established as one entity in 1997. Given its very recent history, it is hard to make a direct comparison to its older, more established and larger competitor institutions. In addition, national university funding arrangements put UWS, as a smaller university, at a disadvantage – this has resulted in many of UWS programs being small in nature in comparison to the University of Sydney and especially UNSW. Much of

UWS' initiatives concentrate domestically, are small in scale and are particularly concentrated in the GWS region which makes an excellent contained environment for analysis. In many ways these limitations have proven to be UWS' own strength, for example the strong regional and domestic focus inadvertently strengthens the community engagement with local communities and local industry, to a much stronger extent than the more established universities.

GWS Industry Strengths

Greater Western Sydney is the fastest growing economy in Australia. The economic output for the region is \$71 billion which makes it the third largest economy in Australia behind the Sydney Central Business District and Melbourne. It is home to approximately 241,976 business entities. The major industry sectors are the manufacturing, construction, property & business services, finances & insurance and wholesale trade. The largest industry in terms of business numbers was the construction industry, comprising 23.5 percent of total businesses.

GWS is a *manufacturing hub*, with the manufacturing sector contributing a significant 20.5 percent of Gross Regional Product, higher than the industry average for Sydney and NSW. Property and Business services and Finance and Insurance industries follow closely behind. Growth forecasts for 2008 predict that manufacturing will increase by 3.2 percent, property and business by 4.0 percent, finance and insurance by 3.0 percent, communication services by 5.5 percent and transport and storage services by 3.9 percent. In relation to industry clusters, South West Sydney, and specifically the areas surrounding the local government area of Liverpool, is one the most significant manufacturing areas in Sydney's metropolitan region. Six local government areas in Western Sydney; Liverpool, Campbelltown, Camden, Fairfield, Bankstown and Penrith, account for 26.5 percent of Sydney's total manufacturing employment, and even higher percentage levels in individual manufacturing categories such as metal product manufacturing (39%), non-metallic mineral product manufacturing (41.3%) and wood and paper product manufacturing (38.6%). The highest concentration of activity is found in the 'manufacturing triangle' of Bankstown, Fairfield and Liverpool, notably in the sectors of metals, furniture, plastics and chemicals.

In relation to employment, the four largest employers of labour in the GWS were *manufacturing* 16 percent, *retail trade* with approximately 14.5 percent, *property and business* amounted to 10.5 percent, and *construction* 8.2 percent and. Retail trade appeared to experience the fastest growing employment with an approximate increase from 90,000 people in 1996 to around 110,000 in 2001. At the level of knowledge intensity, Outer Western Sydney presents lower levels of knowledge workers than North and Inner city, with differences among sub-regions. Blacktown-Penrith presents the lowest levels of knowledge workers. South-West Sydney is ahead in 'engineering' occupations which are specially found in manufacturing. They also have the highest levels of scientists and craft occupations. Business & Information related employment is ahead in the Baulkham Hills/Hawkesbury area where strong business parks as Northwest are located.

Three characteristics stand out in relation to the industry strengths of GWS:

- Manufacturing Hub with clusters of metals, furniture, plastics and chemicals industries;
- Property and business services are the second industry concentration serving the large manufacturing sector;
- Construction and Retail industries are largely servicing the fast growing population.

UWS Knowledge Strengths

UWS has 6 campuses and 35,372 students which concentrate mainly in two fields of study: Management and Commerce (32%) and Society and Culture (20%). Around 73 percent of students live in the Greater Western Sydney region and more than 8,500 students graduate every year as a qualified workforce. Areas that experienced large declines in students' enrolment were 'Information Technology', 'Engineering & Related Technologies' and 'Management & Commerce'. However there was good growth in the 'Natural & Physical Sciences' and the 'Agricultural, Environment & related studies' area as well as in 'Society & Culture'. In 2005 there were 6,119 postgraduate students at UWS, again clustering on 'Management & Commerce' and 'Society & Culture' disciplines. Disciplines such as 'Engineering' and 'Architecture & Building' have small numbers.

In 2005, full-time staff numbered 2,637 with 1,289 academic and 1,348 general staff working across all six campuses. UWS has 8 university research concentrations and 31.30 percent of staff are research active. Publications per academic staff were 1.17 in 2004. UWS also retains patents and obtains licenses that could be released to entrepreneurial firms. UWS has 23 patents, more than half in the construction area (steel/concrete). Most patents have been licensed in 2006. UWS research expenditure concentrates in the categories of Humanities and Social Sciences, while having low level of expenditure on Engineering & Technology and Natural & Physical Sciences, and very low levels in Management & Commerce.

