Manufacturing Innovation in the New Urban Economy: Responses to Globalisation

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Executive Summary

This report discusses core manufacturing competitiveness in the City of Liverpool and South West Sydney, both in terms of industry specialisation and innovation intensity, in order to provide key elements for the development of an industry cluster. The study was funded by the University of Western Sydney Partnerships Program, with Liverpool City Council as the industry partner. The analysis is based on survey results, case studies of manufacturing firms, and analysis of successful manufacturing clusters.

Manufacturing, Cities and Clusters

The character of manufacturing production in countries that are part of the Organisation for Economic Co-operation and Development (OECD) is changing. The distinction between high-technology and low-technology sectors is becoming less relevant, because certain components of high-technology production can also be carried out in non-OECD countries. Manufacturing activity in OECD countries increasingly incorporates high-value added services. The relative and absolute declines in manufacturing employment levels are primarily due to strong productivity growth, but are also affected by the growth of manufacturing capacity in non-OECD countries. At the same time, the loss of manufacturing employment in OECD countries cannot simply be characterised as a transfer of manufacturing production to non-OECD countries, as manufacturing employment levels in non-OECD countries have not grown significantly. Manufacturing production has become more and more integrated at the global level, and companies increasingly explore which parts of production can possibly be carried out at arms length, either within their own country or abroad, or by their foreign affiliates.

Manufacturing has become part of the suburbanisation process of cities, and it is still playing an important role in many cities. On the one hand, manufacturing firms and service firms are closely interrelated; on the other hand, services are actually blurred within manufacturing production. International evidence shows that the level of services sector value added input that is embodied in manufacturing goods amounted to as much as 25-30% of total output in some countries in the mid-1990s. Services can be found at different stages of the value chain, where different specialists operate either from inside the firm or from the supplier environment. One of the challenges ahead for councils relates to keeping manufacturing in our cities and regions, because manufacturing continues to be a strong producer of technological change and innovation activity. To achieve this goal, the link between manufacturing and knowledge can be used to help bring high added value activities into traditional manufacturing sectors such as metals fabrication. Another aspect that needs to be considered is to modernise the firm floor space in such a way that it will appeal to the young, so that attracting a new generation is possible. Factories will need to re-think the way they design their floor space and ensure the environment is clean, quiet and safe, including pleasant interior spaces, ergonomic tools and modern IT facilities. The nature of the jobs will also need to change to become more interesting, challenging, requiring specialised skills and providing good opportunities for employee self-development within organisations that are currently flat.

The diversification of the value-chain brought international attention to the competitive advantage of clusters, which are defined as concentrations of highly specialised skills and knowledge, institutions, rivals, related businesses, and sophisticated customers within a particular nation or region (Porter 2000). Clusters need a strong industry capability base from which to start, but then they thrive on knowledge, innovation activities and alliances. Therefore, local institutions can play a large role in supporting clusters initiatives, facilitating their development and branding their region of operation.

Manufacturing advantage in South West Sydney

The study found evidence of three strong manufacturing concentrations in the South West Sydney 'Manufacturing Triangle' of Liverpool, Fairfield, and Bankstown: metal products; petrol, coal and associated products; and wood and paper products. Of these three production areas, the 'metals' industry was selected for further innovation analysis for the reasons detailed below.

Metal Products Manufacturing employs a large number of people. The industry in South West Sydney represents 39.1% of the Metal Product manufacturing in the entire Sydney metropolitan area. It has one of the highest levels of associated 'basic employment' (892 jobs). The industry also has a strong local component of growth in the shift share analysis, despite strong negative industry growth as a whole (which caused overall job numbers in the industry to contract in the 1996-2001 period). There are also a large number of companies involved in the industry in the South West Sydney (SWS) Manufacturing Triangle, including a good representation in Liverpool. In addition, other strong industry specialisations such as 'steel metal furniture' were able to be analysed together with this cluster. The metals industry also has strong dynamic interactions with other industries of solid growth in SWS such as building and construction, transport and logistics, and furnishing.

The *Petrol, Coal, Chemical and Associated Product Manufacturing* sector was the second industry selected as a potential cluster, for similar reasons: high levels of employment associated with the industry; high levels of associated 'basic employment'; highest level of local component share of all industries in the shift share analysis; and the highest levels of actual job growth in the 1996-2001 period. However, in comparison with the metals industry, it represents less of a homogeneous industry.

A third specialisation is the *Wood and Paper Product Manufacturing*, which shows strong local concentrations of corrugated paperboard containers manufacturing, and mattress manufacturing (excluding rubber).

Case studies of Innovation in Metals Industry

The five case study firms that were analysed range from Small and Medium Enterprises (SMEs) to large firms, and cover different aspects of the value-chain process: from the processing of raw materials, to the delivery and customisation of products and services, and the recycling of waste and disused product. The spectrum of firms is a good representation of the metals industry in South West Sydney, with core competencies

defined around the design and production phases of the value chain (simple through to advanced production).

Skills analysis of these firms shows that the firms have staff with high levels of secondary education qualifications, which is consistent with the predominant concentration of trades in the region. However, the distribution of apprentices by industry indicates that the sectors where the training of new talent is occurring is not the 'metals manufacturing' sector, but rather is in other associated sectors such as 'Building and Construction', 'Automotive', and 'Utilities and Electrotechnology'. Firms also noted the acute difficulties experienced in attracting new people to the industry, and the often concomitant mismatch of skills possessed by new graduates with the skills actually required by firms, as being one of the most important challenges of competitiveness in global manufacturing.

Analysis of innovative activity undertaken by the case study firms in the past three years indicates that all firms had innovated in one or more of the three types of innovation (product, service, and organisational or process). There is a greater focus on product and service innovation, with an incremental degree of novelty.

Innovation intensity was analysed through observation of firm participation in knowledge intensive service activities (KISA) before, during and after manufacturing. The most frequent KISA related to sales, logistics and distribution, safety and Occupational Health and Safety (OHS), and marketing and promotions. There was a diverse use of KISA in the pre-production phase, indicating the high level of knowledge intensity for this phase of the production cycle. It is interesting to note that Marketing and Promotions activities are most accessed at the 'Before Manufacturing' stage, rather than at the 'Selling' stage. This indicates the importance of Marketing and Promotions activities in seeking out a potential market and customers for the firm before the full commitment to manufacture has been made. The 'During Manufacturing' stage also sees access to a diverse range of KISA, but these are of slightly different types, such as quality control and testing, safety and OHS, and maintenance and repairs. The 'Sales' period of the production cycle sees overall levels of KISA access decline. The main activities are naturally sales, logistics and distribution, and marketing and promotions, but also e-commerce and IT services. The 'After Manufacturing' stage presents very few KISA, mostly focused in waste management and recycling, and sales, logistics and distribution.

Firms seem to concentrate on KISA that are complementary to the activity of the firm, such as logistics and distribution, and maintenance and repairs, but not on 'core activities for innovation' such as finance and accounting, or business development advice. These complementary KISA are sourced to a great extent from the Sydney metropolitan area and firms indicated that the local area has less specialised service provider capability than the metropolitan area. Many of the external, specialised services used by these firms are purchased from firms in the Sydney city centre, indicating the important contribution of manufacturing firms to the business and financial cluster in the Sydney CBD. In-house sourcing is most prevalent in recruitment and IT provision. Most KISA are the result of a mix-and-match compendium of services produced in-house or purchased externally, indicating the extensive integration of services at all stages of the manufacturing process for metal firms.

When looking specifically at the advantages of clusters, firms noted: the potential for circulating customers across the cluster; the prospective attraction of more business to the region from different parts of the value-chain; the nurturing of local sources of expertise and talent; the likelihood of access to new jobs circulating through the cluster; and the potential to make the industry more sustainable as a whole. Firms already place an important role on their current collaboration networks, with the main actors being customers and suppliers, and other parts of the industry group to which the firm belongs. Geographically, the collaboration network extends towards the Sydney metropolitan area and elsewhere in NSW more than towards the local area (defined as within a 20 kilometre radius).

The case study firms indicated 'location' was a factor in their decision to either move their business to South West Sydney or to operate from this region. In all cases, the decision related to two key factors: availability of affordable land; and clustering of manufacturing firms. Among the regional resources that were indicated as being advantageous for manufacturing businesses were: the availability of local talent (although new recruitment is difficult); local suppliers, especially for maintenance and repairs; and road and freight infrastructure. Among the disadvantages are the lack of high speed Internet for data transmission, and strict Council regulations for business expansion.

In general, firms saw the role of Councils as being that of regulators, but they also indicated Council's role in other activities, which are more related to knowledge diffusion and cluster facilitation. In particular, the facilitation by Councils of KISA, which were noted as being of particularly high importance for the case study firms, related to providing economic and demographic information on the region, logistic support for industry networks/clusters, and work placements and employment skill development programs.

Learning models of manufacturing clusters

Four manufacturing cluster initiatives were analysed as learning models: the Mackay Area Industry Network (MAIN) in Queensland; the 'City of Playford's Innovative City Economic Plan' in Adelaide; the 'I^{3}Net' cluster in Wollongong; and the 'HunterNet' engineering network in Newcastle. The four networks emerged in response to perceived threats from changing conditions in the global market, decline in the manufacturing sector, or acute skill shortages that threatened the growth of the companies.

The 'Mackay Industry Network' (MAIN) was formed in the mid-1990s, in an attempt to solve the skills shortages experienced by the participating companies, when it became evident that the national apprentice training system was not responding fast enough to keep up with the growth of the manufacturing industry. MAIN acts as an intermediary agent, connecting industry with education agents; they organise all bookings for all their apprentices, and they also focus on anticipating the type of skills gaps prospective employers might have in the near future. The MAIN network example highlights the importance of providing the private sector with mechanisms for participation in the design of solutions to their labour market imperatives. Because these companies based their strategic analysis and planning around the direct local market impacts on their day-to-day work, they were able to move quickly and design a solution that targeted trades as being the core skills needed by their businesses. MAIN is self-sustaining and is likely to continue

operating for the benefit of the manufacturing sector in Mackay, as most of its 50 active companies are small, and the advantages of the cluster model are evident.

The second learning model is the South Australian City of Playford's 1999 Economic Plan, *An Innovative City.* The economic plan was based around a strategy designed to develop new overseas markets, to enhance Playford's innovation system, and to connect with the national innovation system. The plan focused on facilitating clusters and/or networks in the manufacturing sector and today there are more than 200 firms associated with the manufacturing cluster alone. Key elements of success relate to industry, policy, and media environments such as: engagement of dedicated staff who coordinated an initial industry analysis; strong Council leadership; public funding for projects; promotion of business alliances; engagement with media to portray the key role of modern manufacturing; promotion of policy networks; and linking clusters nationally and internationally. KISA facilitated by the development of the strategy are: the organisation of conferences and events; networking services; business development services; design services; economic development consulting services; and preparation of grant proposals and research services.

The third learning model, i^3Net, is a new manufacturing network that started in 2005 in Wollongong, which is in the Illawarra region, south of Sydney. The Illawarra has a history of being a heavy industrial centre, with many of i^3Net's 13 core member companies providing project management and other services to the blast furnaces, continuous casters, rolling mills, steel superstructures, mining infrastructure and equipment, and offshore oil rigs industries. There are 57 other businesses that are less involved in i^3Net activities, but which are still linked to the network. KISA facilitated by the network refer to: secretarial services, such as compiling company profiles outlining core capabilities; marketing and promotional services; website maintenance and information diffusion services; research services for means of entering new markets or new industry sectors; networking services and alliance formation; facilitation of facilitation of overseas travel to create connections and linkages; and facilitation of regional networks to access public funding and support.

The fourth learning model, HunterNet, was set up in 1992 in Newcastle, which is in the Hunter region, as a Co-Operative (Ltd) of SME manufacturing, engineering and consulting companies. The Hunter area has a long association with the mining and manufacturing industries. However, by the early 1990s many companies found themselves competing in a more global environment, largely due to changes in the local industry, national and international markets, and there was a strong need for these companies to join forces in order to survive in that environment. The network has 44 member companies. HunterNet plays a prominent role as a training provider through their own training company - The HunterNet Group Training Company. This enterprise consolidates both on and off-the-job training for apprentices. The network also organises other initiatives, such as the 'Innovate the Hunter' scheme and the 'Export Awareness' training program, which is aimed at assisting engineers and manufacturers in securing export markets. The network also maintains the HunterNet website, which acts as an information conduit for member and other interested organisations.

The analysis of learning-cluster models indicates there are four main elements consistently present in successful manufacturing clusters. First is the training of apprentices

for the member companies, which acts as a means of recruiting new talent and providing customised learning. Second, is to promote alliances to create bigger, stronger, and more sophisticated competencies, and usually involving 2-3 companies from within the cluster. The new company or alliance then commonly pursues new markets (e.g. in Asia) or new industry sectors (e.g. defence). Third, is the provision of secretariat services to organise meetings, overseas delegations and marketing projects. Fourth, is the delivery of more sophisticated intellectual services (KISA), such as research and development (R&D) and business development advice, and political services such as lobbying governments for funding for specific projects and infrastructure. Clusters constitute an excellent platform for delivering KISA that are customised to the needs of firms within a particular industry sector, and within a particular business space. Essential to cluster development is the appointment of a full-time facilitator from the early stages of the cluster. The facilitator is usually funded by public programs for a period of 2-5 years, or until the cluster becomes self-funded.

Key Recommendations

The main recommendation of this study is for the Councils of the 'South West Sydney manufacturing triangle' (Liverpool, Bankstown and Fairfield) to form a 'manufacturing support partnership' to facilitate the development of manufacturing clusters (e.g. fabricated metals). Facilitating clusters can have a positive impact on addressing skill shortages at the local level, which can result in the creation of skill-hubs for the current and future needs of the industry. However, clusters need a regional focus to better reflect the extension of economic activity and interactivity through the value-chain. They also need resources that can be shared across the industry region.

Companies need support to initiate these collaboration structures, and dedicated professionals are needed for the task. It is too hard for companies, especially those located within industries that are in transformation, to obtain the capital required for the creation of the organisational structure such clusters need. This is where governments and local agencies can provide assistance, through supporting clusters and networks, which in turn enables creation of skills-hubs and innovation spots. The investment is usually small, and the solutions provided by companies working together are usually very well tailored to the local operating context. State programs such as those lead by the Department of State and Regional Development (DSRD) are well placed to support cluster development in collaboration with local Councils.

There are four key strategic areas of cluster development: (1) cluster governance; (2) 'core' KISA delivery; (3) training and skills upgrading; and (4) branding the South West Sydney manufacturing triangle. *Cluster governance* is at the centre of the plan because both the literature and the analysis of firms and successful learning models noted the importance of having dedicated professionals (1 full-time facilitator and a cluster Board) and a good management and strategic structure to guide the process over time.

'Core' KISA delivery refers to the cluster acting as a platform for the use and production of knowledge intensive service activities, specifically those that are more related to the core capabilities of the firms and to the core of the innovation process. These

activities relate to business planning advice, accounting and finance, IT services, marketing and promotion, and research and development. Good cluster governance would understand the changing needs of the firms, and whether or not the core KISA should remain unchanged or need to be updated.

Training and skills upgrade refers to the need to focus on customising training to target both the core competencies of firms, and those skills needed to meet changing business demands. Industry clusters provide a 'thinking business space' in which to design potential solutions to skills shortages, lack of attraction of new talent, and the challenges of up-skilling and re-skilling the workforce.

Branding South West Sydney manufacturing triangle (cities of Liverpool, Bankstown and Fairfield) addresses the need to link clusters across broader economic spaces. It also encourages other firms to perceive the area as a solid manufacturing base focusing on high value added activities. These activities can create a motivating environment for attracting a new generation of employees, for keeping manufacturing workers and enterprises in the area, and for stimulating the creation of new enterprises that are focused on providing specialised manufacturing services to the region and other manufacturing regions nationally and internationally.

Two actions are needed for branding the manufacturing triangle. First is to communicate with the firms and bring them together to discuss the possible development of a cluster. A parallel action is to prepare a memorandum of agreement between the Councils so that existing regional resources can be used and a new grant to State or Federal agencies can be prepared for a full time cluster facilitator. A 'metals industry manufacturing summit' organised by the Councils could facilitate this process of engagement with both firms and institutions. The role of local Councils as facilitators of cluster development is relevant to the reform of manufacturing in cities, and involves providing a solid leadership for industry and employment local policy.

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1. Introduction to the Report

The international research-based literature clearly indicates the multiple dimensions of innovation and innovative activity by firms (OECD 2001a). From an initial focus on product innovation alone, it is now widely understood that innovation encompasses not only radical and incremental product development, but also new production methods and new organisational forms. It has become clear that these multiple aspects of change characterise innovative firms and influence competitive success. Networks and clusters are acknowledged as being innovation channels, where formal knowledge and ideas travel in conjunction with tacit non-specific information (OECD 2001 a,b,c). International evidence also points out that industry clusters cannot be 'created', but rather are stimulated through the right environmental conditions such as the support of knowledge intensive and networking activities in strong industry sectors (Porter 2000; AEGIS 2003b), and developing links to knowledge institutions that are in a position to provide specialised expertise for the group of firms (AEGIS 2003a).

OECD countries are now realising the importance of innovation to traditional sectors, for both industry and regional growth (OECD 2001). Recent research has also provided evidence that the Australian manufacturing sector falls within the group of what can be called innovation-intensive industries (Toner et al 2004). Triggered by these findings, this study aims to analyse innovation components within the manufacturing industry of South West Sydney. Despite the numerous studies in the area, presenting quantitative analysis of census data and business concentrations data (Fagan 2003; Randolph & Holloway 2003; DOTARS 2003), no study has yet dealt with the analysis of innovative activity and its role in the formation of an industry cluster in the South West of Sydney, despite its role as one of the most important manufacturing regions in Australia.

One in four workers in this region is employed by the manufacturing industry, amounting to a total of approximately 50,000 workers (Fagan 2003). The capacity of this industry to contribute towards innovation and employment growth in the region is critically important to the future of the City of Liverpool and South West Sydney. Concomitantly, the future of manufacturing in the region is linked to the growth of competitive small and medium enterprises working within regional networks and developing the right environment in which competitive clusters can emerge. Clusters may be understood to be an informal association of firms, usually in geographic proximity, which pursue deliberate practices of collaboration in order to heighten their competitive edge in regional, national and international markets. Clusters offer a structure that articulates strategies designed to foster knowledge, utilise technology applications, and develop innovation at the firm level (Martinez-Fernandez 1998). Additionally, clusters attract needed specialised services to a region, generate demand for more firms with similar and related capabilities to move to a region, have an open membership with shared social values, and involve both cooperation and competition (OECD 2001).

The focus of this study was to understand the innovation capabilities of the South West Sydney manufacturing sector and to investigate the potential for local institutions to facilitate an industry cluster.

Value of the Study

The results of this study can be used as the basis for a regional industry development strategy. Industry innovation is best achieved through networks or clusters of firms, where knowledge and learning can be enhanced (OECD 2001). Therefore, the identification and innovation analysis of manufacturing clusters will greatly improve industry perspectives for existing firms and for firms seeking relocation. This report contributes to our understanding of 'industry clusters' in global manufacturing. Clusters are still poorly understood, mainly because they have been strongly driven by the private sector, which often does not have the capacity or the time to apply innovation techniques and empirical analysis to the identification of industry clusters. Too often, analysts in the field are presented with reports about clusters that have been identified by means of 'word of mouth' or 'picking winners', and which often do not last for long enough to allow for their development into a sustainable cluster. National industry agencies are then left with a wastage of funds from supporting 'clusters' that do not have the potential or the innovation strength to be sustainable over time.

This report will increase the awareness of other firms in the SWS region regarding the potential benefits that clusters can provide to existing business levels. The specific focus on manufacturing networks creates the ideal conditions for robust industry clusters to develop in areas where manufacturing strengths already exist. This is especially important for Australia, as its manufacturing capabilities as a whole are not strong, and face critical challenges due to its proximity to strong manufacturing countries such as Japan, China and other Association of Southeast Asian Nations (ASEAN) countries.

There is a strong need at both the local and regional levels to develop targeted programs that will support local industry capabilities. The data presented in this report will permit improved targeting and prioritisation of policy interventions, and the creation of effective industry development strategies for both the immediate and longer terms. It is through this understanding and targeting that Councils and regional organisations will be better prepared to achieve sustained employment growth over the coming decades and in the face of constantly changing competitive conditions. In the immediate term, the support of manufacturing networks will contribute to the transformation of the related sectors, with modern business models helping firms to make the transition to the so called 'knowledge economy'. All sectors today are knowledge intensive, and we have found particularly that manufacturing firms are blurring their products with services in an effort to highly customise their offering (AEGIS 2003c).

Research Methods

The research questions to be investigated are:

- What significant manufacturing industry concentrations already exist in Liverpool City and SWS?
- What role do knowledge flows, knowledge intensive service activities (KISA) and collaboration infrastructure play in the innovation process of SWS manufacturing firms?
- What are the key elements found in successful cluster initiatives? What knowledge intensive service activities (KISA) do these clusters facilitate?

The project was developed in four steps:

STEP 1: Literature review of cluster research and the role of manufacturing in the urban space.

STEP 2: Analysis of manufacturing industry concentrations in Liverpool and surrounding areas using existing databases and bibliographic sources. This would indicate which sectors are dominant, the size of the firms, and other relevant aspects of the firms' innovation structure such as skill levels and their position in the value-chain.

STEP 3: Investigation of innovation, knowledge and collaboration elements of selected case studies. A recent innovation survey in the region provided background information relating to the use, access and integration of knowledge intensive service activities (KISA). Selected case studies supplied information regarding specific linkages to regional institutions (such as training, research & technology, and government departments, and other firms from the value-chain, thereby providing critical information for the understanding of innovation processes already existing in South West Sydney's manufacturing firms.

STEP 4: Learning models of successful manufacturing clusters were analysed to identify critical elements of cluster competitiveness in the manufacturing sector. The clusters analysed are:

- MAIN in Mackay (Queensland)
- City of Playford 'Innovative City' Economic Plan in Adelaide (South Australia)
- I^3Net in Illawarra (New South Wales)
- HunterNet in Newcastle (New South Wales)

The report is divided into six chapters. After this introduction, Chapter Two presents a literature review of clusters and manufacturing in cities, and their role in the knowledge economy. Chapter Three discusses manufacturing concentrations in South West Sydney. Chapter Four discusses innovation elements within case studies of manufacturing firms. Chapter Five discusses best practices of manufacturing clusters. Chapter Six presents conclusions and policy suggestions.

2. Manufacturing, Cities and Clusters

The Reform of Manufacturing Industries

- Manufacturing production is changing in OECD countries due to an increasing focus on high-value added services. Decline in employment is due to productivity growth, not transfer of activities to non OECD-countries.
- Manufacturing is embedded in cities' production and services networks. Manufacturing activities are blurred, with multiple services occurring throughout the value-chain and frequently within the manufacturing firm.
- The diversification of the value-chain brought attention to the competitive advantage of clusters, which are defined as concentrations of highly specialised skills and knowledge, institutions, rivals, related businesses, and sophisticated customers within a particular nation or region (Porter 2000).
- Clusters need a strong industry capability base and they thrive on knowledge, innovation activities and alliances.
- Local institutions play a large role in supporting cluster initiatives, facilitating their development, and branding their region of operation.

2.1 Manufacturing in the New Urban Economy

Manufacturing can be defined as the output of an economic activity, which is physical and tangible, does not need to be consumed immediately, and where the final user does not participate in the production process (Illeris 1996). Despite the attractive growth of services as an industry that is very much related to the urban space, manufacturing is still a driver of economic growth in many countries (especially South East Asia and Eastern Europe) and some segments of manufacturing are remarkably resilient, such as the food processing, paper and packaging, and the chemicals industries (OECD 2006).

Manufacturing was associated with high levels of employment until the last part of the 20th Century and until then it also correlated with urban growth rates. Since this time, the reverse can be observed; manufacturing plants moved out of the city area into the

suburbs, where prices were cheaper, thus allowing for ongoing production and expansion. Manufacturing then became part of the suburbanisation process of cities, and it is still playing an important role in this respect in many cities. For example, manufacturing employment is over 30% in the European cities of Torino, Genova and Zaragoza, while service cities such as London, Paris, Frankfurt, Helsinki and Stockholm account for less than 15% (OECD 2005). An open question here is how are manufacturing industries responsible for sustaining other economic activity that is more related to services, such as design, R&D, legal advice, and marketing, and to what extent do these relationships occur across different spaces in the city, from suburbs in the periphery through to the city's central business district.

In addition to the networked functions of the manufacturing and services businesses, both functions are actually blurred within manufacturing production. A recent OECD study (Pilat and Wölf 2005) found that the level of services sector value added input that is embodied in manufacturing goods amounted to as much as 25-30% of total output in some countries in the mid-1990s. Most manufacturing units are also not very diversified and services are integrated into the same production establishment.

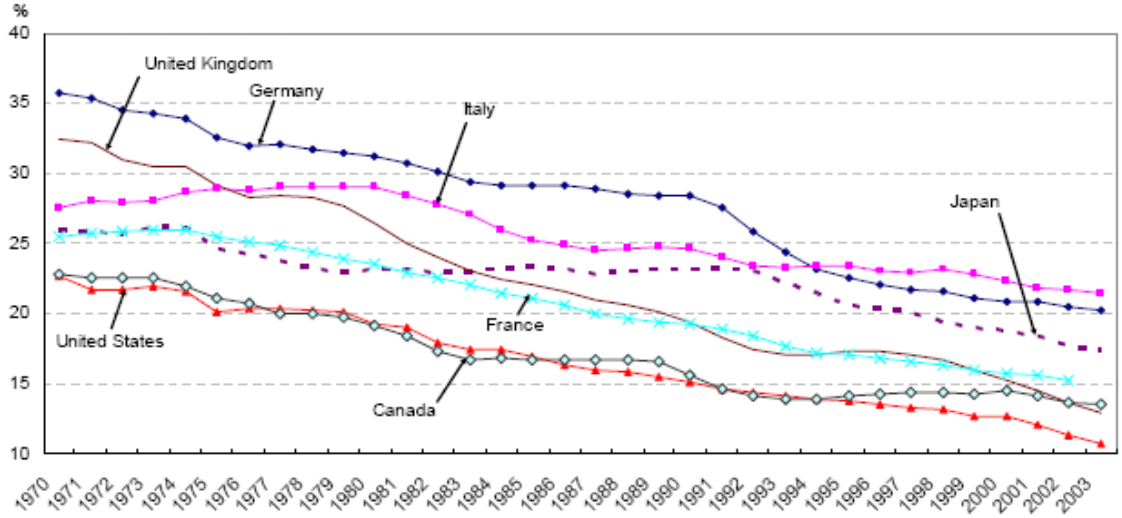
Services can be found at different stages of the value chain, where different specialists operate either from inside the firm or from the supplier environment. In this way, manufacturing firms become embedded within the urban area in which they are located, with multiple functions being linked from manufacturing to services. Value-chain analysis is also a useful tool to use in identifying the reach of the firm regarding purchasing of services and where these services are located. The dynamics of the value chain are complex, as they are continuously adapting to prices, technological changes and changes in demand, and the spread of manufacturing business value chains can alter across the city thereby influencing location factors of new businesses and suppliers.

The dynamics of manufacturing in cities are especially important for urban regions within which manufacturing businesses are located. The specific regional assets and strengths of the region for manufacturing businesses, and the institutional set-up at the local level can be an important influence on the competitiveness of firms and on the production of new ideas that will allow them to remain competitive in the global manufacturing arena. In this way, urban manufacturing regions are both the scene of manufacturing decline, and the area where new approaches are developed and tested. The analysis of modern manufacturing therefore has many different dimensions, all of which need to be analysed as a system of competitiveness, including the firm, the value chain, the industry and the region.

Employment decline

The declining employment figures within the manufacturing industry has been evident in OECD countries since 1970 (see Figure 1) and has been hastened by changes in the production system and the rapid employment growth in the services sector (Miles 2003). The exceptions to this decline are Norway, Canada, Spain, Mexico and Ireland, where manufacturing employment has been growing in the last two decades.

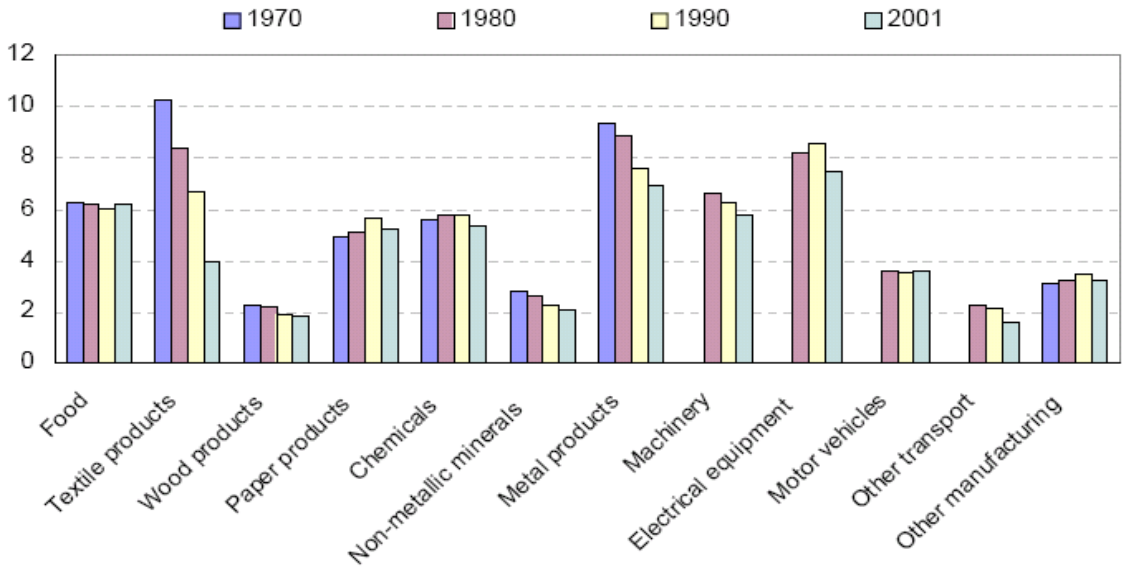
Figure 1: Share of manufacturing in total employment, G7 countries, 1970-2003, in %



Source: OECD, 2006. STAN indicators database, December 2005

The decline in manufacturing sector employment levels has not occurred equally and some sectors such as textile and metals show higher decline than other sectors (see Figure 2), due to strong demand of certain products (such as motor vehicles) or because production is close to the market (as in the case of food processing) and therefore international competition does not have a great impact on local employment levels. The variation in impact across countries is high, and some countries continue to have a competitive advantage in certain sectors (such as Korea and Norway in shipbuilding), despite international off-shore competition.

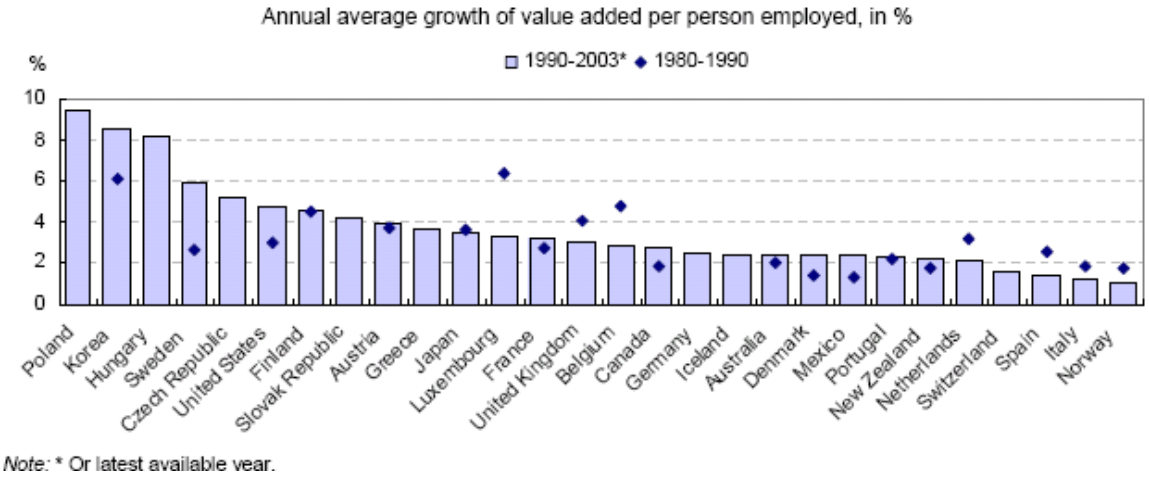
Figure 2: Manufacturing employment by key activity, G7 countries, 1970-2001, million workers



Source: OECD, 2006. STAN indicators database, December 2005

Decline in manufacturing employment levels in OECD countries has been blamed on the employment shift to non-OECD countries. In actual fact however, manufacturing employment in non-OECD countries has not grown. Although it is true that shifting of production sites has play a role, the key explanation is rapid productivity growth, notably in countries such as China and India, where there has been a closure of inefficient state-owned enterprises, leading to a rise in more competitive private enterprises. Prices also contribute to the declining share of manufacturing in value added, as manufacturing products have become cheaper, thereby accounting for a smaller proportion of the economy. However, as manufacturing provides important inputs to other sectors of the economy, it is clear than manufacturing still accounts for a considerable share of overall economic activity (OECD 2006). Despite its relatively small share in terms of value added and employment, the sector makes a significant contribution to aggregate productivity performance, particularly in countries such as Finland, Hungary, Korea, Poland and Sweden (see Figure 3).

Figure 3: Productivity growth in manufacturing, 1980-90 and 1990-2003*



Note: * Or latest available year.

Source: OECD, 2006. STAN and STAN indicators database, December 2005

Box 1 below summarises the situation of the manufacturing industry across OECD countries.

Box 1: Review of Manufacturing in OECD Countries

The ***share of the manufacturing sector*** in total economic activity continues to decline in OECD countries and is likely to do so in the future. The relative decline in the share of manufacturing in production and value added results primarily from relatively slow growth in demand for manufacturing products, as demand for services is growing more rapidly. The relative and absolute decline in manufacturing employment is primarily due to strong productivity growth, but is also affected by the growth of manufacturing capacity in non-OECD countries. At the same time, the loss of manufacturing employment in OECD countries cannot simply be characterised as a transfer of manufacturing production to non-OECD countries, as manufacturing employment in non-OECD countries has not grown significantly.

The ***character of manufacturing production*** in OECD countries is changing. The distinction between high-technology and low-technology sectors is becoming less relevant, as certain components of high-technology production can also be carried out in non-OECD countries. Manufacturing activity in OECD countries

increasingly incorporates high-value added services. This change seems due to business models that increasingly emphasise intellectual assets and high-value added activities (OECD 2006), such as research and development, financial and after-sales services, instead of manufacturing production as such. The distinction between manufacturing and services is blurring, complicating empirical analysis with data by economic activity.

Manufacturing production has become more and more integrated at the global level. Manufacturing companies increasingly explore which part of production can be carried out at arms length, either within their own country or abroad, or by their foreign affiliates. This leads to a growing fragmentation of production, notably in those industries where production can be fragmented (*e.g.* electronics) and to growing inter-industry and inter-firm trade. Due to these changes, trade patterns and patterns of comparative advantage across countries are increasingly complex as they are heavily influenced by location choices of multinational enterprises.

Innovation in manufacturing remains dominated by OECD countries. The emphasis on high-value added activities translates into a growing importance of innovation. Research and development in non-OECD countries is growing, notably in China. Thus far, growth of R&D in non-OECD countries has not translated into much new innovation, as measured by triadic patents. OECD countries continue to account for the bulk of global patenting activity. That being said, the R&D intensity of OECD countries has not grown significantly in recent years, even if there appears to be a growing emphasis on innovation in national policies.

Source: OECD 2006: 32

2.2 Defining Industry Clusters

Our present understanding of clusters goes back to the first half of the 19th century. In 1826, North German landowner Johann Heinrich von Thunen published *The Isolated State*, which for the first time scrutinised issues regarding the localisation of economic activities and their relationship to the theory of rent. His work claimed agricultural production and land use would agglomerate in concentric circles around the city (von Thunen 1826). Later that century, theorists like Alfred Marshall (1890) helped correlate economic literature to agglomerations of related industrial activities (Marshall 1961). This established a link between the locality of firms and their economic efficiency. In 1909, Alfred Weber identified the relationship between geographic agglomeration and scale economies, and observed how an enterprise's location decision is often driven by the benefits deriving from minimising delivery and production costs (Weber 1929).

By the 1930's, Walter Christaller described the demand and supply of goods and services as being largely centralised, but also prone to spill-overs that diminish with distance. He found that central regions are surrounded by areas of low market activity in largely peripheral border areas (Christaller 1966). Much of the arguments put forward in the 19th and 20th centuries largely emphasised pecuniary linkages (ie. demand and supply linkages), which were supposed to encourage spatial concentration (Braunerhjelm & Johansson 2003, p.42).

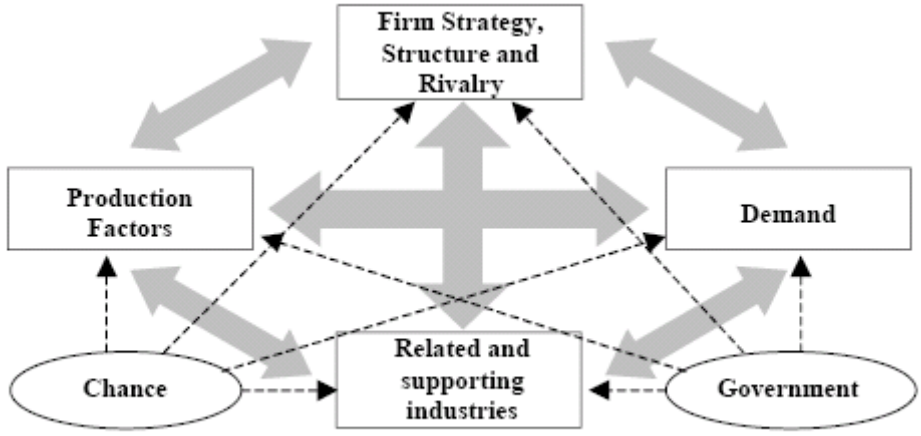
However, during this same decade, Joseph Schumpeter introduced a surprising new element into the clusters argument – the role of innovation. He stressed the role of technological change in industrial development and emphasised that innovation plays a pivotal role (Andersson et al 2004). The role of innovation and the localisation of activities were from here on in to play a central role in the literature.

By the 1980's, interest in industrial agglomerations and clusters resurfaced, largely encouraged by the success of the 'third Italy'. This accounted for the flourishing business development in the North-east and central Italy, which contrasted dramatically with the South and the recession-hit North-west regions. The interest in 'third Italy' emphasised the significance of the region's economic and social structure, which was made manifest by the focus of firms clustered in particular localities according to different industry sectors. Such clusters were often established by strong competitors in a number of traditional product categories such as shoes, furniture, tiles and musical instruments, just to name a few. Such enterprises often showed a great propensity to innovate in terms of production processes as well as product qualities (Andersson et al 2004).

Researchers began examining the flexibility of enterprise structures and specialisation, particularly in relation to small to medium sized enterprises (SME). Studies attributed their strength to inter-firm collaboration, services from government and trade associations, as well as peculiarities relating to positive historical and social factors. By this point, similar cluster initiatives were being examined in other parts of the world (Andersson et al 2004).

However, a breakthrough in cluster research came about with the publication of Michael Porter's seminal work, *Competitive Advantage of Nations*, in 1990. Porter contradicted then current US-based local development objectives, by advocating diversified economies, promoting specialisation according to historical strength, and emphasising the importance of industrial clusters. Most importantly, Porter emphasised that a multiplicity of factors, not only the internal dynamics of an individual firm, play an important role in its overall performance. Porter introduced a 'diamond model' (see Figure below) which outlined four sets of interrelated forces (Andersson et al 2004, p.16). Porter's analysis brought clusters to the attention of both policy makers and analysts alike and his now famous diamond model showing four interacting forces – demand conditions, factor conditions, firm strategy, rivalry and structure and other related industries.

Figure 4: Porter's Diamond Model



Source: PricewaterhouseCoopers 2001 (based on Porter 1991)

The concept of clusters and the diamond model developed by Michael Porter as his paradigm for understanding company competitiveness, national implications and new global strategies (Porter 1990) has moved towards a more inclusive definition, embracing one critical aspect of innovation: the generation and transfer of knowledge. In 1990, Porter provided a definition of what he called 'vertical and horizontal clusters'. Vertical clusters are made up of industries that are linked through buyer-seller relationships. Horizontal clusters include industries that might share a common market for the end products, use a common technology or labour force skills, or require similar natural resources (Porter 1990). Eight years later, in 1998, he expanded his definition to include linked industries and other institutions that are important in competition such as suppliers of specialised inputs, manufacturers of complementary products or services, universities, think-tanks and other government institutions (Porter 1998). At this time, Porter further ascertained that local competition creates incentives of best practice and therefore increases pressure to innovate.

This concept of clusters was now strongly related to the 'competitiveness' of different industries and nations. Finally, in a paper he wrote in 2000, Porter defined clusters as concentrations of highly specialised skills and knowledge, institutions, rivals, related businesses, and sophisticated customers within a particular nation or region (Porter 2000). This is a more sophisticated view of the cluster, and acknowledges the reach of cluster boundaries into political, administrative and regional education institutions. In his new definition, skills and knowledge are the key to the formation and development of clusters. Recently, attention has been focused on biotechnology or IT as being natural sites for the development of clusters, yet evidence also shows that innovation is intensive in traditional industry sectors such as agriculture and manufacturing (Toner et al 2004).[1]

It was also around this time that Paul Krugman, picking up on late 19th and early 20th century theorists such as Alfred Marshall, Alfred Weber and Walter Isard, helped draw attention to the role played by location in economics. Krugman (1991) argued that small regional differences in wages have the propensity to shift an entire manufacturing sector into a region. He thereby showed just how sensitive conditions could be to small changes, and how such changes tend to induce centripetal forces thus promoting agglomeration (Braunerhjelm & Johansson 2003). This issue has since been taken up by Brainard (1993), Markusen (1995) and Venables (1996).