Generation of knowledge per se is not enough for transfer of knowledge to happen. This implies the adoption and implementation of knowledge generated by UWS staff or in a co-production fashion with industry partners. Patenting activity shows one way to transfer knowledge into innovation and commercialisation. Another way is through research partnerships and conducting knowledge intensive activities with industry. An example of successful knowledge transfer is the UWS Nanotechnology Network, a knowledge intensive service activity operating in South-West Sydney since 2003. This network engages manufacturing companies willing to learn about new technology and its commercial applications. Industry surveys conducted in 2003 and 2005 show that companies applying frontier technologies seem to rely more in scientific knowledge produced by universities and public/private research institutions (RTOs) than on in-house knowledge or consultancy firms. An interesting result of the survey is that the perceived barriers for the introduction of nanotechnology in a firm's product development have more to do with issues of 'relevance and information' than with the market or the expertise. The nanotechnology service activity lead by UWS, addresses this point because companies are able to have a quality well planned context where they are confident to discuss nanotechnology with other interested parties and they are also able to see applications by others, new commercial prospects and exposure to discoveries by university researchers.

UWS knowledge strengths have the following characteristics:

- *Transmission* of knowledge. Production of a qualified workforce clustering around the areas of Management & Commerce and Society & Culture. Areas related to manufacturing & construction industries such as Engineering and Architecture & Building produce smaller numbers of graduates.
- *Generation* of knowledge. Research expenditure concentrates in the area of Humanities. Low levels go into areas of Engineering & Technology or Management & Commerce.
- *Transfer* of knowledge. Strong release of patents in the Construction area. Knowledge intensive service activities by UWS seem significant in influencing new technology uptake by manufacturing SMEs in the sub-region of South-West Sydney.

Strategic and Policy Issues

The analysis of the region's industrial strengths and the university knowledge strengths show some level of mismatch in relation to provision of knowledge to the regions large manufacturing industry. On one hand, UWS deploys a qualified workforce on the areas of management and commerce which produces knowledge workers that can be employed by manufacturing firms in management positions. This qualified workforce also supplies the second largest industry concentration of property and business companies. While business management is an important component of firms' innovation, it is not enough to build internal capabilities in core areas such as Technology and Engineering. These areas are at the core of manufacturing business and UWS has both low levels of transmission and generation of knowledge. Transfer of knowledge in this area is strong, however, with networking activities linking frontier technologies and SMEs at Sydney's manufacturing hub around the Liverpool area.

Another industry of importance in the region is Building and Construction, with strong growth due to the residential boom in Western Sydney and the strong housing growth prediction to 2030. UWS produces only small numbers of graduates and no significant research expenditure in this area. However, there is a strong patenting activity in steel and concrete materials in the area which transfer innovative activity and provides opportunities for commercial applications by local players such as OneSteel. This activity is isolated in a research centre and with one particular scientist, which can jeopardise future developments if the strength does not spread to other areas of the university.

Much can be done at the strategic and policy level to strengthen the capabilities of UWS in providing relevant knowledge to the region. However, the contribution of UWS to 'intellectual vitality' in the region is not a task that can remain at the executive level of the university although strategies need to align with the industry and community needs of the region. Administrative units often have communication constraints and control roles that constitute barriers for the development of networks where communication flows freely. Intellectual vitality can be achieved when university scientists are able to participate in formal or informal knowledge networks where ideas and analysis are tested with other stakeholders in the region. The relevance of the flows of knowledge and its level of intensity would very much depend on the creative thinking of these scientists and their willingness to communicate. It is upon this free exchange of information that innovation might occur at different levels of the region.

Governments have a role to play in fostering research centres and universities in regions because the educational basis and knowledge is still a strong lever for economic development. Governments need to take care of the knowledge base and need to foster activities to build up a stock of knowledge. Government policies can address knowledge from the region, facilitate bringing knowledge into the region through scientists' mobility programs and foster research to generate new knowledge in the region. Governments at all levels need to acknowledge that knowledge migrates and that researchers are in a position to bring and apply new relevant knowledge into the region via their participation in research networks. Thus, governments' investment on research and university education is a powerful transformative tool of regions into the knowledge economy.

For the last half-century, governments' policies have focused on fostering business in cities and regions. However, to advance and foster knowledge intensity and intellectual vitality a different set of policies is needed. Modernisation of the economy through knowledge might take 25 to 30 years to become aware of the effects but without fostering the 'knowledge keepers' knowledge cannot contribute to economic change. Research units and regions develop symbiotic relationships over time and government policy can foster interlink between

structural change and the development of a knowledge-intensive workforce through teaching and research training.