Related research streams were developing in tandem with this economic cluster theory definition. For example, 'Innovation Systems' literature paid attention to the spectrum of national, regional, sectoral and firm level interactions. This realm asserted the importance of links between different value-creating activities, thereby facilitating greater coordination in managing the exchange of information, which in turn allows for a process of innovation and mutual learning between different participatory actors (Andersson et al 2004). Another off-shoot was the so-called 'new growth theory', which, unlike the traditional 'neo-classical' growth theory, believes endogenous growth models emphasise knowledge spillovers as being a key part of growth (Andersson et al 2004).

[1] A detailed study of the literature of clusters and innovation can be found in Martinez-Fernandez (1998) and the relationship between innovation networks, collaboration infrastructure and planning systems can be found in Martinez-Fernandez (2004).

All of these complementary and converging research strands contributed pieces towards solving the overall puzzle that forms our evolving understanding of clusters. Not all strands fit and neither are they in harmony with one another. As shown, some researchers have preferred to focus on the supply and demand side, others on innovation and technological improvements, market forces, or the role of the entrepreneur. There is no doubt that the exact definition of clusters will continue to develop over the years.

Classification of Clusters

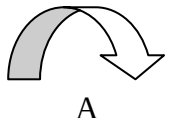
The concept of a 'cluster' has different meanings to different researchers and it is therefore difficult to label it definitively. However, recent research authoritatively shows that industrially-based clusters can be classified within the following parameters:

a. input-output or buyer-supplier relationships;
b. co-location within a geographic area;
c. indication of informal co-operative business competition; and
d. sharing similar business-related regional organisations.

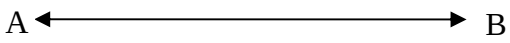
(Feser & Bergman 2000, p.3).

DeBresson and Hu (1999) used a cluster typology to help differentiate existing cluster types. There are 6 elementary structures that they utilised to help identify and analyse clusters and their formation in this study. These 6 structures are:

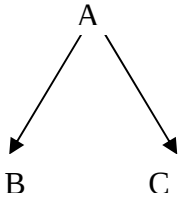
a. 'Development Point': An isolated enclave industry with innovative activities enclosed within itself and not linked to other firms.



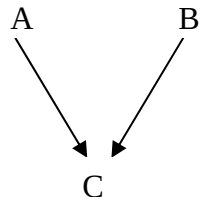
b. 'Innovative couple': Two industries which supply innovative outputs to each other only, in a symmetrical fashion.



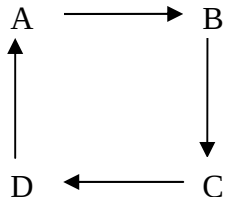
c. 'Standard tree': One industry supplies innovative outputs to other industries but no return output is reciprocated.



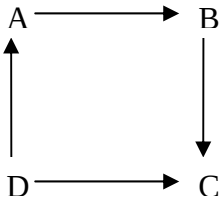
d. ‘Non-standard tree’: Similar to the ‘standard tree’ model but with two industries feeding innovative outputs to only one industry, which does not reciprocate.



e. ‘Standard cycle’: When one industry supplies another with innovative outputs, which in turn supplies another and so on. Eventually the innovative output comes back to the original industry completing the circle.

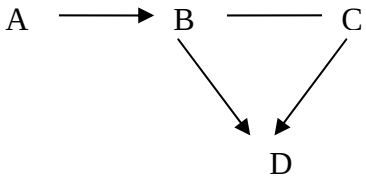


f. ‘Non-standard cycle’: Similar to the ‘standard cycle’ but complete circularity of supply relationships does not exist.

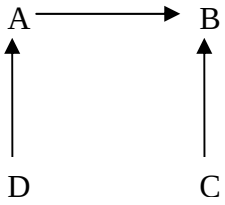


There are also 3 composite structures, which cover all possible clusters:

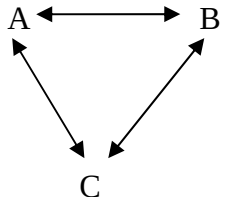
a. ‘Simple agglomeration’: A composite cluster with little integration.



b. ‘Technological complex’: Another composite cluster with less integration.



c. ‘Clique’: A perfect cluster where all participating industries supply each other with innovative outputs.



(DeBresson & Hu 1999, pp.43-44).

Earlier research characterised clusters as zones linked via formal production connections, regardless of physical proximity. When these clusters exhibited a strong measure of geographical concentration, it was usually called an ‘industrial complex’ (Czamanski & Ablas 1979).

2.3 Highlights of Cluster Research

Innovation and Competitiveness

On the whole, Australian clusters and the related knowledge and innovation studies are very much in their infancy, with the work largely being dominated by a handful of researchers. Marceau (1999) found Australian cluster development in the 1990s extremely patchy, with many firms unable to find partners with which to develop innovative products and processes. This poor record was principally a result of a lack of diversity in the economy, which was dominated by large enterprises, most of whom were foreign multinational corporations (MNC) that preferred to keep the major proportion of their R&D at ‘home’, thus stunting any possible relationships with local educational and training institutions. He also found that local authorities made little effort to help build links with local R&D institutions (Marceau 1999).

Recent efforts towards cluster research in Australia are found in the following studies:

- Robert and Enright's (2003) paper on the tensions between globalisation and localisation of industries, and how regional clusters can compete via improvements in innovative performance. This study appears to be the most comprehensive examination of Australian-based cluster development.

- Johnston (2003) maps out the progress of cluster studies in Australia, with the implicit intention of taking stock of the progression of science, technology and innovation in Australia, and therefore providing a comprehensive overview in terms of players, resources, networks and performance (Johnston 2003, p.4). Johnston provides a list of identified 'clusters' in Australia (2003, pp.21-22).

- Searle and Pritchard (2005) examine the probability of labelling the North Ryde-North Sydney area as a high-tech cluster. The study found the willingness to co-locate was largely due to the availability of advanced producer services and opportunities from MNC businesses. In this case, economic urbanisation as opposed to clustering per se accounted for the growth of this 'cluster' in Sydney (Searle & Pritchard 2005).

- Martinez-Fernandez' studies look at the role of both traditional industries such as steel (2003) and mining (2007), and frontier technologies (2004, 2006). In these studies, the role of connectivity to knowledge institutions and the lack of penetration of firms' innovation capabilities in the urban fabric are highlighted as being elements acting either as facilitators or as barriers for knowledge flows in industry clusters.

Similar national studies have already been completed overseas. Luukkainen (2001) examined industrial clusters in Finland, Diederen et al (2005) looked at manufacturing clusters in the Netherlands, while Hertog and Brouwer (2001) looked at a construction clusters, and Drejer et al (1999) investigated industrial clusters and Danish technology policy.

Overview studies of cluster initiatives have been undertaken, most notably by Solvell, Lindqvist and Ketels (2003) in *The Cluster Initiative Greenbook*. This study provides a comprehensive overview of clusters, including a solid background study , and in particular looks at how 'Cluster Initiatives' (CI) evolve and where they are likely to develop. It also examines and summarises these CI around the world. At the centre of this study is an internationally-based 'Global Cluster Initiative Survey', which investigates the predominance of CI. This study also looks at how CI evolve through stages (Solvell et al 2003).

Cluster Dynamics between Large and Small Firms

Taking into account Searle and Pritchard's (2005) and Marceau's (1999) observations on the influential role MNC have on knowledge transfer and cooperation, aspects relating to relationship dynamics between large and small firms can therefore be

deemed important. De Beule, Van den Bulcke, Daniel and Xu's (2005) study on MNC's subsidiaries in South Chinese manufacturing clusters is deemed to provide important information about relationships between multinational corporations and smaller companies. It recognises that clusters in the fastest growing regions are formed due to 'hub-and-spoke' relationships, that is, a large firm dominating an area with smaller suppliers (de Buele et al 2005).

Another study on the relationship between large and small business entities, Thompson's (2002) study on foreign direct investment (FDI) effects on mainland Chinese clusters, highlights the role of 'Clustered FDI', and illustrates that this is significantly better than dispersed FDI at transferring technology, implying that industry cluster and FDI policies should be considered in tandem rather than separately if developmental benefits from both are to be optimised.

The dynamic differences between large and small firms are also highlighted by Whitford and Zeitlin (2004) in their study, which looks at the US manufacturing landscape. Whilst accepting that decentralisation of production is vital, it questions whether in practice firms will actually engage in the collaborative relationships envisaged by optimistic theorists of a 'new production paradigm'. Surveys found that many large US manufacturers are actively seeking to improve collaboration, by sharing strategic information and engaging in joint design, yet persistent organisational dysfunctions create systemic barriers to the broader development of cooperative relations with suppliers.

Cluster Formation and Knowledge Flows

Since the early 1990s, a clear connection between 'national innovation systems', innovative activity, and clusters has been made by the likes of Lundvall (1992) and Nelson (1993). It is also well accepted that knowledge clusters gain a competitive advantage via building and transmitting knowledge (HHHIPA 2004). Knowledge intensity and transmission therefore play a vital role in the creation, sustenance and viability of clusters. Gonda and Kakizaki (2001), while investigating knowledge transfer in Japanese manufacturing clusters, assert that these types of industries are dependent on tacit knowledge, such as design and know-how. As a result, many of these firms tend to co-locate in agglomerations (Gonda & Kakizaki 2001). In the area of knowledge intensity, Koo (2005) analyses industry clusters' input-output linkages, occupational employment and knowledge data, shared knowledge, and patents. Koo claims that when firms co-locate, they do so looking for high quality suppliers, a large pool of skilled workers or local knowledge stock. He also asserts that characteristics of industry clusters may differ according to the type of 'glue' used, which create formal and informal ties.

Also related to the realm of knowledge within clusters, but often ignored, are the social aspects involved in alliance building - an element that is important to agglomeration or cluster formation. Chung, Singh and Lee's (2000) paper is probably one of the few studies related to the role of social ties in cluster formation when looking at the dynamics of large and small firms. They see resource complementarity, status similarity, social capital, direct prior alliance experience, opportunity exchange and indirect prior alliance experience as key factors in their analysis. As a case study, this paper explores the roles of US investment banks and their resource complementarity, status similarity, and the role

social capital plays in alliance formation (Chung et al 2000). It claims that such firms form strategic alliances with the expectation of enhancing performance and creating value, and derives the following findings:

- Firms with complementary or matching resource bases are more likely to become alliance partners;
- Firms of comparable or similar status are more likely to become alliance partners;
- A firm's previous direct alliance experience with a partner is optimistically associated with the chance that the firms will give further alliance opportunity to that partner;
- A firm's direct past alliance experience with a particular partner has an inverted U-shaped relationship, with the likelihood being that the firm will give an additional alliance opportunity to that partner;
- Probability of alliances between two potential partners increase with common exchanges of alliance opportunities;
- The more indirect alliance contact two firms have with each other, the higher the likelihood that these firms will become partners at a later date; and
- Continued indirect ties with a firm have an inverted U-shaped relationship, with the decreasing likelihood that the firm will continue to give an alliance opportunity to that partner (Chung et al 2000, pp.4-7).

In a similar vein, Hoetker (2005) draws similar parallels with a firm's selection of a supplier for a technically innovative component. Hoetker believes that when uncertainty is low, a decision is made on the basis of differences in technical capabilities. He found that when uncertainty increases, previous relationships and a supplier being internal take on greater positive significance comparative to the importance of their technical capabilities. At extreme levels of uncertainty, the value of internal supply relationships becomes very high and past relationships lose their significance.

Cluster Policies

Government support for clusters has increased in the last few years. For example, in 2005 the United Kingdom's Department of Trade and Industry published *A Practical Guide to Cluster Development* (2005). This publication is a simple 'how to' manual aimed at providing general cluster information for policy makers, enterprises and interested entities. It also gives very good basic information on how to identify, and ways to improve, cluster initiatives and also provides good pointers for survey questions (DTI 2005).

Benneworth and Charles (2001) examined policy relating to clusters and clustering and how to convert academic conceptions into operationalised policies that can help boost economic performance. The paper asserts that clusters (in a stable macroeconomic environment) need low cost intervention to help map and facilitate cluster formation and encourage contact between firms. They also examine the reasons why governments support clusters, how policy makers identify clusters and the role governments play in cluster development (Benneworth & Charles 2001).

Hallencreutz and Lundequist (2003) set out to investigate the use of the cluster approach as an analytical, proactive policy tool, an approach based on negotiated and collaborative efforts to manufacture and utilise 'visions' of regional development possible

futures. They also highlighted the large role played by the public sector in cluster initiatives. Such initiatives include the 'branding' of regions as clusters and the creation of 'meeting places' to facilitate knowledge exchange and building trust.

2.3 Summary

The character of manufacturing production in OECD countries is changing. The distinction between high-technology and low-technology sectors is becoming less relevant, because certain components of high-technology production can also be carried out in non-OECD countries. Manufacturing activity in OECD countries increasingly incorporates high-value added services. The relative and absolute declines in manufacturing employment levels are primarily due to strong productivity growth, but are also affected by the growth of manufacturing capacity in non-OECD countries. At the same time, the loss of manufacturing employment in OECD countries cannot simply be characterised as a transfer of manufacturing production to non-OECD countries, as manufacturing employment levels in non-OECD countries have not grown significantly. Manufacturing production has become more and more integrated at the global level. Manufacturing companies increasingly explore which parts of production can possibly be carried out at arms length, either within their own country or abroad, or by their foreign affiliates.

Manufacturing has become part of the suburbanisation process of cities, and it is still playing an important role in many cities. On the one hand, manufacturing firms and service firms are closely interrelated; on the other hand, services are actually blurred within manufacturing production. International evidence shows that the level of services sector value added input that is embodied in manufacturing goods amounted to up to 25-30% of total output in some countries in the mid-1990s. Services can be found at different stages of the value chain, where different specialists operate either from inside the firm or from the supplier environment. In this way, manufacturing firms become embedded in the urban area within which they are located, with multiple functions and innovation activities occurring all across the field, from manufacturing to services.

The growing attention to the value-chain and the urban context within which manufacturing occurs pointed to the discovery of 'clusters', although our present understanding of clusters goes back to the first half of the 19th century. In 1826, North German landowner Johann Heinrich von Thunen published *The Isolated State*, which for the first time scrutinised issues regarding the localisation of economic activities and their relationship to the theory of rent. However, a breakthrough in cluster research came about with the publication of Michael Porter's seminal work, *Competitive Advantage of Nations*, in 1990. Porter contradicted then current US-based local development objectives, by advocating diversified economies, promoting specialisation according to historical strength, and emphasising the importance of industrial clusters. In 1991, Porter introduced a 'diamond model', which outlined four sets of interrelated forces – demand conditions, factor conditions, firm strategy, rivalry and structure, and other related industries. Clusters definition evolved further over time, and is was again Porter who in 2000 defined clusters as being concentrations of highly specialised skills and knowledge, institutions, rivals, related businesses, and sophisticated customers within a particular nation or region (Porter 2000).

The literature emphasises innovation and competitiveness as being the drivers of cluster development. It also points to the success of cluster dynamics that have developed between large and small Firms, recognising that the fastest growing regions are formed due to ‘hub-and-spoke’ relationships, that is, a large firm dominating an area with smaller suppliers. Therefore, the difficulties of ‘creating’ a cluster from scratch are evident. However, in relation to cluster competitiveness, the link between cluster development and knowledge flows is evident. Knowledge intensity and knowledge transmission play a vital role in the creation, sustenance and viability of clusters.

Government support for clusters has increased in the last few years, becoming an area of policy attention especially for local economic development agencies. Policy interventions in OECD countries point to the need for low cost intervention to help map and facilitate cluster formation and encourage contact between firms. There is often a large role played by the public sector in cluster initiatives such as the ‘branding’ of regions as clusters and the creation of ‘meeting places’ to facilitate knowledge exchange and build trust.

3. Manufacturing Advantage in South West Sydney

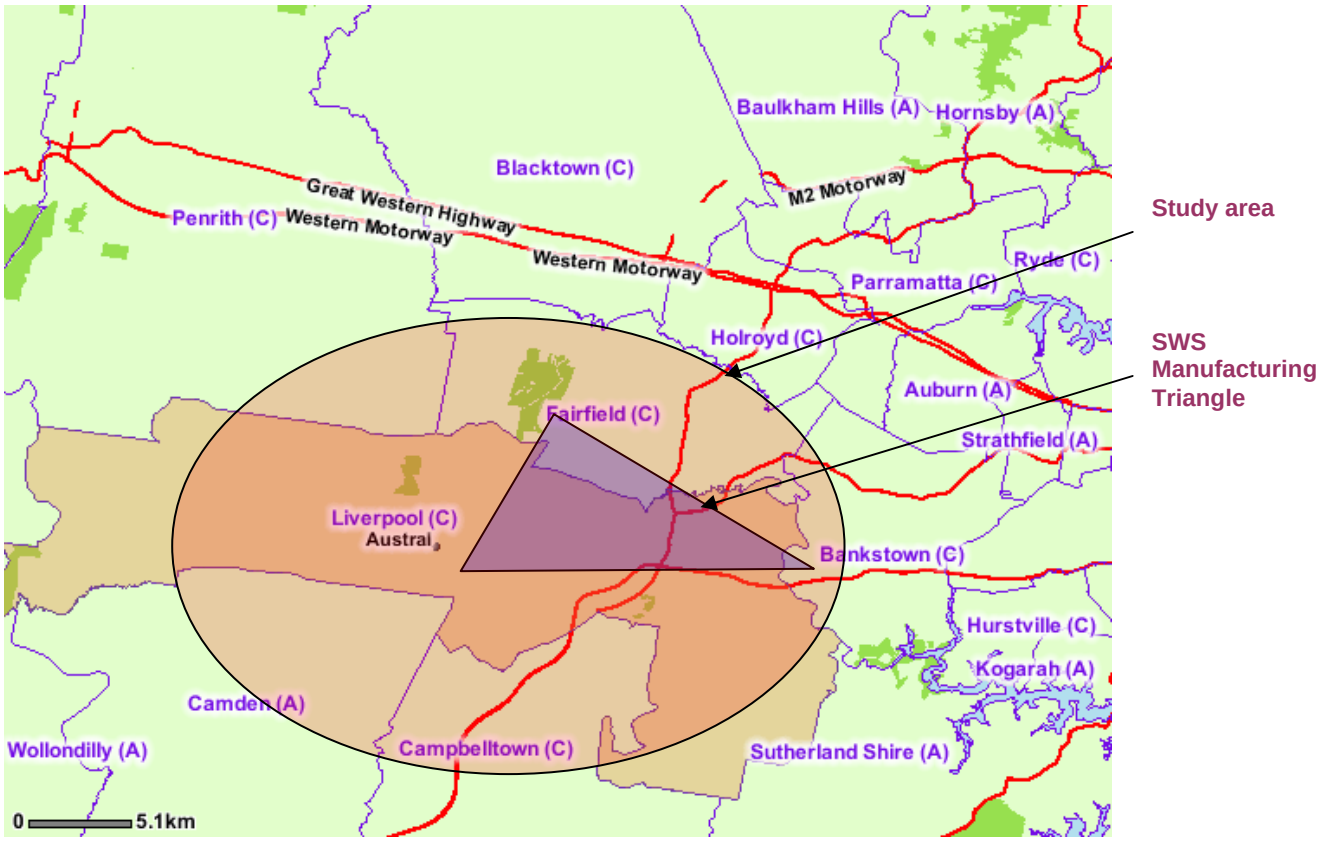
Manufacturing Advantage

- *Manufacturing Triangle*: Liverpool, Fairfield, Bankstown.
- *Metal Products Manufacturing*. High level of employment, high level of production (39.1% of total Sydney metropolitan area), strong local growth component despite strong negative whole-industry growth, large number of companies involved in the industry in South West Sydney (many based in Liverpool). Specialities: aluminium rolling, drawing and extruding, non-ferrous pipe fitting, steel metal furniture.
- *Petrol, Coal, Chemical and Associated Product Manufacturing*. Highest levels of employment, highest levels of actual job growth in the 1996-2001 period. Specialities: paint, soap and other detergents, plastic bags and films.
- *Wood and Paper Product Manufacturing*. Strong local concentration of corrugated paperboard containers manufacturing and mattress manufacturing (excluding rubber).

3.1 South West Sydney: A Manufacturing Hub

South West Sydney and the areas surrounding the local government area (LGA) of Liverpool are one the most significant manufacturing areas in the global city of Sydney. The South West region has a number of key transport links that greatly influence its manufacturing advantage (see Figure 5). The primary road links are: the Hume Highway, which runs through Liverpool and is the main highway to Canberra and Melbourne; and the M5 Motorway, which starts at Liverpool and, via the M5 East, runs through to the airport, Port Botany and the Sydney CBD. The current construction of the M7 Western Sydney Orbital will see a road joining the Hume Highway/ M5 in the south with the M4 in the north, thereby providing highway access to Central West Sydney and then on to North West Sydney and eventually the Central Coast.

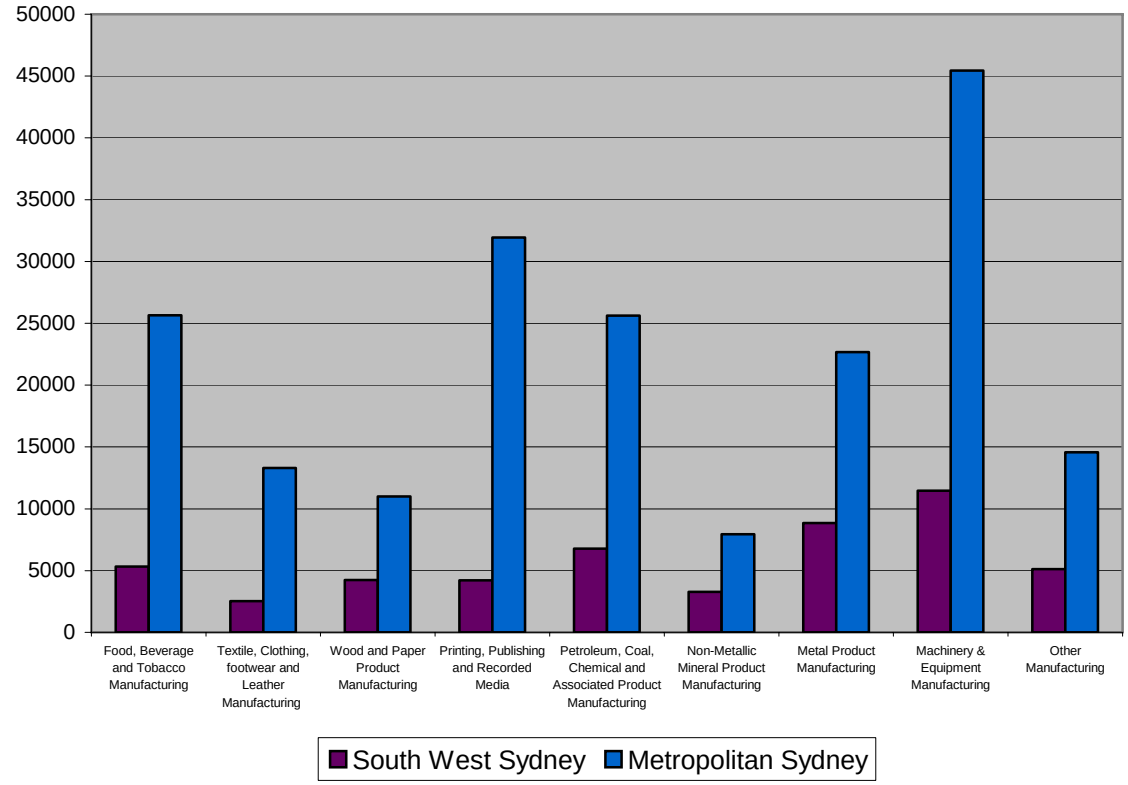
Figure 5: Liverpool local government area and surrounds



The six local government areas under investigation for this study (see above map) include Liverpool, Campbelltown, Camden, Fairfield, Bankstown and Penrith, and account for 26.5% of Sydney's total manufacturing employment, and an even higher percentage within individual manufacturing categories such as metal product manufacturing (39%), non-metallic mineral product manufacturing (41.3%), and wood and paper product manufacturing (38.6%)[2]. The graph below (Figure 6) shows the levels of manufacturing employment in these identified areas of South West Sydney compared with employment levels for the whole of the Sydney metropolitan area.

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

Figure 6: Manufacturing Employment South West Sydney and Metropolitan Sydney



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

The wider region of Western Sydney is well known for its manufacturing potential and, as the table below shows, South West Sydney is the centre of the manufacturing hub, with manufacturing being the largest employment industry even when compared with neighbouring regions. Table 1 represents the percentage of people working in the broad industry categories captured, for the regions of South West, Central West and North West Sydney, in comparison with statistics for Metropolitan Sydney. The bold highlighting is used to draw attention to both the largest industry concentrations, and areas of comparison between the three regions.

Table 1: Regional industrial base (by employment) 2001

Industry	South West	Central West	North West	SMA
Agriculture, Forestry, Fishing	1.80%	1.00%	3.10%	0.60%
Mining	0.90%	0.20%	0.10%	0.20%
Manufacturing	**18.10%**	**17.90%**	**11.40%**	**12.60%**
Electricity, Gas & Water Supply	0.60%	1.40%	0.40%	0.60%
Construction	6.60%	6.70%	8.00%	5.00%
Wholesale Trade	5.30%	7.50%	7.60%	6.40%
Retail Trade	**17.60%**	**18.50%**	**19.30%**	**13.80%**
Accommodation, Cafes & Restaurants	3.30%	3.60%	4.30%	4.90%
Transport & Storage	4.30%	4.40%	1.90%	5.00%
Communications Services	1.00%	1.30%	1.00%	2.40%
Finance and Insurance	1.70%	1.80%	2.50%	6.60%
Property and Business Services	**7.50%**	**7.20%**	**13.40%**	**14.80%**
Gov't Administration & Defence	4.90%	4.00%	4.30%	3.60%
Education	**9.30%**	**8.90%**	**8.30%**	**6.70%**
Health & Community Services	**11.00%**	**9.20%**	**7.50%**	**9.30%**
Cultural & Recreation Services	1.50%	1.80%	2.10%	2.80%
Personal and Other Services	3.40%	3.70%	3.90%	3.60%

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

Manufacturing is the largest employing industry in South West Sydney, closely followed by retail trade, and then health and community services. Property and business services employment, however, falls well behind manufacturing. The strength of employment levels displayed in the industry categories of health and community services, and education in Central and South West Sydney can be attributed to the young age profile of the three regions, as well as the large percentage of children and young people residing in the regions. The higher employment rates in these industries may also be due to the location of major regional hospitals in the regions; Liverpool Hospital in the South West is one of the largest employers in the region, as is Nepean Hospital in Central West Sydney (Sharpe 2007). There is a hospital in North West Sydney, but it is not a major hospital. Generally speaking, the areas of health and community services, and education[3] are a function of population growth and location (Maglen 2001), which is evident in all these regions. They are not as dependent at the regional level on endogenous processes of industrial development as are some of the other industry categories.

Table 2 below examines the amount of industrial change that occurred within these broad industry categories in the decade between 1991 and 2001. The manufacturing industry in South West Sydney and Central West Sydney experienced strong growth (15.7% and 14.60% respectively) when compared with both the overall Sydney metropolitan area (8.4%) and North West Sydney (8.67%). This result is particularly promising considering that the manufacturing industry in Australia was rationalised in the 1990s (Fagan 2006). The growth in manufacturing is, however,

[3] Education includes employment in pre-school, primary and high school education , and also employment in tertiary education institutions such as Universities and TAFE (Technical and Further Education Colleges). These resources are important for evaluating the innovative capacity of the regions, especially in terms of their relationships with local businesses, and this aspect of 'Education' will be discussed in later chapters.

dwarfed by the high level of growth in wholesale and retail trade[4], which has grown enormously in the same time period: by 43.24% in South West Sydney; 41.82% in Central West Sydney; and 40.85% in North West Sydney. In the overall Sydney metropolitan region, employment in this sector only grew by 25.67%. These figures highlight the increasing suburbanisation of some service activities, as noted earlier, particularly the move in retail and aspects of the wholesaling and distribution function away from the centre of the Sydney metropolitan area (Sharpe 2007).

Table 2: Industrial change (based on employment) in Outer Western Sydney 1991-2001

Industry	South West	Central West	North West	SMA
Agriculture, forestry, fishing	-0.59%	0.44%	0.59%	0.35%
Mining	-4.43%	-0.15%	-0.12%	0.01%
Manufacturing	15.71%	14.60%	8.67%	8.64%
Electricity, Gas & Water Supply	-1.22%	0.60%	0.26%	0.38%
Construction	5.37%	3.27%	3.07%	3.80%
Wholesale & Retail Trade	43.24%	41.82%	40.85%	25.67%
Transport & Storage	6.54%	8.38%	0.99%	5.39%
Communications Services	-0.50%	-0.24%	0.92%	2.84%
Finance, Insurance, Property & Business Services	11.67%	11.88%	27.43%	27.24%
Government Administration & Defence	-2.52%	1.55%	0.43%	3.17%
Education, Health & Community Services	20.71%	12.54%	11.67%	14.99%
Cultural, Recreation, Personal & Other Services	3.90%	3.94%	4.15%	6.76%

Source: ABS Journey to Work dataset 1991-2001

Other characteristics of the region, at a glance, are presented in Box 1 below.

[4] Due to changes in the industrial categories with the 1996 census, it has been necessary to aggregate some industry groups, to enable calculation of growth figures across the 10-year period. Groups affected are: Wholesale Trade, and Retail Trade (amalgamated into Wholesale and Retail Trade); Finance and Insurance, and Property and Business Services (amalgamated into Finance, Insurance, Property and Business Services); and Cultural and Recreational Services, and Personal and Other Services (amalgamated into Cultural, Recreational, Personal and Other Services).

Box 2: South West Sydney at a Glance

South West Sydney (SWS) is the strongest growing region in Western Sydney, with 32 percent population growth since 1991 and an expected 200,000 new residents in the next 20 years. However, this growth in population does not correspond with the growth in employment, which is lower than neighbouring regions of Central West and North West Sydney.

The largest employment sector in SWS is manufacturing, and large concentrations are found in retail, construction, property and business services, and health and community services. The strongest industry sector across the three sub-regions is retail, with growth rates above 40 percent, almost double the Sydney metropolitan area average. Manufacturing firms are larger in size, while the smallest units are found in the building and construction sector. The majority of the firms have a medium turnover: between $50,000 and $99,999.

SWS has low levels of knowledge occupations, and high levels of trades. Apprentices across the three sub-regions are concentrated in the learning clusters of Building and Construction, Automotive, and Utilities and Electrotechnology. Although SWS is lagging behind in the level of knowledge workers, the sub-region has high levels of engineering and scientific based occupations. The overall rate of education attainment is low when compared with Central West and North West regions.

There are also areas of social disadvantage. South West Sydney has a larger population receiving Centrelink income support (29%) than Central West and North West and the Sydney metropolitan region. It also has higher percentages of population under mortgage stress. The area also has the highest population of overseas-born residents from non-English speaking countries.

Source: Martinez-Fernandez and Sharpe (2007)

The rest of this chapter presents the results of the analysis of manufacturing concentrations in SWS.

3.2 Empirical identification of manufacturing concentrations

A three-phase method is employed to analyse the industrial composition of South West Sydney and to identify industry concentrations that may have potential for supported network/cluster development. The analysis uses a number of regional economic analysis techniques, including the calculation of location quotients (LQs), shift share analysis and firm structure analysis. Box 3 outlines the structure of the analysis.

Box 3: Industry Concentration Analysis

Phase 1 – Calculation and analysis of Location Quotients (LQs) to determine relative levels of industrial specialisation.

Phase 2 – Following on from the LQ calculations, shift share analysis to determine the growth performance (in terms of employment) of industrial specialisations.

Phase 3 – Company analysis using the firm database KOMPASS to determine the number and structure of the companies in the region within these specialisations.

Data sources and limitations

The primary source of data for this industrial analysis is the Australian Bureau of Statistics' 5-yearly censuses. The census' unit of analysis, by definition, is the individual; therefore information on industries is based on counts of individuals' industry of employment. Counts are at the four-digit level in the ANZIC codes and are taken at local government area boundaries and aggregated to form the investigation area geography of South West Sydney.

Firm level data at this low level of geography is not available from the ABS. In this instance, for the firm analysis we used a privately maintained, self listing database of companies: 'KOMPASS'. This database has been widely used in industry research at this level of geography.

The two sources of data, ABS census data and KOMPASS firm data, are used in combination to help diminish some of the limitations of only using a single data set.

3.2.1 Phase 1 - Location Quotients

Location Quotients are a commonly used technique that compare the local economy, in this case South West Sydney, with a reference economy, in this case the Australian national economy. In making this comparison, the technique aims to identify any specialisations in the local economy. The technique calculates a ratio between the local economy and that of the reference economy.

Location Quotients (LQs) can be interpreted in three ways.

1. LQ is less than 1, meaning that local employment was less than was expected when compared with the reference economy.
2. LQ equals 1, this calculation means that local employment was exactly at the level expected when compared with the reference economy.
3. LQ is more than 1, meaning that local employment was more than was expected when compared with the reference economy, suggesting some degree of specialisation, as some of this local employment could be considered to be 'basic employment'.

Using the Australian economy as the reference, 46 industry categories in South West Sydney had a Location Quotient of more than one. In order to further reduce this number of categories and draw out stronger instances of specialisations, industry categories where Location Quotients of more than 2 were found are shown in the Table below.

When an LQ of more than 1 is calculated, a further calculation of the level of basic employment is also required, to ascertain how much of this local employment could be defined as 'basic'or additional employment, and hence ascertain what remainder reflects some industrial specialisation in the local economy. These calculations have also been provided in Table 3.

Table 3: Location Quotients and Basic Employment Calculations for SWS

Industry	Location Quotients	Basic Employment
Wood and Paper Products Manufacturing		
Corrugated Paperboard Containers	3.64	158
Paper Bag & Sack Manufacturing	3.39	101
Petrol, Coal, Chemical and Associated		
Paint Manufacturing	2.04	343
Soap & Other Detergent Manufacturing	3.01	317
Ink Manufacturing	2.43	60
Plastic Bag & Film Manufacturing	2.11	188
Plastic Foam manufacturing	3.48	168
Non-Metallic Mineral Products		
Glass & Glass Product Manufacturing	2.5	572
Clay Brick Manufacturing	2.16	207
Metal Products		
Aluminium Rolling, Drawing & Extruding	2.36	130
Non-Ferrous Pipe Manufacturing	6.72	162
Machinery and Equipment Manufacturing		
Battery Manufacturing	2.54	92
Electrical Sign Manufacturing	2.06	217
Machine Tool and Part Manufacturing	2.12	279
Other Manufacturing		
Sheet Metal Furniture Manufacturing	2.24	44
Mattress Manufacturing (except Rubber)	3.47	137

With the area's strong manufacturing base, numerous specialisations calculated through the use of the location quotient technique emerge:

1. *Wood and Paper Products Manufacturing* – Corrugated paperboard containers, and Paper bag and sack manufacturing.
2. *Petrol, Coal, Chemical and Associated Manufacturing* – Paint manufacturing, Soap and detergent manufacturing, Ink manufacturing, Plastic bag and film manufacturing, and Plastic foam Manufacturing.
3. *Non-metallic Mineral Product* – in particular, Glass product manufacturing, and Clay brick manufacturing.
4. *Metal Products* – in particular, Aluminium Rolling, Drawing & Extruding, and Non-Ferrous pipe fittings.
5. *Machinery and Equipment Manufacturing* – in particular, Battery manufacturing, Electrical sign manufacturing, and Machine tool and part manufacturing.
6. *Other Manufacturing* – specifically Sheet metal furniture manufacturing, and Mattress (not rubber) manufacturing.

These six industrial categories and their associated smaller product classifications will be the focus of the next section of analysis – shift share analysis.

3.2.2 Phase 2 - Shift Share Analysis

The previous analysis using Location Quotients provided some understanding of industrial concentrations present in the South West Sydney economy in 2001 (when the latest census was taken). This section uses shift share analysis to supply a dynamic picture of how these sectors were preforming (in terms of employment growth) in the period from 1996-2001. This analysis indicates whether the sector was growing or contracting in the five years prior to 2001, when the Location Quotient analysis suggested an industry concentration.

Shift share analysis is a technique that allows regional industrial growth over a time period, in this case 1996-2001, to be decomposed into three components. These components include: the *national share*, outlining what proportion of growth in a region was due to growth at the national level: the *industrial mix*, which shows what component of growth was due to the industry mix of the region i.e. fast growing or declining industries; and finally, the *local share* component, which determines the proportion of growth not explained by the other two categories, and which is therefore assumed to be due to local factors and local competitiveness of industries.

Each of the six industrial categories identified through the Location Quotient analysis are examined.

1 - Wood and Paper Product Manufacturing

Table 4 below shows the shift share calculations for Wood and Paper Products manufacturing. Corrugated Paperboard Manufacturing, and Paper Bag and Sack Manufacturing were the two product areas identified as possible specialisations through use of Location Quotients. Both of these categories had negative growth in the industry shares and positive growth in the national shares. The Corrugated Paperboard Containers Manufacturing had strong positive growth in the local share. The local share of Paper Bag and Sack Manufacturing was slightly negative.

Examining the entire industry category shows an overall negative industry component, but with strong national and local growth shares. The local share suggests that the region characteristics have contributed to the growth of some 250 jobs.

Table 4: Wood and Paper Product Manufacturing
Shift Share Analysis 1996-2001

Manufacturing	National growth	Industry mix	Local share
Log Sawmilling	0.26	-1.27	10.01
Wood Chipping	0.00	0.00	0.00
Timber Re-sawing and redressing	1.73	-13.98	44.25
Plywood and Veneer Manufacturing	1.82	-5.47	-2.35
Fabricated Wood Manufacturing	2.69	-17.98	29.29
Wooden Structural Component Manufacturing	149.09	423.57	-597.65
Pulp, Paper & Paperboard	19.95	-45.89	42.94
Solid Paperboard Container Manufacturing	8.76	-64.83	-20.93
Corrugated Paperboard Containers	**48.65**	**-480.63**	**88.97**
Paper Bag & Sack Manufacturing	**13.18**	**-16.09**	**-5.09**
Total Wood and Paper Product Manufacturing	**336.42**	**-216.65**	**248.23**

2- Petrol, Coal, Chemical and Associated Product Manufacturing

The second industry category identified as a potential industry concentration was Petrol, Coal, Chemical and Associated Industries, especially Paint, Soap and Other Detergent Manufacturing, and Plastics Production, in particular, Plastic Bag and Film Manufacturing, and Rigid Fibre Reinforced Manufacturing. Table 5 shows the shift share component calculations for this industry category.

Paint Manufacturing has experienced very strong industry growth, with the industry share component in the table below showing the largest component of growth of any industry analysed. Soap and Other Detergent Manufacturing's largest growth component comes from the local share, with negative growth experienced in the industry share and small growth in the national component.

The various plastic product categories present a mixed bag, with the product categories of Plastic Bag and Film Manufacturing, and Plastic Product Rigid Fibre Reinforced Manufacturing both having positive local share components. Overall, the Petrol, Coal, Chemical and Associated Product Manufacturing category added a significant amount of jobs (786) from the local share. However, this is a diverse category, and additional analysis is required to determine its suitability for further work in industry network development.

Table 5: Petrol, Coal, and Chemical and Associated Product Manufacturing Shift Share Analysis 1996-2001

Industry category	National growth	Industry mix	Local share
Petroleum refining	8.41	59.25	-5.66
Fertilizer Manufacturing	11.71	24.09	-143.80
Industrial Gas Manufacturing	13.79	12.47	-44.26
Synthetic Resin Manufacturing	6.85	-45.84	58.99
Explosive Manufacturing	2.08	-4.25	-5.83
Paint Manufacturing	**43.36**	**105.36**	**22.28**
Medicinal & Pharmaceutical Product	50.56	112.89	-130.45
Pesticide Manufacturing	0.35	-0.49	18.14
Soap & Other Detergent Manufacturing	**32.96**	**-50.77**	**112.82**
Cosmetic & Toiletry Preparation Manufacturing	17.69	-9.08	71.39
Ink Manufacturing	**6.07**	**20.26**	**4.67**
Rubber Tyre Manufacturing	10.84	-13.12	-33.73
Plastic Bowl Mould Product Manufacturing	21.34	-117.81	89.47
Plastic Extruded Product	19.17	-46.70	-12.47
Plastic Bag & Film Manufacturing	**38.59**	**-231.00**	**104.41**
Plastic Product Rigid Fibre Reinforced	**3.12**	**-12.24**	**55.11**
Plastic Foam Manufacturing	24.98	-64.46	-12.52
Plastic Injection Mould Product	84.65	276.98	-597.63
Total Petrol, Coal, Chemical & Associated	**511.09**	**-420.28**	**786.18**

3- Non-Metallic Mineral Product Manufacturing

Within the Non-Metallic Mineral Product industry, Glass Product Manufacturing and Clay Brick Manufacturing were identified as the possible concentration industries. Table 6 shows the shift share calculations for this industry sub-group.