Building institutional infrastructure with new research centres or industry incubators is not sufficient to foster knowledge and intellectuality in a region. A functional understanding of knowledge and of its three dimensions - generation, transmission and transfer is needed. Universities today are magnets of specialised knowledge and much knowledge migrates with the attracted scientists; this alone is a strategic tool for policies aiming at bringing knowledge into the region of Western Sydney. But then it is necessary to ensure that this knowledge melts and expands through participation in networks of collaboration. Support programs to participate in national and international research networks and conferences will assist to keep knowledge relevant and intellectually 'vital'. Policy makers also need to be aware of the science and technology conditions under which researchers work. There is an increasing competition from other regions to attract scientists; knowledge carriers are often targeted by other players to move institutions and knowledge bases. Government regulations in favouring certain knowledge fields can hamper other forms of new knowledge resulting on decline in knowledge migration and, maybe, urging scientists to emigrate.

In summary, UWS strategies can certainly be structured in Western Sydney to directly enhance the relevance of knowledge produced and the employability of graduates, but government policies have a critical role to play in regulating and fostering the conditions where intellectual vitality is made up of intensive research collaboration networks that attracts and retain knowledge carriers. Communities are also changing perceptions of universities and research centres and there is increasing recognition of universities as key intellectual resources to a region's economic future and social stability, thus the climate for intellectual vitality has never been better.

4.1 Recommendations

Strategic and Policy Recommendations

The study has highlighted the critical importance of universities and research departments to foster intellectual vitality that results in local development. Specifically, the study has the following recommendations to support this process in Western Sydney:

1. Increase the potential of UWS to strengthen the teaching and research area of 'Technology and Engineering', in tis way making UWS a direct contributor to the core competencies and knowledge transformation of the strong manufacturing industry in Western Sydney;
2. Increase the potential of UWS to strengthen the teaching, research and patenting capabilities its 'Architecture and Building' programs, as a direct contributor to innovation of the built environment at a time of strong current and projected growth in development in Western Sydney;
3. Increase the potential of UWS engagement strategies to provide incentives to researchers for participating in formal and informal knowledge networks with regional stakeholders so as to intensify the transfer of knowledge into Western Sydney;
4. Governments at all levels need to create policies and programs that support he mobility of researchers inter-state and internationally, producing a 'brain circulation' that will bring new and revitalized knowledge into Western Sydney;

5. Governments need to increase funding for research activity at universities, including basic research, in order that knowledge becomes a transformative tool for local development and that local industry partnerships can proliferate through this leverage;
6. Governments need to create programs to support participation of researchers in conference and research networks where new knowledge can be discussed and tested through presentations of peer-reviewed publications; this new knowledge can be distributed through local networks later on.

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Appendix 1

UWS programs or projects that engaged with local industry or business were as follows in 2004-2005:

- UWS Office of Regional Development (ORD)

The Office of Regional Development represents UWS' interests in many regional projects and is part of important local and regional organisations, committees and boards. The organisations primary goal is to strategically engage with the GWS community, while at the same time developing relationships and partnerships with local, national and international bodies via cooperative programs. (UWS, 2004, p37)

The most comprehensive resource describing UWS' Community Engagement initiatives is the "UWS Directory of Community Engagement" compiled by the Office of Regional Development. This directory identifies organisational units within UWS with functions that are non-academic, academic as well as research based. In 2004 it listed at least 39 research initiatives and well over a hundred other student and research placements, in most cases with industries and private and public services within the GWS and the Sydney metropolitan area (ORD, 2004)

- UWS Business and Industry Advisory Panel (B&IAP)

The role of panel is to develop successful strategic partnerships with industry to promote innovation via the commercialisation of research outcomes at UWS. The panel aids this process by setting up meetings between potential industry partners and sources of venture capital. It also provides advice on how to move ideas and projects forward. (UWS, 2004, p39)

- Greater Western Sydney Infrastructure Forum

UWS in conjunction with a high-level national think-tank called 'The Global Foundation', held a roundtable discussion examining the infrastructure in the GWS region. Participants were from federal, state, local government, high-level bureaucrats, private enterprise and senior UWS management levels. Outcomes from this roundtable were used to brief state and federal governments on possible strategies to further enhance strategies for GWS regional development. Such forum advances the stature of UWS and bolsters its role as a leader in the region. (UWS, 2004, p41)

- UWS Innovative Technology Network

The ITN network program was started in 1997. In 2003-2004, it offered a series of seminar programs to small and medium sized enterprises in GWS with the implicit aim to improve the efficiency of local manufacturers particularly through a strategy of sharing which is in turn used to promote new technologies and innovative processes. This program is funded by the NSW Department of State and Regional Development. In the coming years the ITN hope to provide a forum for UWS academics to share their expertise and knowledge with local businesses. (UWS, 2004, p42)

- UWS Nanotechnology Project

The Nanotechnology project is concerned with the transfer of knowledge in nanotechnology from UWS to local industry. The primary focus has been on the development of a UWS Nanotechnology Network which “brings industry, academics, students, researchers and the interested public onto the Campbelltown campus, on a quarterly basis to participate in lectures, presentations and discussions surrounding the take up of the knowledge of emerging science such as nanotechnology”. This project is funded through the Federal Department of Transport and Regional Services Sustainable Regions Programme. (UWS, 2004, p42)