Glass Product Manufacturing has declined significantly and the shift share analysis attributes this to the local share, with the industry as a whole performing well. This can be attributed to the closure of a major glass manufacturer within the time period investigated.

Clay Brick Manufacturing has positive local share and national share components, with the industry mix being in the negative and a relatively small amount of actual employment growth over the 1996-2001 period (11 jobs).

Overall, the Non-Metallic Mineral Product manufacturing industry had positive growth within all categories.

Table 6: Non-Metallic Mineral Product Manufacturing
Shift Share Analysis 1996-2001

Industry category	National growth	Industry mix	Local share
Glass & Glass Product Manufacturing	**92.02**	**501.98**	**-703.00**
Clay Brick Manufacturing	**32.44**	**-53.29**	**31.85**
Ceramic Product Manufacturing	11.62	-65.60	-64.02
Ceramic Tile and Pipe Manufacturing	3.90	-11.12	-14.79
Cement and Lime Manufacturing	1.82	2.28	6.90
Plaster product	11.62	0.00	-19.62
Concrete Slurry Manufacturing	11.80	-76.82	35.03
Concrete Pipe & Culvert Manufacturing	8.85	-58.86	7.01
Total Non-Metallic Mineral Product	**247.26**	**68.35**	**115.38**

4- Metal Product Manufacturing

Within the Metal Product Manufacturing industrial sub-group, Aluminium Rolling, Drawing and Extruding Manufacturing and Non-ferrous Pipe Fitting Manufacturing were identified as possible concentrations for further analysis. Table 7 shows the shift share calculations for this industry sub-group.

Both the national and local shares of these two categories were positive, despite strong negative industry demand. The overall trend in the industry is declining; however there are a number of categories with strong industry share and strong local share.

Table 7: Metal Product Manufacturing
Shift Share Analysis 1996-2001

Industry category	National growth	Industry mix	Local share
Basic Iron & Steel Manufacturing	63.83	419.69	357.48
Iron and Steel Casting and Forging	10.75	-82.78	46.03
Steel Pipe & Tube Manufacturing	12.92	100.60	-29.52
Alumina Production	1.39	-3.40	-4.99
Aluminium Smelting	4.16	12.09	187.75
Copper, Silver, Lead & Zinc Smelting	3.12	0.01	88.87
Aluminium Rolling, Drawing & Extruding	**31.66**	**-181.59**	**10.93**
Non-Ferrous Metal Casting	21.16	-147.71	-69.45
Structural Steel Fabricating	80.48	-627.90	-4.59
Architectural Aluminium Products	55.51	-321.38	111.87
Metal Container Manufacturing	26.97	-135.62	-87.36
Hand Tool and General Hardware Manufacturing	9.71	-56.90	51.18
Spring and Wire Product Manufacturing	34.86	8.74	35.40
Nut, Bolt, Screw and Rivet Manufacturing	17.09	-62.88	-85.20
Metal Coating and Finishing	40.24	-175.79	-18.45
Non-Ferrous Pipe Fitting Manufacturing	**41.72**	**-405.97**	**74.25**
Total Metal Product Manufacturing	**814.38**	**-1920.79**	**557.41**

5- Machinery and Equipment Manufacturing

Within the Machinery & Equipment Manufacturing industry, the Battery Manufacturing, Electrical Sign Manufacturing, and Machine Tool and Part Manufacturing were the identified specialisations.

Within the Battery Manufacturing sub-group, there was a significant component of negative growth in the local share, but positive in the industry and national shares. Electrical Sign Manufacturing also had negative local share, as well as negative industry share. Overall growth was smaller as well. The Machine Tool and Part Manufacturing industry is also declining; modest increases from the national and local components do not offset the decline and actual regional job growth has again been negative (minus 205 jobs).

The Machinery and Equipment sub-group has many areas of industry decline, as shown in Table 8. There has been virtually no growth in actual employment levels in this group.

Table 8: Machinery and Equipment Manufacturing
Shift Share Analysis 1996-2001

Industry category	National growth	Industry mix	Local share
Motor Vehicle Manufacturing	26.11	58.18	32.71
Motor Vehicle Body Manufacturing	29.05	-28.06	6.01
Automotive Electrical and Instrument Manufacturing	5.64	-44.20	26.56
Shipbuilding	0.00	0.00	0.00
Boatbuilding	2.08	26.94	-17.02
Railway Equipment Manufacturing	27.06	-122.00	-89.06
Aircraft Manufacturing	82.13	-108.76	10.62
Photographic and Optical Good Manufacturing	11.97	-5.63	-40.33
Medical and Surgical Equipment Manufacturing	5.98	38.98	-14.96
Computer and Business Machine Manufacturing	4.60	56.67	39.74
Telecommunications, Broadcasting & Transceiving Equipment Manufacturing	77.80	-149.04	-298.76
Household Appliance Manufacturing	61.06	-221.66	-22.39
Electrical Cable & Wire	62.62	-246.18	-139.44
Battery Manufacturing	**16.22**	**173.10**	**-224.32**
Electrical Sign Manufacturing	**38.94**	**-51.03**	**-14.91**
Agricultural Machinery Manufacturing	3.99	-14.74	26.75
Mining and Construction Machinery Manufacturing	9.71	-5.78	61.06
Food Processing Machinery Manufacturing	21.08	-111.66	-93.41
Machine Tool and Part Manufacturing	**63.40**	**-273.57**	**5.17**
Lifting and Material Handling Equipment Manufacturing	55.85	-53.42	-74.43
Pump and Compressor Manufacturing	4.08	4.25	60.67
Total Machinery and Equipment Manufacturing	**991.13**	**-381.10**	**-562.03**

6- Other Manufacturing

Within the final manufacturing sub-group of 'Other Manufacturing', Sheet Metal Furniture Manufacturing and Mattress Manufacturing (excluding rubber) were the two identified areas of potential specialisation. Both had positive local share and national share growth in the face of significant negative growth due to the industry mix.

Overall, this is an extremely diverse group of manufacturing industries, more a residual of groups that did not fit with any other categories. Further analysis would be difficult without realigning some of these categories, for example Steel Metal Furniture Manufacturing with Metal Products Manufacturing.

Table 9: Other Manufacturing
Shift Share Analysis 1996-2001

Industry category	National growth	Industry mix	Local share
Prefabricated Metal Building Manufacturing	11.01	-66.18	-15.83
Wooden Furniture & Upholstered Seat Manufacturing	121.25	-610.13	149.89
Sheet Metal Furniture Manufacturing	**16.13**	**-158.33**	**36.20**
Mattress Manufacturing (except Rubber)	**32.26**	**-265.07**	**52.80**
Jewellery and Silverware Manufacturing	9.11	86.87	-120.98
Toy and Sporting Good Manufacturing	10.15	51.25	-98.39
Total Other Manufacturing	**376.32**	**338.32**	**77.37**

The Location Quotients determined in Phase 1 showed those industrial categories that had an LQ of more than 2 when compared with the reference economy – the national economy. The amount of basic employment associated with each of these suggested specialisations was also calculated. Phase 2 looked at the dynamics of these industry categories in terms of their employment growth from 1996-2001, in the context of the wider industry to which they belong. The shift share analysis decomposed employment growth in the industries into a national share, an industry share and a local share. The local share is the component resulting from some apparent competitive advantage in that region within that particular industry. The graph below (Figure 7) summarises the broader industry categories and their components of growth, national, industry and local, as well as giving an indication of the total employment growth in each of the industry sectors.

As can be seen in Figure 7, all sectors except the Machinery and Equipment Manufacturing group had positive shares of local growth. The largest numbers are in the Petrol, Coal and Chemical and Associated Product Manufacturing (786 jobs), and Metal Product Manufacturing (557 jobs). Both industry sub-groups also had significant components of negative industry mix, which is perhaps not surprising for manufacturing in Australia.

Figure 7: Shift Share components for industry sectors 1996-2001

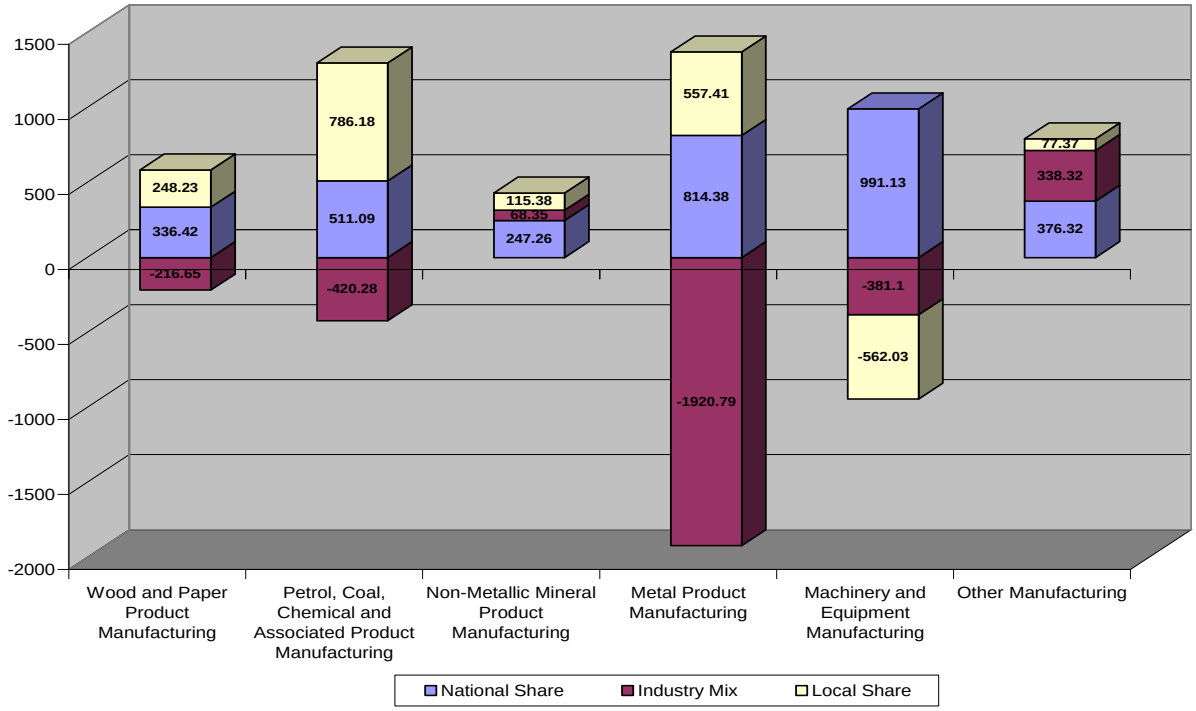
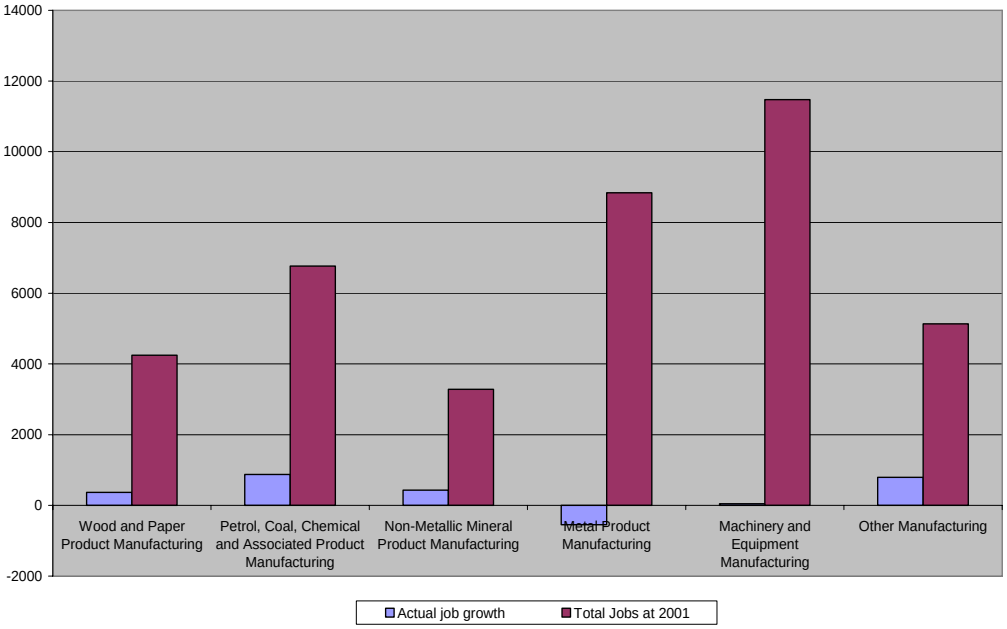


Figure 8 below shows the actual job growth in each of the industry sectors from 1996-2001 and actual number of jobs in 2001. The Petrol, Coal, Chemical and Associated Product Manufacturing group had the highest levels of actual job growth. Metal Product Manufacturing was the only category to record job losses over the five year period, but as Figure 5 shows, this was due to massive negative industry mix shares, which could not be compensated for by strong positive national and local share components.

Figure 8: Actual Job Growth 1996-2001 and Total Employment 2001 by industry sector



3.2.3 Phase 3 - KOMPASS Company Analysis

This section focuses on the companies in the various industry sectors. Specifically, it looks at how many companies are involved in each sector and how many people are employed by these companies. This will give an indication of the structure and characteristics of the firms within each industry.

As mentioned earlier in this chapter, data at the level of the firm in not readily available at this level of geography, so this analysis will be made using KOMPASS, a privately maintained business database. This database is built by directly contacting companies, which are then asked to input their details into the KOMPASS listing, so in this sense it is a self-selecting database. However, this database has been extensively used in similar industry analysis where information at the firm level is necessary.

The categories applied to companies in the KOMPASS database do not exactly match those used in the census, and therefore closely applicable categories have been selected. It should be noted that this analysis is designed to provide some indication of firm characteristics within industries and is intended to be complementary to ABS data analysis utilised in the previous two sections.

The following closely aligned industry categories were identified in KOMPASS: Furnishings (associated with the earlier Other Manufacturing category); Plastics/ Chemicals (aligned with the Petrol, Coal, Chemical and Associated Product category); Metals (aligned with Metal Product Manufacturing category); and Glass (Non-Mineral Product Manufacturing).

Figure 9 shows the number of companies listed in the KOMPASS database for each of these categories. The graph also shows the geographical Local Government Area (LGA) distribution for each of the sectors.

As was the case in the previous two sections, the Metals, and Plastics/ Chemicals Product Manufacturing are the largest sectors. Liverpool LGA is also well represented in these sectors, particularly the Metals Manufacturing. This picture is also reflected in the employment figures for these companies, shown in Figure 10.

Figure 9: Number of companies per sector by LGA using KOMPASS database

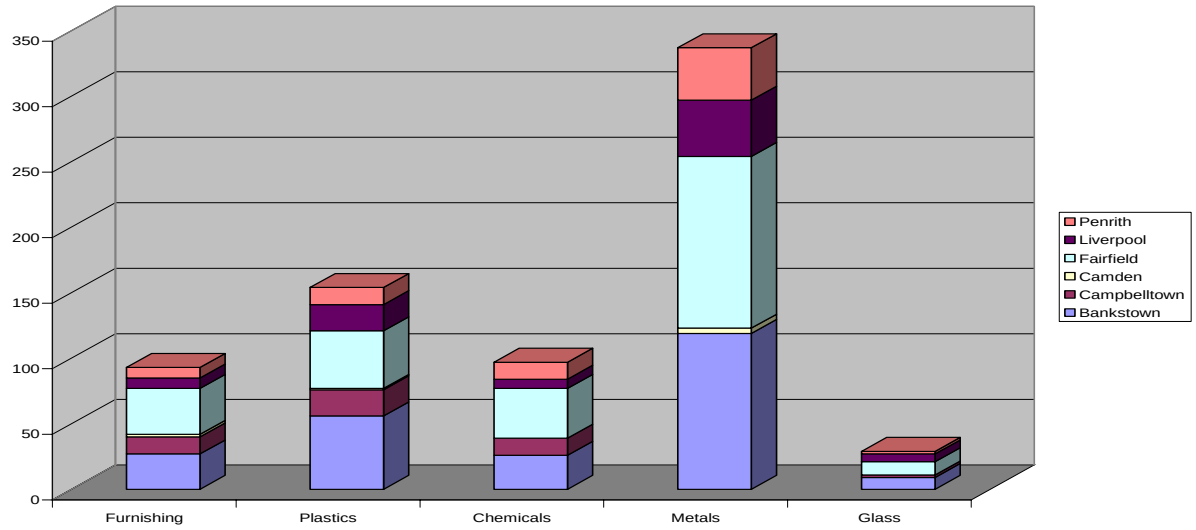
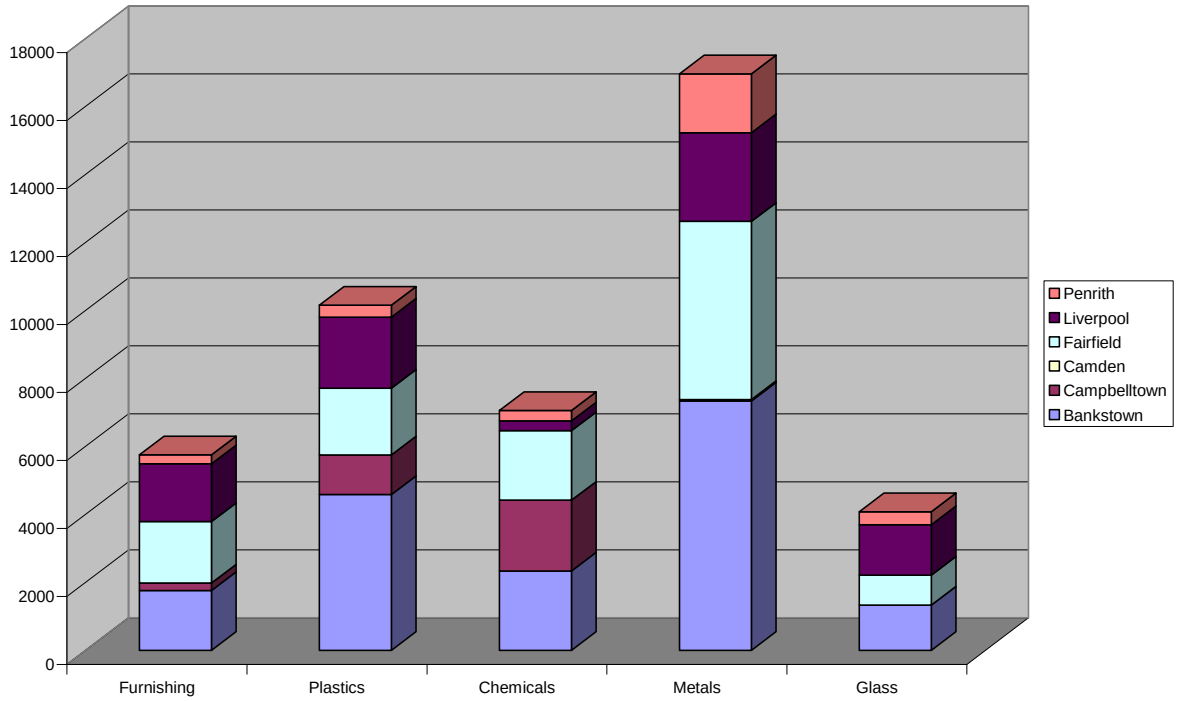


Figure 10: Number of employees per sector by LGA using KOMPASS database



These figures also highlight the regions that are strongest in manufacturing industries: Bankstown, Liverpool and Fairfield, which are also called in this report 'the manufacturing triangle'.

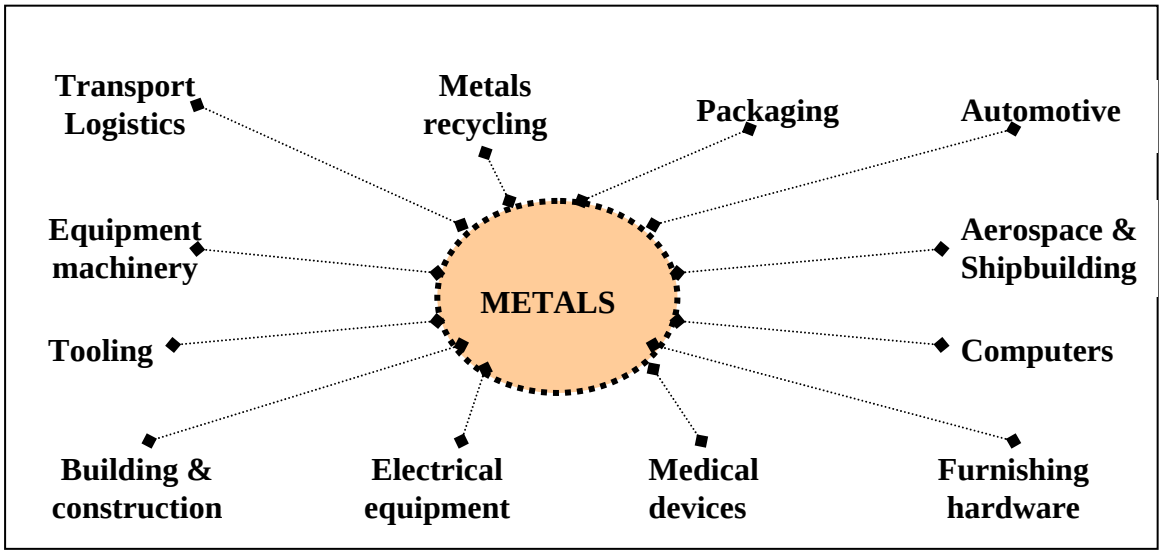
3.2.4 Selected Concentrations

The analysis discussed in this chapter identified 'Metal Product Manufacturing' and 'Petrol, Coal, Chemical and Associated Product Manufacturing' as being the two sectors with a particularly strong base in Liverpool and its neighbouring regions. The following criteria were used to decide the most robust industry concentrations (see Table 10 below for a comparative summary):

- Industry concentration
- Growth potential
- Higher levels of employment reach
- Number of companies based in SWS manufacturing triangle (Liverpool, Bankstown and Fairfield)

The metals sector was selected for further in-depth case study analysis. The Fabricated Metals category encompasses a vast array of manufacturers. It covers products such as iron, steel, non-ferrous metals, castings, pipes, valves, tanks, sanitary and household articles. The Fabricated Metals industry is the largest employer, especially in the 'manufacturing triangle' of Bankstown, Fairfield and Liverpool. By far the bulk of the employment is located in Bankstown (7,338), followed by Fairfield (5,242), Liverpool (2,609) and Penrith (1,733). The large number of Bankstown jobs are held by only about 119 firms, while Fairfield's lesser amount of jobs are sustained by a higher number of 131 firms. This is largely due to at least 12 Bankstown-based firms hiring in excess of 200 people each. In comparison, there are only 5 firms that hire in excess of 200 people in Fairfield. The diversity of products and services of the metals industry can be seen in the Figure below, which shows the different user-sectors of fabricated metals. Sectors such as storage, furnishing, building and construction, and transport and logistics are also specialised sectors in Western Sydney, which provide further strength to the metals sector. Product maps for other sectors are found in Appendix B.

Figure 11: Key industries utilising metals products and services



Source: KOMPASS database 2005, customers of metals firms in South West Sydney

Table 10: Industry Concentration Comparison

Characteristics	Wood and Paper Products	Petrol, Coal, Chemical and Associated	Non-Metallic Mineral	Metal Products	Machinery & Equipment Manufacturing	Other Manufacturing
Total employment (2001)	4247	6770	3282	8841	11476	5131
% of Sydney metro employment	38.6%	26.4%	41.3%	39.1%	25.2%	35.4%
Industry sector LQs						
Industry categories with Location Quotients of more than 2.	• Corrugated paperboard Containers • Paper bag & Sack Manufacturing	• Paint • Soap & Other • Ink • Plastic Bag & Film • Plastic Foam	• Glass and Glass Product • Clay brick	• Aluminium Rolling, Drawing & Extruding • Non-Ferrous Pipe Fitting	• Battery • Electrical Sign • Machine Tool & Part	• Sheet Metal furniture • Mattress (excludes Rubber)
Total basic employment in these specialisations	259	1076	779	892	588	181
Industry Shift Share job growth components	National 336 Industry -217 Local 248	National 511 Industry -420 Local 786	National 247 Industry 68 Local 115	National 814 Industry -1921 Local 557	National 991 Industry -381 Local -562	National 376 Industry 338 Local 77
Actual Job growth 1996-2001	368	876	430	-549	48	792
Number of Companies (KOMPASS)		251	29	337		93
Number of Companies in Liverpool (KOMPASS)		27	6	43		8
Number of Employees (KOMPASS)		17211	4077	16962		5753
Number of Employees in Liverpool (KOMPASS)		2372	1478	2609		1699

3.2 Summary

Based on the comparisons and analysis presented in this chapter, the *Metal Products* manufacturing industry was selected as the primary sector for further analysis. The metals industry employs a large proportion of people, second only to Machinery & Equipment Manufacturing. The metals industry in South West Sydney represents 39.1% of Metal Product manufacturing in the entire Sydney metropolitan area. It has the second highest level of associated 'basic employment' (892 jobs), second only to Petrol, Coal, Chemical and Associated Product manufacturing. The industry also has a strong local component of growth in the shift share analysis, despite strong negative industry growth as a whole (which caused overall job numbers in the industry to contract in the 1996-2001 period). There are also a large number of companies involved in the industry in the South West Sydney Manufacturing Triangle, including a good representation in Liverpool. In addition, other strong industry specialisations such as 'steel metal furniture', which was analysed under 'other manufacturing', could be analysed together with this cluster. The metals industry also has strong dynamics with other industries of solid growth in SWS such as building and construction, transport and logistics, and furnishing.

The *Petrol, Coal, Chemical and Associated Product Manufacturing* sector was the second industry selected for further analysis, for similar reasons: high levels of employment associated with the industry; high levels of associated 'basic employment'; highest level of local component share of all industries in the shift share analysis; and the highest levels of actual job growth in the 1996-2001 period. However, in comparison with the metals industry, it represents less of a homogeneous industry.

A third specialisation is the *Wood and Paper Product Manufacturing*, which shows strong local concentration of corrugated paperboard containers manufacturing and mattress manufacturing (excluding rubber).

4. Case Studies of Innovation in the Metals Industry

Competitiveness of Metals Firms

- South West Sydney metal firms cover all different sectors of the industry value-chain from raw materials to design
- High concentration of trades, low educational levels of employees
- High level of incremental innovations of products and services
- Firms produce and use multiple services across the whole manufacturing process
- Knowledge intensive service activities (KISA) concentrate on sales, logistics and distribution, safety and OHS, and marketing and promotions; especially before and during manufacturing processes
- KISA are a mix of in-house and externally purchased services. External services are accessed more frequently from Sydney metropolitan area than from the local area
- Collaboration networks are very important for firms, with the main actors being customers and suppliers and other parts of the industry group to which the firm belongs
- Regional resources such as availability of land, local talent, modern road and freight infrastructure and the large manufacturing base are the key factors for firms to locate in SWS
- The desired role for Councils extends from regulators to facilitators of KISA for cluster development and innovation intensity.

The metals industry is a strong sector in NSW, with NSW also being the largest metals industry state in Australia (having 35% of all metal manufacturing businesses and one third of all metal manufacturing employment), and is one of the fastest growing manufacturing sectors in the nation (near 50% growth between 2001-02 and 2004-05). Industry innovation, measured as the traditional measure of Research and Development (R&D), indicates that NSW metals businesses spent $630 million on metals R&D between 2000 and 2005.[5]

However, very little is known of the innovation activity of metals firms in South West Sydney or their capabilities as an industry concentration. This chapter discusses the innovation analysis of five case studies of metal firms located in South West Sydney. The analysis used questionnaires and in-depth interviews as sources of data. Firstly, it is discussed from a value-chain and skills levels position for these firms; second, innovation

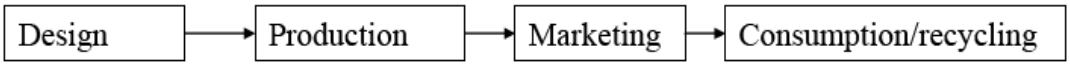
[5] NSW Department of State and Regional Development (2007) Metal Manufacturing, Growth Industry Profile, New South Wales Government.

activity and integration of manufacturing services are examined; thirdly, collaboration activities are reviewed; and finally, regional resources for these firms are considered.

4.1 Value-Chain position and Skills levels

The five case studies were selected by taking into account their position in the metals industry value-chain, in order to have a complete analysis of the different production orientation of metals firms in South West Sydney (see Figure 12 for a simple representation of a manufacturing value-chain).

Figure 12: Manufacturing activities, simple value-chain



Firm capabilities at different levels of the value-chain are one of the characteristics of cluster development and, as can be seen in Table 11, the case study firms cover different aspects of the value-chain process; from the processing of raw materials, to the delivery and customisation of products and services for customers, and the recycling of waste and disused product. Core competencies exist in the design and production (simple through to advanced production) phases of the value chain.

Table 11: Case study firms' position in the value chain

Value chain process	Case A	Case B	Case C	Case D	Case E
Raw materials					
Design					
Production (simple parts)					
Production (complex comp.)					
Production (assembly)					
Marketing					
Delivery					
Customisation					
Consumption/ recycling					

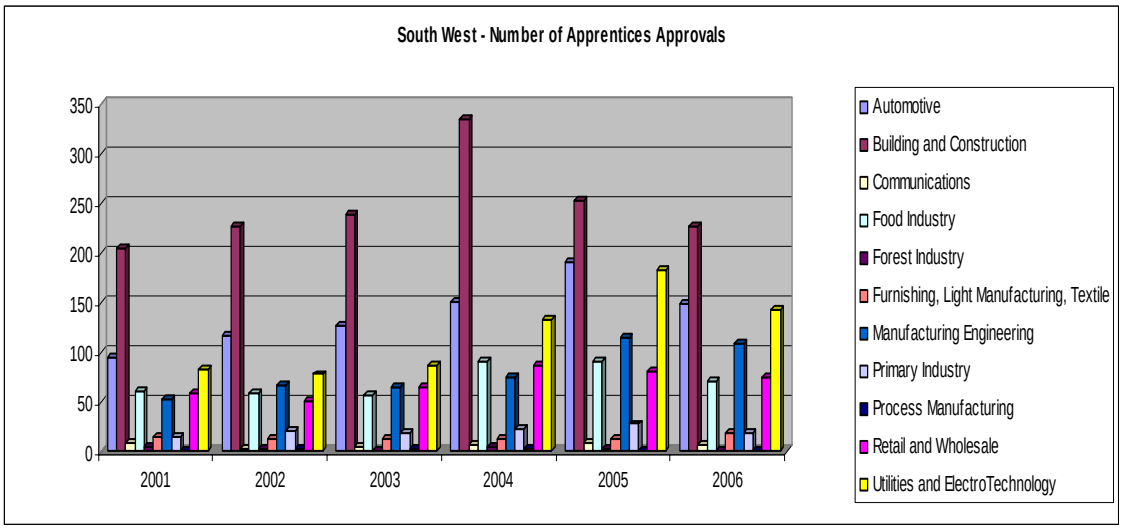
The next table (Table 12) examines the knowledge and skills base of the firms through an analysis of employee qualification levels. The vast majority of the employees in these firms have qualifications at the Secondary School or Certificate/Diploma level. The occupations closely matched to these qualifications are trade and craft based occupations. These occupations have a strong focus on learning through experience and learning-by-doing and they are associated with the apprentice type knowledge transfer process.

Table 12: Educational qualifications of employees in case study firms

Highest level of Education	Case A	Case B	Case C	Case D	Case E
Secondary Education	90%	90%	90%	2%	32%
Certificate or Diploma level	10%	10%	10%	75%	67%
Bachelors Degree	0%	0%	2%	10%	0%
Masters Degree	0%	0%	0%	2%	1%
PhD	0%	0%	0	1%	0%
Total number of employees	80	195	60	150	60

The high levels of secondary education qualifications in these firms is aligned with recent findings on skills distribution in South West Sydney, indicating the predominant concentration of trades in the region, and showing a total number of 6,565 apprentices as at 1st September 2007 (Martinez-Fernandez & Sharpe 2007). However, the distribution of apprentices by industry indicates the sectors where the training of new talent is occurring, and the industry attracting more apprentices is not in the 'metals manufacturing' sector, but rather in 'Building and Construction', 'Automotive', and 'Utilities and Electrotechnology' (see Figure 13).

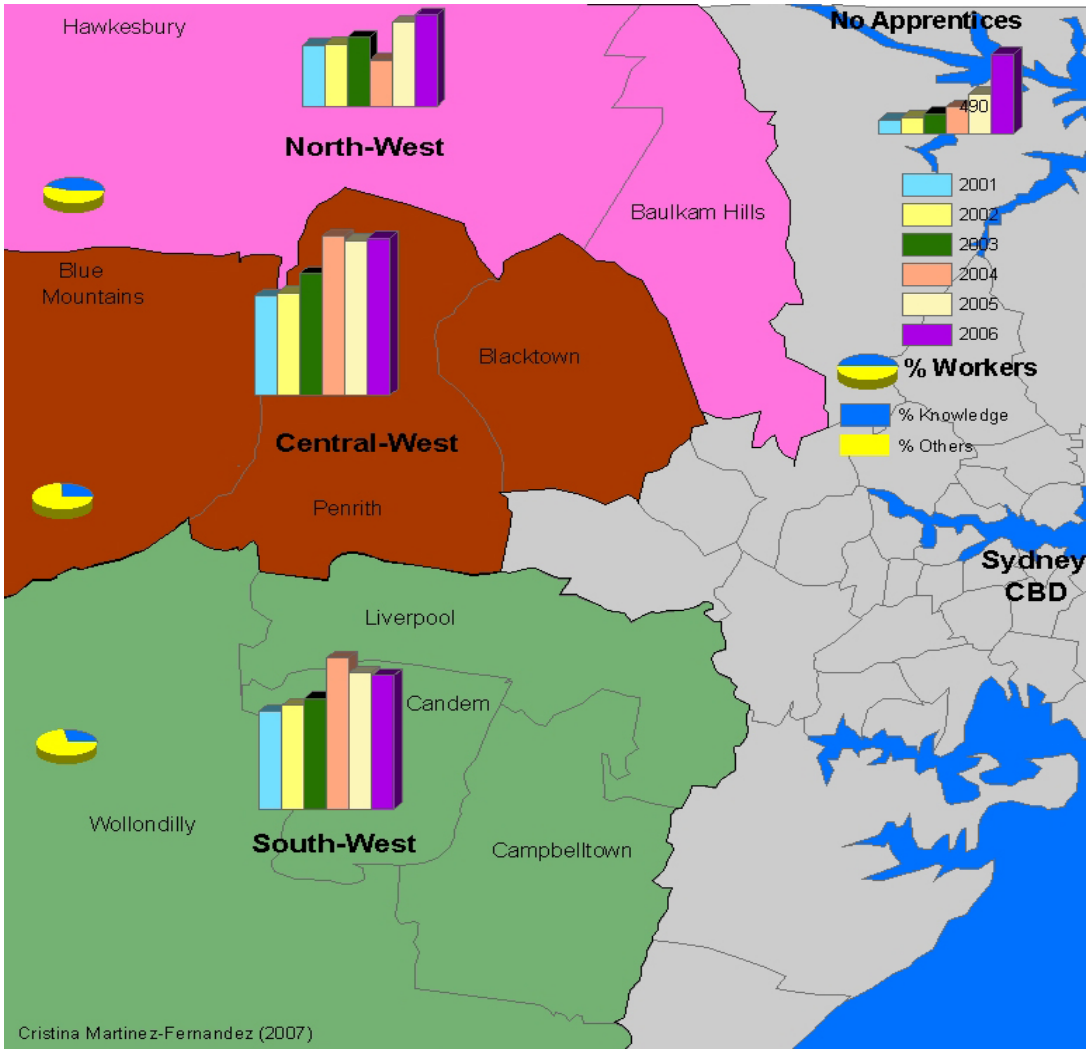
Figure 13: Number of Apprentices approvals in South West Sydney



Source: Martinez-Fernandez & Sharpe, 2007

This analysis indicates the potential for metals companies to increase the level of education and specialisation of employees. Three of the companies analysed have only 10 percent of their employees at the certificate/diploma level, despite a strong tradition of trades in the region, whose numbers are significantly higher than the concentration of knowledge workers (see Figure 14). In this regard, recent investment by the Australian Government in the Australian Apprentices Scheme (see Appendix B) means that companies and employees have access via the program to several subsidies, allowing them to upgrade their skills.

Figure 14. Distribution of trades and professionals in Western Sydney sub-regions



Source: Martinez-Fernandez & Sharpe, 2007

4.2 Innovation Activity and Integration of Manufacturing-Services

The section above provides an initial picture of the spread of these firms in the metals value-chain in South West Sydney, and the skills level and likely knowledge transfer processes (learning-by-doing) that exist in the South West Sydney metals manufacturing industry. The next section extends this analysis further and aims to analyse the role of knowledge flows, knowledge intensive service activities, and collaboration infrastructure within the innovation process of these firms.

To begin this analysis, it is essential to first look at the types of innovative activities being undertaken by these firms. Innovation is defined as any new or significantly improved product, service or process. Research has also shown that innovation is an interactive process. Innovation is driven through feedback from customers, clients and

suppliers, and new knowledge and learning received from contacts with other firms, research and government organisations. This interactive process can be both formal and informal in nature, and therefore includes collaboration and research partnerships, formal meetings, and conferences, but also informal meetings and personal contacts with relevant professionals and organisations. This broader understanding of what is entailed by innovative activity has necessitated extending how we analyse and understand innovation. Patent counts, and research and development expenditure and employment are no longer sufficient measures of innovative activity, analysis must now also include the usage of knowledge intensive service activities, and details of firm collaboration activities and knowledge networking activities.

There are three broad types of innovative activities identified: new or significantly improved products and services; new or significantly improved operational processes (i.e. the way in which goods and services are produced); and new or significantly improved management processes (i.e. the way a firm organises internal processes). The distinction between the types of innovation is important, as it further highlights the complexity and breadth of activity and behaviour that make up innovation activity and therefore highlights the associated complexity of its analysis. The analysis of product and service innovation and operational process innovation has a long history. A more recent realisation involves the role of organisational process innovations and their contribution to the productivity of firms. Examples of these types of innovations include: changed corporate directions; implementation of advanced management techniques such as Total Quality Management (TQM); improved business performance measures; significant workplace re-organisations; and important changes to communication and information networks.

Table 13 outlines the types of innovative activity undertaken by the case study firms in the past three years. The first thing to note is that all of the firms had innovated in one or more of the three categories and two of the firms had innovated in all three categories; both of these firms also described their innovations as being incremental, the next evolutionary step for the product or process. Incremental innovation activity is not surprising in this industry, as it is a mature industry and very capital intensive. All but one of the case study firms had innovated in the product and services category, with three out of the five firms innovating in each of the process categories. Case Study Firm B only innovated in the management process innovation category, but described the innovation as being radical, with organisation-wide implications.

Table 13: Innovation activities of case study firms

Innovative activity	Case A	Case B	Case C	Case D	Case E
New product or service					
New operational process					
New management process					

This research therefore shows that there are a range of innovation types undertaken by case study firms. There is a focus on product and service innovation with an incremental degree of novelty. The next section explores the use of knowledge intensive service activities (KISA) in the innovation processes of the case study firms and how and when these services are utilised.

4.2.1 Knowledge Intensive Service Activities (KISA)

KISA were recently defined by the OECD as

> "…the production or integration of service activities, undertaken by firms and public sector actors – in the context of manufacturing or services, in combination with manufactured outputs or as a stand-alone service" (OECD 2006, p.31).

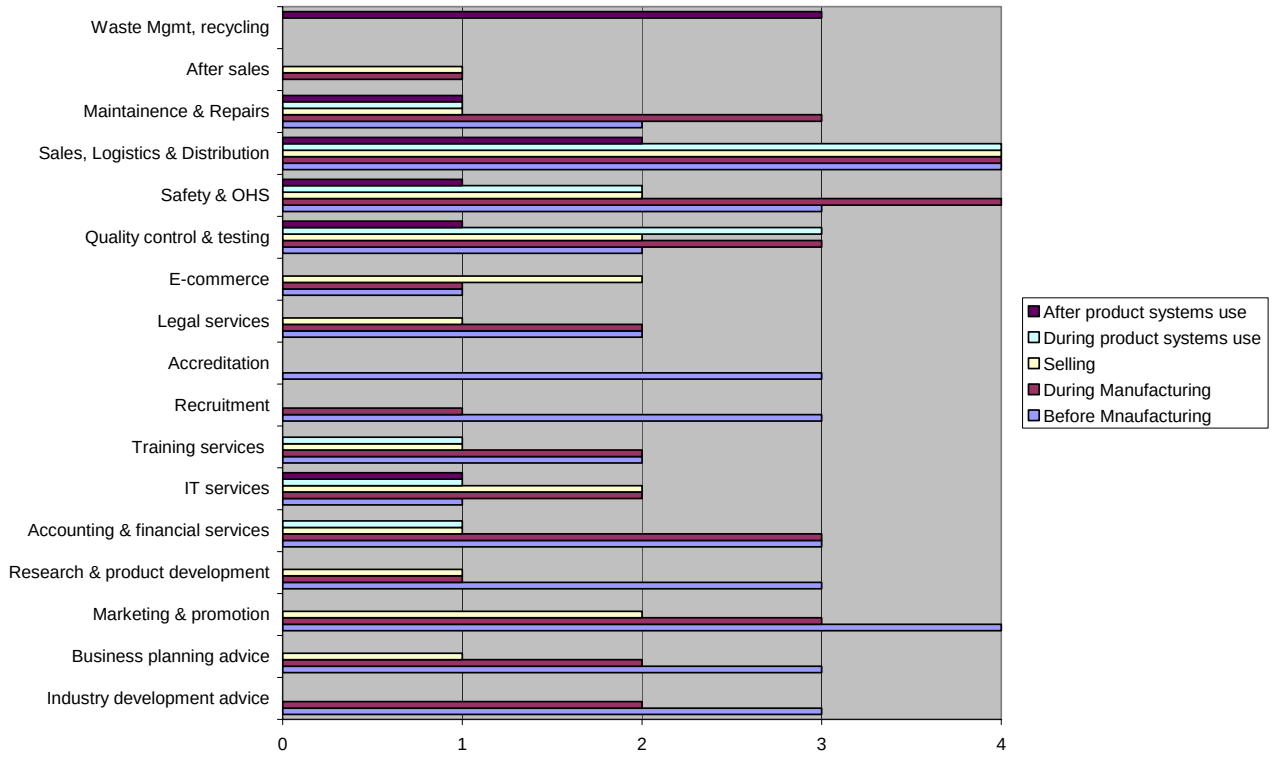
The importance of KISA for firm innovative activity is summarised below.