- Cooperative Programs

This programme connects organisations with UWS students who can undertake industry research projects or tasks in an array of disciplines. In 2003/2004 163 students were taken on by 91 industry partners, many of whom were also graduates. Approximately one-third of these industry partners participated in this scheme in previous years. In 2004, this program generated approximately \$1.39 million in income and grants. (UWS ORD, 2004, p11)

The Graduand Internship Program was introduced in 2004 and assigns graduates in 12 week placements prior to being offered a permanent position. The Cooperative Programs also arranges placements for international students studying at UWS. In 2004/2005 a new extension to the placements will be introduced with the Coop International program. UWS students can undertake overseas placements during their summer vacation in Fiji, India, the Philippines, New Zealand and the United Kingdom. (UWS, 2004, p43)

UWS programs or projects that engaged with GWS communities were as follows:

- UWS Regional and Community Grants Scheme

This scheme was established in 2001 and aims to strengthen links with community by providing a source of funding, around \$250,000 annually. This source of funds is accessible only to UWS staff for the establishment of “innovative projects supporting regional development and community engagement in GWS”. (UWS, 2004, p39)

- UWS Regional Partnerships Awards

These awards recognise the good external partnership UWS has with organisations and individuals who support regional development and community engagement in the GWS. Active participants of these awards are included as members of the Regional Partnerships Awards Steering Committee that decide on the allocation of awards. In 2004, awards were given to Fairfield Council, NSW Department of Education (Blacktown and Campbelltown) and Karitane (UWS, 2004, p40). In 2006 the Liverpool City Council was the recipient of a highly commended award in the category of Local Councils.

- UWS Regional Council

The UWS Regional Council is the primary committee that deals with university participation in regional social agendas and has been in operation since 2001. The Council is chaired by the Vice-Chancellor (UWS, 2004, p37).

- UWS Arts Consultative Panel

This panel was formed to raise the profile of the university in relation to arts, communication, cultural and design based activities and programs. It also aims to facilitate these interests in relation to the GWS region. (UWS, 2004, p38)

- Academic Service Learning Grants Scheme

The ASLGS was formed in 2003 and is facilitated by the ASL Steering Committee, which is chaired by the Pro-Vice Chancellor Academic. These grants aim to “promote civil society and sustainable communities by building their social and intellectual capital”, and is cited as a priority for development in the standing UWS Strategic Plan for Regional and Community Engagement. In 2004 this scheme was used to help support projects that introduce ASL into UWS curriculum. (UWS, 2004, p40)

- Australian Universities Community Engagement Alliance

In 2004, the AUCEA hosted an inaugural conference to ensure a “continuing commitment of sharing best practice and promotion of scholarly activity nationally and internationally on the higher education agenda”. Presently the AUCEA has representatives from 30 national universities, 3 international universities, governments, community organisations and industry, all of whom are committed to university-community engagement for the betterment of social, environmental, economic and cultural development. (UWS, 2004, p41)

- Visiting Scholars Program

The Office of Regional Development (ORD) established this program in 2004 with the AUCEA to “profile national and international leadership and scholarship in community engagement, to disseminate knowledge and generate new ideas for connecting with community in local, regional and international contexts”. So far the program has included the likes of Prof Philip Nyden from Loyola University Chicago, Prof David Charles from the University of Newcastle upon Tyne in the UK and Mrs Bella Sattar from the Durban Institute of Technology in South Africa. (UWS, 2004, p41)

- UWS Directory of Community Engagement

This directory is coordinated by the Office of Regional Development. One of the objectives of this directory is to identify area of strength in community engagement. UWS staff submits a compilation of strategic alliances and/or partnerships, including the nature of the relationship, a brief project description and head contract details. UWS intends to use this document as a tool for assessing performance of Key Performance Indicators in the area of Regional and Community Engagement. (UWS, 2004, p42)

- Maximising Potential in Macarthur (MPM)

The MPM is a project proposed to begin in 2005 that will develop a leadership mentoring program for young people in the Macarthur region. This project plans to be an excellent example of cross sectorial and multilevel partnership and will include UWS, school and TAFE students, local government representatives and industry and community leaders. (UWS ORD, 2004, p9)

- Membership of regional organisations

One of the primary objectives of UWS’ Office of Regional Development (ORD) is to build strategic alliances with regional stakeholders which include industry, government, community and even UWS community. Presently the ORD represents UWS on various regional Economic Development Boards, businesses and business groups, networks, interests groups, regional council bodies and public sector organisations. (UWS ORD, 2004, p10)