> "Increasing supply and demand for specialised KISA signifies the evolving divisions of labour in the economy. Specialised expert and integrator services help organisations manage increasingly complex technologies, rapidly changing operational environments and evolving business concepts" (OECD 2006, p.47).

This analysis provides information on what KISA firms use, when and how they incorporate them into their innovation and production processes, and from where they acquire the services, including both internal and external sources. This latter point will not only inform on both the internal/ external dynamics of firm knowledge sourcing, but also provide an understanding of the geographical extent of external knowledge sources. It is important to gain this understanding of the geographical reach of firms' knowledge gathering activities, because part of the purpose of this research is to assess the knowledge flows of South West Sydney's geographically co-located industrial concentration of metals manufacturing firms.

Figure 15 below shows the KISA that are most accessed by the case study firms and at which stage of the production process they are used. The most important sources of KISA were in the areas of sales, logistics and distribution advice, safety and OHS advice and marketing and promotions.

Figure 15: KISA usage and where in the production cycle they occur



It is interesting to note that Marketing and Promotions activities are most accessed at the 'Before Manufacturing' stage rather than at the 'Selling' stage. This suggests the importance of Marketing and Promotions activities in seeking out a potential market and customers for the firm before the full commitment to manufacture has been made. In fact, the 'Before Manufacturing' stage sees the most diverse range of KISA accessing, with other important activities included, such as: accreditation, recruitment, accounting and financial services, research and development, business planning and industry development advice. Some of these activities are traditionally linked to this stage of the production process such as research development, and business planning and industry development advice, but the broader range of KISA accessing suggests a general 'getting the house in order' attitude at the pre-manufacturing stage.

The 'During Manufacturing' stage also sees a diverse range of KISA accessing, but of slightly different types. Marketing and promotions, research and development, and sales, logistics and distribution are still important, but so are other KISA, such as quality control and testing, safety and OHS, and maintenance and repairs.

The 'Sales' period of the production cycle sees overall levels of KISA access decline. The main activities are naturally sales, logistics and distribution, and marketing and promotions, but also e-commerce and IT services. This suggests the importance of online activities in the sales process.

The 'After Manufacturing' stage shows very few KISA, mainly around waste management and recycling, and some sales, logistics and distribution.

Sales, logistics and distribution activities are considered crucial at all stages of the production process. Overall, the KISA usages suggest a pattern of using certain types of activities at certain times in the production process. The diverse use of KISA in the pre-production phase highlights the knowledge intensity of this phase of the production cycle.

The activities performed by these firms can be analysed according to recent innovation surveys in outer Western Sydney, which found that different KISA correlated with different levels of innovation in firms (see Box 4 below). All core activities are performed by the case study firms, but not to a large extent. These core activities for innovation and competitiveness are also externally sourced, not from the local area, but rather from the Sydney metropolitan area and Australia as a whole (see Figure 16 below), which indicates a certain weakness of local suppliers of core knowledge intensive services for firm innovation. The highest usage of KISA by these firms is in other activities such as maintenance and repairs, or sales, logistics and distribution, which are considered complementary KISA. These complementary KISA are also sourced to a large extent from the Sydney metropolitan area (see Figure 17).

Box 4: KISA type by innovation and competitiveness output in Western Sydney firms

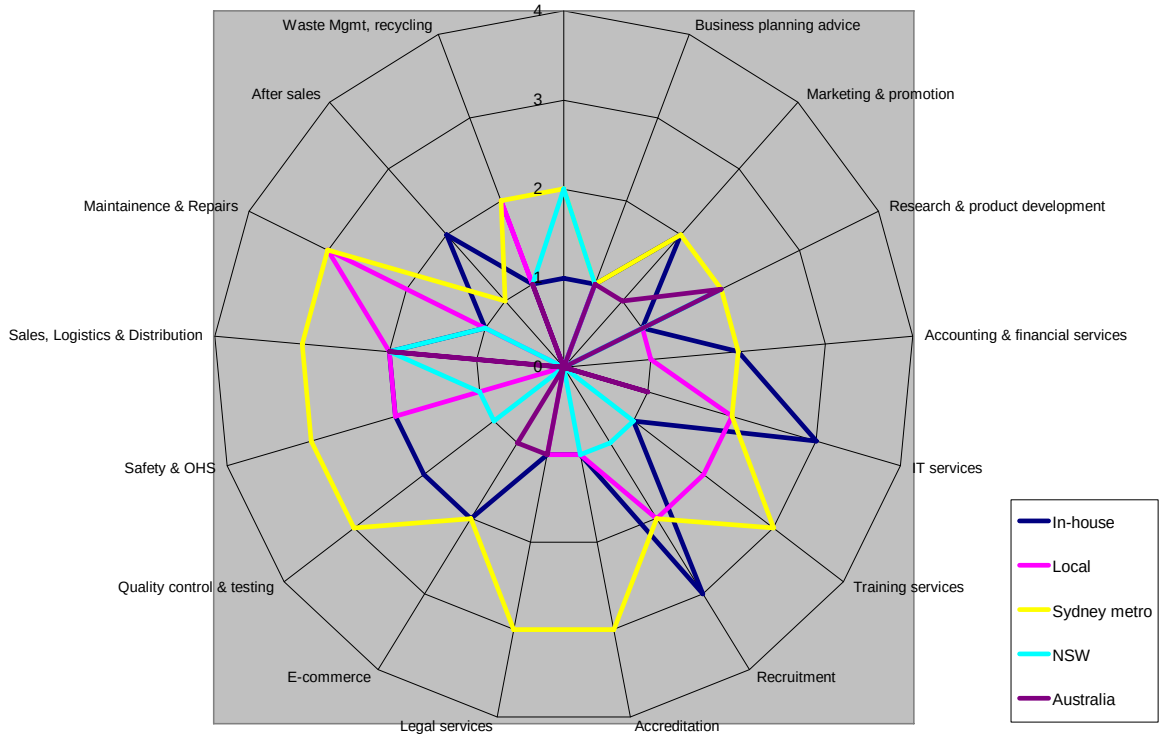
Core KISA (those activities most highly correlated with firm innovation activity and competitiveness): business planning advice, marketing & promotion, research & development, accounting & financial services, and IT services;

Complementary KISA: 'Standardisation KISA': accreditation, legal services (IP, patents) and e-commerce; 'HR KISA': training and recruitment; and 'Industry development KISA': industry development advice.

Source: Sharpe, 2007; Martinez-Fernandez & Sharpe, 2007

The next section of KISA analysis concerns the location for the service provision. This analysis allows two characteristics to be known: firstly, the levels of internal versus external KISA sourcing within the firms; and secondly, the geographic boundaries of external KISA access. Figure 16 shows the location of KISA sources for each of the case study companies. It should be noted that firms could name multiple locations for the same KISA, for example research and development KISA can be internal to the firms as well as obtained from a number of external sources. Knowing the locations of the service provision allows us to better understand the mix and match of services used by the firm in their operational processes.

Figure 16: KISA sources by location



In examining the dynamics between which KISA are accessed internally (shown in dark blue) and which activities are accessed externally (shown in the other colours), we see that while there is a great deal of external accessing, this is always typically complemented by in-house resources of KISA. In-house sourcing is most prevalent in recruitment and IT service provision.

In terms of external sources of KISA, all four levels of geographic scale are represented, local through to national. However, the most prevalent scale for sourcing external KISA is at the city or Sydney metropolitan level. This is particularly the case for training services, accreditation, legal services, quality control and testing, safety and OHS, sales, logistics and distribution, and maintenance and repairs KISA. Maintenance and repairs KISA also have strong locally based providers. This local focus is to be expected with the concentration of metals industry manufacturers and associated firms that are located in the South West Sydney area.

External expertise is sought from further afield in the case of a couple of firms, and again in particular activities. KISA for sales, logistics and distributions, research and development, and industry development advice are sourced from across NSW. Nationally, the only KISA sourced concern waste management and recycling. This suggests that this type of KISA are highly specialised and may only be available from a small number of providers. It also suggests that this is an emerging field of knowledge for the industry, as waste management and recycling is new for many industries with the advent of increasing environmental regulation and triple bottom line reporting requirements.

Overall, this chart shows that the knowledge flows of these firms are largely contained within the Sydney metropolitan area, and that certain service activities have associated geographies. The local area has less specialised service provider capability, as stated by company C:

> 'This area lacks professional services in certain areas. Certain services are OK; for example, legal services are pretty OK in the region; specific services like IP there are only in the city. If many of these firms did their own analysis I think they will find very quickly that their market is not in the city but here' (Case study C's interview, November 2006).

Firms' expenditure on these services is not insignificant, especially given their relatively small size. Of the five firms studied, all but one firm had expenditure in excess of $100,000 on their external KISA in the last financial year. The remaining firm had expenditure of between $20,000 and $50,000 in the previous year. If many of the specialised services are outsourced to firms in the city, there is a strong argument for the need to recognise the contributions made by the manufacturing sector in South West Sydney to the business and financial cluster in Sydney CBD.

4.3 Collaboration Activities

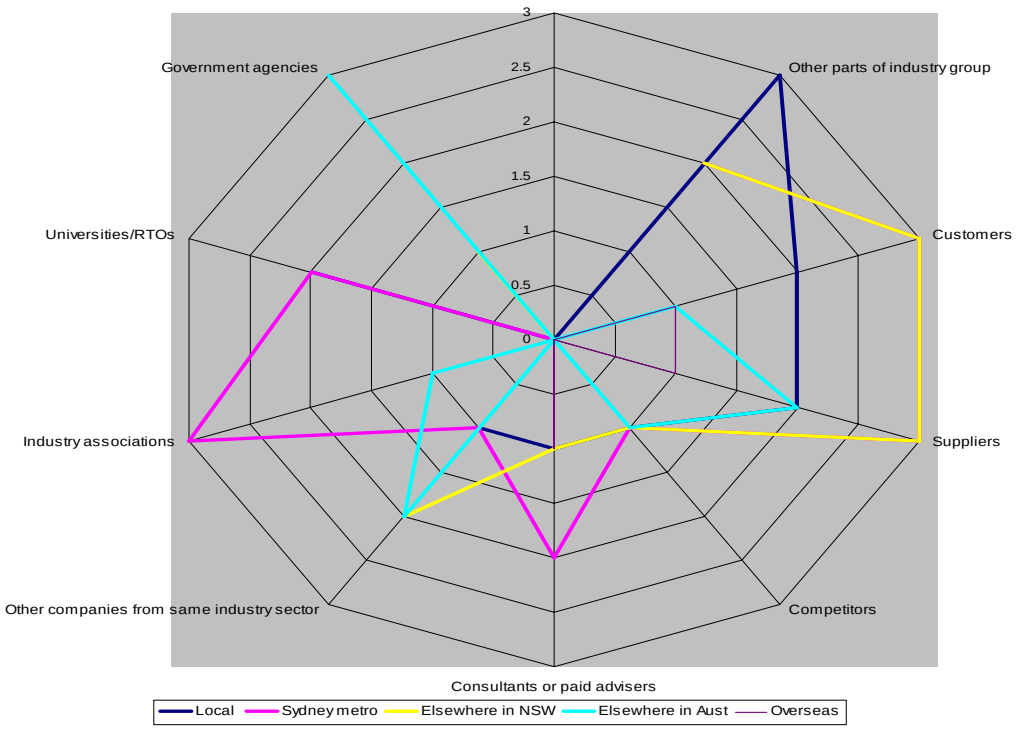
Collaboration activities by the case study companies were analysed at three levels: type of collaborative arrangement; type of partner organisation; and whether the collaboration was formal or informal.

While companies collaborate under different forms, they are usually through formal contractual arrangements. They often have joint marketing or distribution, joint manufacturing, joint research and development, licensing agreements, and joint ventures. Companies with a higher number of employees tend to have more collaboration agreements and more sophisticated ventures than the smaller companies. Most of these collaboration agreements are with suppliers and customers, as can be seen from Figure 17 below.

Firms noted that the trend towards vertical integration by the big firms in the metals industry is driven by customer's needs, although this should not restrict a potential cluster development, as noted by one of the firms:

> 'We offer turn-key solutions, where we take the project from offer to delivery, including all the logistics and including all the external suppliers that are needed for delivering that particular project. We can pretty much do everything except from the recycling. We managed all our machines internally and we can use external suppliers when needed. Our competitive advantage is turn-key solutions where we care for product quality, technical skills and experience in design. Customers do not want to go to 20 shops to find what they want; they want one shop for their demand. Our advantage is that we can do everything internally. This doesn't really go against clusters because they do work as one body anyway' (Case study D's interview, November 2006).

Figure 17: Collaboration Partners



Note: RTOs – Research and Technology Organisations

The figure above demonstrates the collaboration networks of these firms, which are largely from the private sector, ranging from other parts of the industry group through to customers and suppliers, and industry associations. Other more formal partners such as consultants and paid advisers and competitors have less presence in the network. Of interest is the low nomination of universities and research institutions as collaboration partners. Geographically, the collaboration network extends towards the Sydney metropolitan area and elsewhere in NSW more than towards the local area (20 kilometre radius). In most cases, informal activities with other organisations that are within the network space of the firm would lead to formal contractual agreements and vice-versa as firms develop long-term relationships.

The in-depth analysis of these case studies indicates that collaboration at the local level between firms within the same industry sector is very limited and there are almost no collaboration ties with competitors in the industry. However, when companies were asked about the relevance of industry clusters for their development and competitiveness, the responses clearly identify ‘clusters’ as being a possible competitive advantage for their businesses. Below are some of the firms’ elaborations:

Box 5: Firms' selected quotes on cluster advantage

Case A: 'A cluster of companies will be an advantage because it provides contacts of potential customers. This is the only advantage for us. Being with competitors is not a problem; we all know each other. We can get new knowledge about the needs of customers and about what directions we might need to take. We might understand new ways to do things and to satisfy customers today'.

Case B: 'In relation to industry clusters, we will support them if we have an advantage for getting more scrap. If there is a benefit for us, yes we will support them. We don't direct the manufacturing sector, they are strong enough on themselves. We will get involved in clusters if the advantage is clear. It has to be an advantage for people to get involved – otherwise it will not happen'.

Case C: 'A network/cluster in the metals will be very beneficial in terms of attracting more businesses to our region. Companies from the different parts of the value chain need to be involved because this is what the industry is made of'.

Case D: 'Clusters benefit the area by creating jobs and minimising transport costs, because you can do things locally with local partners. It also expands individual companies' reach nationally and internationally – as a cluster you have the ability to do more. It also allows for lessening the costs for the supply-chain because the work is guaranteed. You lower the costs and you have more work so the work is more sustainable. This is actually a great advantage because you reduce the costs and you maintain the work for longer periods as 'jobs' circulate in the cluster so your capacities became sustainable that way. Competitiveness is also improved because you do different things'.

Source: Case study firms interviews, November 2006

In relation to 'cluster governance', some of the responses by the case studies metal firms are:

Box 6: Firms' selected quotes on cluster governance

Case A: 'If a cluster is formed, companies should lead the process; Local Governments do not know much about this business. Councils can provide logistics but not drive the business because they do not understand it'.

Case B: 'Clusters should be governed by industry not council. The private sector should always have the ability to govern itself in that regard. The private sector should always be able to control their investments. The private sector should be able to control their destiny. Council should always be part of it but I don't think the Council should be the guiding body. Time to time the relationship between the manufacturing sector and Council can be rather strained. I think they need to be involved but I don't think they should exercise control'.

Case C: 'The process should be led by the private sector probably. Governments are just to slow to react; they cannot respond'.

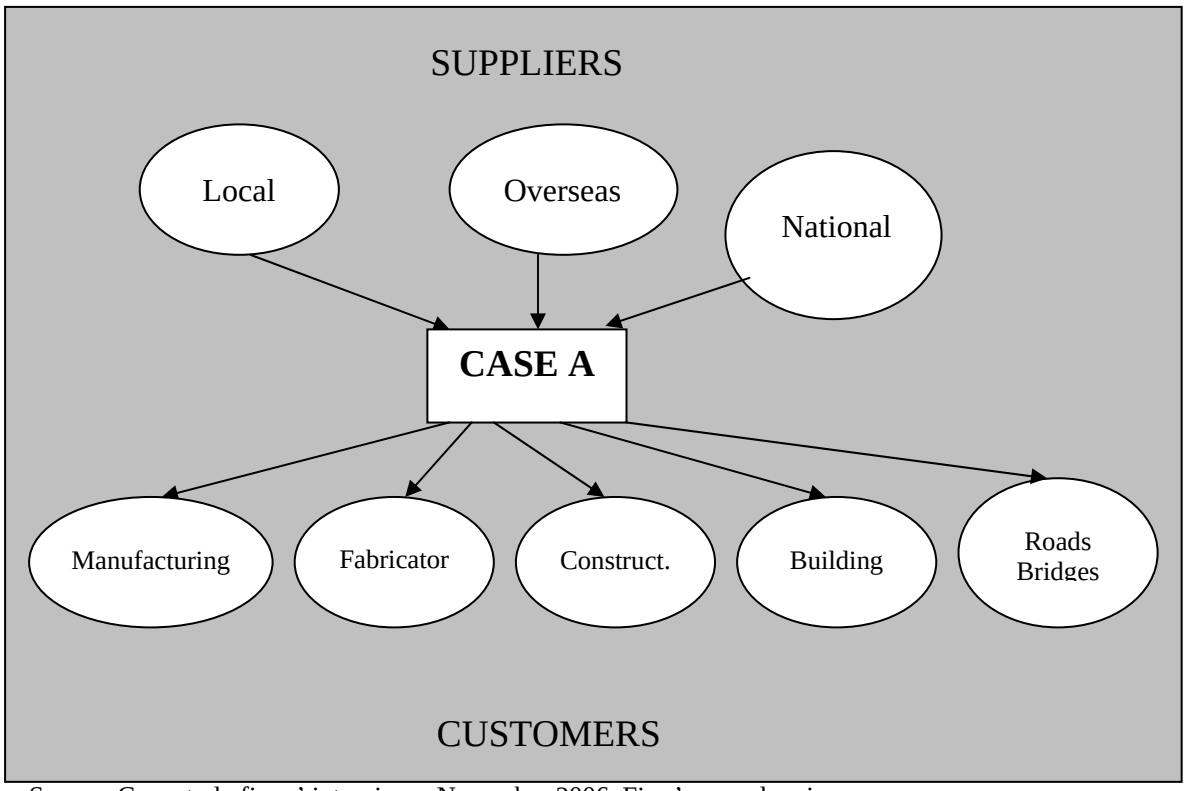
Case D: 'Private sector should lead not the public sector. Needs an impartial representative that is un-biased and that is good for the cluster. The lead has to come from an organisation that can deliver but perhaps some direction needs to come from that impartial institution'.

Source: Case study firms interviews, November 2006

4.3.1 Knowledge and Capacity Networks

These firms are very aware of the importance of networks and alliances, as well as the importance of integrating knowledge obtained from their business networks. Below are four selected maps of the firms' knowledge and capacity networks, and commentaries by the firms. As can be seen from Boxes 7, 8, 9 and 10, these firms rely on a vast number of actors from their network space: customers, suppliers, industry, education and government organisations, and in-house engineers and managers.

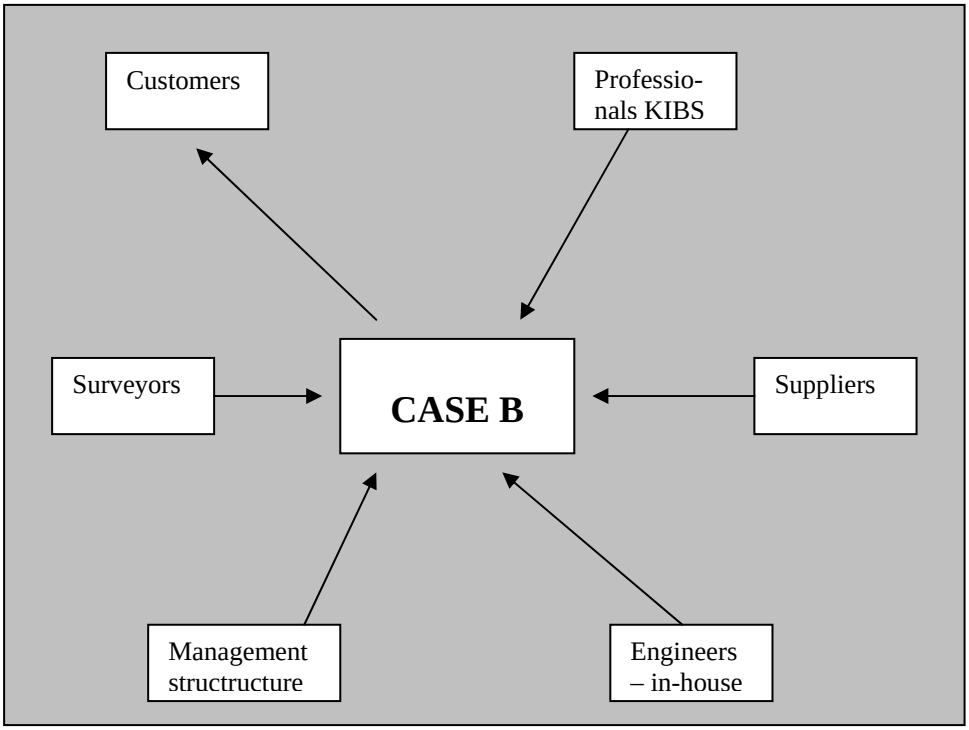
Box 7: Case study A's knowledge and capacity network



Source: Case study firms' interviews, November 2006. Firm's own drawing.

> 'Most people do not know where the steel goes; it goes everywhere. Steel is in the frame of trucks, it is in the Olympic stadium, in housing, etc. I have worked for 10 different owners in 36 years. Customers follow me because you built the relationship with the customer—this is a very 'incestuous' business. We work with the opposition; we are with them sometimes and against them sometimes. Bigger companies take over the small ones; the competitors now are probably just 4; there were more than 20 when I started' (Case study A's interview, November 2006).

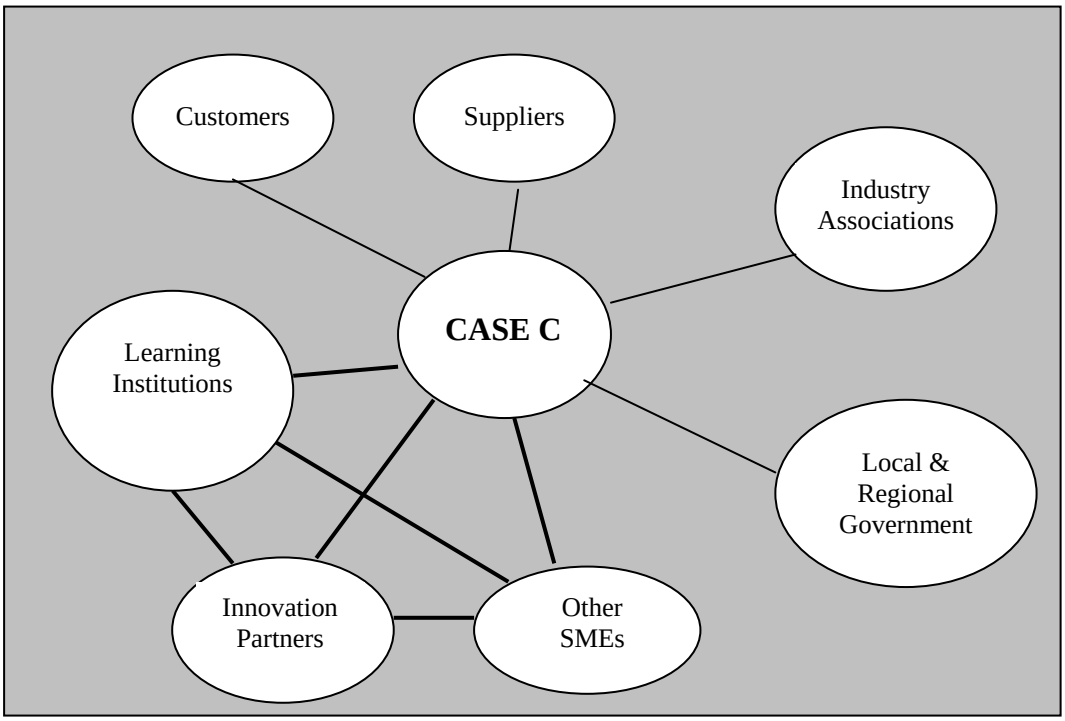
Box 8: Case study B's knowledge and capacity network



Source: Case study firms' interviews, November 2006. Firm's own drawing.

'We utilise proportions of consulting people to advise on the machinery that we utilise in the yard, to give us an insight to whether we can do with the yard, also on council regulations and guidelines. We get our ideas from professionals (knowledge intensive business services firms - KIBS). We employ them to give us ideas about pieces of equipment. We also utilise the management structure (internal) that obviously is very knowledgeable within the industry. We also have professional engineers in our Sydney office that we can utilise. And between all that we usually come up with the ideas that we want to produce. Our engineers travel all around Australia. We have commercial development managers that do acquisitions for us, that do client analysis for us' (Case study B's interview, November 2006).

Box 9: Case study C's knowledge and capacity network

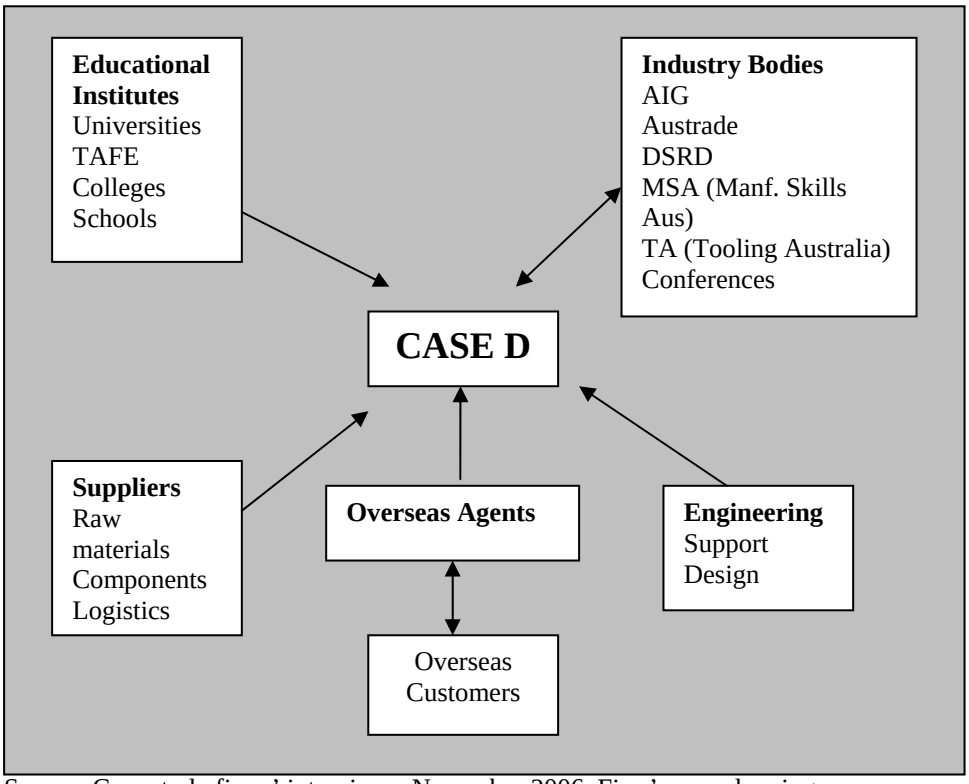


Source: Case study firms' interviews, November 2006. Firm's own drawing.

'Our competitive advantage is that we try very, very hard to be fast to market and also to customise the product as much as possible. If a customer wants to do a special shape we would probably say 'yes, we will do it'. Our machines are quite flexible. I have been sourcing materials for many countries and I can tell you the cost of tooling in countries like Singapore, China, Malaysia, Taiwan is superior in value to what you can get here in Australia. It is of a very, very good quality and for a small proportion of the cost of what you can make in here. What we have found is that if we didn't offer fast response to market and very high customisation we will not be able to compete. It is not possible to compete in standard products because you can get these products from overseas very cheap. For example you can get small parts from 'OfficeWorks' for the same amount we get the material. We can only compete because we target a much more sophisticated, complex manufacturing and higher quality. We are able to produce small quantities of products (as low as 5 pieces) because the level of complexity is high and we can offer a high level of quality'.

'Storage is a problem but we solve this with our suppliers – we tell them we need a supply of such and such but only deliver this part now and this other next. Sometimes we need something very quickly. For example, Fridays afternoon are just crazy – people call and said: 'I need this for Monday; can you make it over the weekend?' When we are very busy we have extended shifts' (Case study C's interview, November 2006).

Box 10: Case study D's knowledge and capacity network



Source: Case study firms' interviews, November 2006. Firm's own drawing.

> 'We deal with our suppliers very closely. They supply the material and with that material we are able to deliver what we have been requested to do. We do the design and the manufacturing from beginning to end. A lot of the components we need, the work has gone to China;, local suppliers cannot compete with the type of prices they have. The design might have started in the US or in other parts but the manufacturing is done in China or Korea or even South Africa. Time for finishing a machine might be 4-6 months, and they last almost forever. They also can be retrofitted, and changed to do new functions. We have offices worldwide, they are small with 1-2 men but they do all the client relationship. They do all the sales and after sales services' (Case study D's interview, November 2006).

4.4 Regional Resources

South West Sydney is well known as being a region that hosts a strong manufacturing base. The case study firms were asked about the decision to move or operate their business from South West Sydney. In all cases, the decision relates to two key factors: availability of affordable land; and clustering of manufacturing firms. The box below shows selected responses.

Box 11: South West Sydney Manufacturing Location Advantage

Case A: 'SWS is a substantial area of business. In the beginning, most companies were in the city, but all manufacturing was pushed away to cheaper areas. We have been here for 16 years. No disadvantage in being here; best thing is to be part of the customer base here; logistically is very central. Transport is cheaper here too. The price of the land was the main factor to move here'.

Case B: 'This region is unique for business. It has the largest concentration of manufacturing businesses in Sydney. For generation of scrap metal and for manufacturing in general you need to be in the South-West of Sydney'.

Case C: 'This area is excellent for business. The firm moved here in the first place because of the price of the land. Moved here 10 years ago from Moorebank. So, the firm was close to their customers and close to the M5. Most employees live around here. The majority are locals. People don't want to waste time sitting in the car. The main advantage for us is that we are surrounded by complementary services, we don't need to look very far to find someone that complements what we do. There is a good source of people, people available in this region have the proper levels of education'.

Case D: 'We are in the centre of a logistic hub (the best in Australia). We have access to 2 ports within 40 minutes, container transport through railway, roads, freeway, and airports. The biggest disadvantage is that the region is 'in Australia', we still are a new supply to the global economy and the distance is a challenge. We moved here because it was the next stage of growth for the manufacturing industry here in Sydney. Most companies were coming and moving to the west due to the land price. In the early 80s, this area was earmarked as the next big area for development because it is so close to Sydney and so accessible to all. Around 1979 there was a huge relocation of big companies to the areas of Preston and Ingleburn and then here. We have the vision for development at this place and at the time it was a good price for the land. We know we will expand so we bought a site twice as large as we needed at that time and now we are thinking of building a new factory in that area'.

Source: Case study firms' interviews, November 2006.

One of the companies also noted some of the challenges present in SWS in terms of facilitating business growth:

> 'At the disadvantage level [sic] is that for a couple of difficult jobs we have it is now difficult to recruit people. Sometimes you need to have industry knowledge. For example, the young recruit we got recently from UWS, we have to put him in the engineering area because we couldn't find experienced people to do the job we wanted. There are people out there with experience that could do it but first they are expensive to poach from somebody else and second it is not something they teach in universities; there are skills that you have to acquire in the industry itself. Our approach is rather to go and to poach people from somewhere else, probably from our competitors; we are better off developing our own

expertise. I know this is a longer process but in the long term, with our training, they are more likely to be aligned with our own vision and our own directions'.

'There are some infrastructure issues too. We don't have broadband speed. We have double the speed from 2 years ago but that is all you can get and it is not enough. Nothing has changed much at that level. All goes back to Telstra; if they don't upgrade their equipment it doesn't matter what server you use it is not going to work. There are also issues with local council such as council approvals and regulations. Regulations can stop the business from growing' (Case study C's interview, November 2006).

The role of Councils in providing knowledge intensive service activities to firms was also discussed with the case study firms. In general, the firms saw Council's role of regulator as somehow limiting expansion of the firm, but they also indicated Council's role in other activities that are more related to knowledge diffusion and cluster facilitation, as summarised in Table 14 below.

Table 14: Preferred activities to be provided by Local Council to firms

Activities by Local Council	Little importance	Some importance	High importance
Provide economic and demographic information on the region			
Organise Industry forums			
Logistic support for industry networks/cluster			
Lobby state/federal government on behalf of your industry			
Provide information about other government services			
Work placements and employment skill development programs			

Source: Case study firms' interviews, November 2006.
Note: table shows only most nominated activities

The traditional role of local Councils as regulators is indicated by some of the firms:

'Council have some role in providing services to companies; for example our major target is exports so they could help. Local Councils can be out of touch with industry and there are conflicts of politics and industry goals. There are people like MACROC that do their best to engage with industry and that is good. There are good things they are doing such as putting out there a big container centre. We still getting [sic] difficulties when dealing with local Councils, sometimes (it) is difficult getting a license for expansion. Then it's the problem of politics from different political parties and how that impacts local councils' (Case study D's interview, November 2006).

'Local Government does not always understand our business; we have substantial barriers to expand our warehouse. They put (up) barriers to stop us doing things, not to help us to grow. Some things are good; such as the Awards for best Employee. We (are) involved in that and one of our employees won the award. That was very good' (Case study A's interview, November 2006).

4.5 Summary

This chapter focused on the innovation capabilities and collaboration activities of metal firms in South West Sydney, through the in-depth analysis of five case studies. The case study firms range from SMEs to large firms, and cover different aspects of the value-chain process; from the processing of raw materials, to the delivery and customisation of products and services, and the recycling of waste and disused product. The spectrum of firms is a good representation of the metals industry in South West Sydney, with core competencies being defined around the design and production phases of the value chain (simple through to advanced production).

Skills analysis of these firms shows that the firms have staff with high levels of secondary education qualifications, which is consistent with a predominant concentration of trades in the region. However, the distribution of apprentices by industry indicates that the sectors where the training of new talent is occurring is not the 'metals manufacturing' sector, but rather is in other associated sectors such as 'Building and Construction', 'Automotive', and 'Utilities and Electrotechnology'. Firms also noted the acute difficulties experienced in attracting new people to the industry, and the often concomitant mismatch of skills possessed by new graduates with the skills actually required by firms, as being one of the most important challenges of competitiveness in global manufacturing.

Analysis of innovative activity undertaken by the case study firms in the past three years indicates that all firms had innovated in one or more of the three types of innovation (product, service and organisational or process). There is a greater focus on product and service innovation, with an incremental degree of novelty.

Innovation intensity was analysed through observation of firm participation in knowledge intensive service activities (KISA) before, during and after manufacturing. The most frequent KISA relates to sales, logistics and distribution, safety and OHS, and marketing and promotions. There was a diverse use of KISA in the pre-production phase, indicating the high level of knowledge intensity for this phase of the production cycle. It is interesting to note that Marketing and Promotions activities are most accessed at the 'Before Manufacturing' stage, rather than at the 'Selling' stage. This suggests the importance of Marketing and Promotions activities in seeking out a potential market and customers for the firm before the full commitment to manufacture has been made. The 'During Manufacturing' stage also sees access to a diverse range of KISA, but these are of slightly different types, such as quality control and testing, safety and OHS, and maintenance and repairs. The 'Sales' period of the production cycle sees overall levels of KISA access decline. The main activities are naturally sales, logistics and distribution, and marketing and promotions, but also e-commerce and IT services. The 'After Manufacturing' stage presents very few KISA, mostly focused in waste management and recycling and sales, logistics and distribution.

Firms seem to concentrate on KISA that are complementary to the activity of the firm, such as logistics and distribution, and maintenance and repairs, but not on 'core activities for innovation' such as finance and accounting, or business development advice.

These complementary KISA are sourced to a great extent from the Sydney metropolitan area and firms indicated that the local area has less specialised service provider capability than the metropolitan area. Many of the external, specialised services used by these firms are purchased from firms in the Sydney city centre, indicating the important contribution of manufacturing firms to the business and financial cluster in the Sydney CBD. In-house sourcing is most prevalent in recruitment and IT provision. Most KISA are the result of a mix-and-match compendium of services produced in-house or purchased externally, indicating the extensive integration of services at all stages of the manufacturing process for metal firms.

The case study firms collaborate in different ways and under formal contractual arrangements in joint marketing or distribution, joint manufacturing, joint research and development, licensing agreements, and joint ventures. Companies with higher number of employees tend to have more collaboration agreements and more sophisticated ventures than the smaller companies. However, the study shows that collaboration networks are still important for these firms. These networks include partners that are largely from the private sector, ranging from other parts of the industry group to customers and suppliers. Other more formal partners such as consultants and paid advisers and competitors have less presence in the network. Of interest is the low nomination of universities and research institutions as collaboration partners. Geographically, the collaboration network extends towards the Sydney metropolitan area and elsewhere in NSW more than towards the local area (20 kilometres radius).

The case study firms indicated ‘location’ as being a factor in their decision to either move their business to South West Sydney, or to operate from this region. In all cases, the decision relates to two key factors: availability of affordable land; and clustering of manufacturing firms. Among the regional resources indicated as being an advantage for manufacturing business were the availability of local talent (although new recruitment is difficult), local suppliers, especially for maintenance and repairs, and road and freight infrastructure. Among the disadvantages is the lack of high speed Internet access for data transmission and strict Council regulations regarding expansion of businesses.

The role of Councils in providing knowledge intensive service activities to firms was also discussed with the case study firms. In general, firms saw the role of Council as being that of regulator, but they also indicated Council’s role in other activities that are more related to knowledge diffusion and cluster facilitation. In particular, the facilitation by Councils of KISA related to provision of economic and demographic information on the region, logistic support for industry networks/cluster, and work placements and employment skill development programs were noted as being of high importance for the case study firms.

5. Learning Models of Manufacturing Clusters

Manufacturing Clusters Best Practices

- Mackay Area Industry Network's (MAIN) focus on *training apprentices* to solve acute shortage of skills during the mining boom.
- City of Playford Economic Plan – *An Innovative City* - focus on promoting alliances, forming *network companies* to enter new markets, and provision of intellectual services to firms.
- I^3Net's focus on secretarial services for *export missions*, entering new overseas markets and entering new sectors.
- HunterNet's focus on *training* for the engineering company members through their own training company.
- The four learning models provide KISA to their members in relation to marketing, networking, and other intellectual and political services such as R&D, business development advice, and lobbying governments to improve industry and regional environment by funding projects and infrastructure.

Successful industrial clusters, such as the famous information and communications cluster in Silicon Valley, have economic, political, regional and cultural pre-conditions that cannot be replicated elsewhere and therefore learning models need to be look at from a closer proximity in terms of those contextual pre-conditions. During the course of this study several clusters around the world were evaluated, including the 'Silicon Saxony' cluster in Dresden (Germany), the manufacturing metals cluster in New Zealand, and the 'Pearl River Delta Economic Zone' in the Guangdong province of China. In the end, the study focused on learning models from within Australia because demographic, industry, economic and cultural settings have a similar base and therefore the lessons have a higher probability of being successfully transferred to South West Sydney.

This chapter discusses four learning models: the Mackay Area Industry Network (MAIN), the 'City of Playford's Innovative City Economic Plan', the 'I^3Net' cluster in Wollongong and the 'HunterNet' engineering network in Newcastle.

5.1 Mackay Area Industry Network (MAIN)

Mackay is a city of 84,856 inhabitants, located on the central coast of the State of Queensland. Mackay has the distinction of being the largest sugar producing region in Australia, and has the largest bulk sugar facility in the world (737,000 tonne capacity). In addition, the Mackay region has one of the largest coal loading terminals in the Southern Hemisphere (Hay Point), with a capacity of over 50 million tonnes per annum. The

resources boom in Australia has seen Mackay's minerals and mining industry explode, with more than 20 coal mines now operating in the region. Mackay's unprecedented growth and subsequent wealth creation since 2004 has put significant pressure on company development; skills-shortages in particular are a constant threat to industry growth.

During the mid 1990s, the shortage of tradespersons, and challenges of the apprentice training system were considered risk-factors for the manufacturing sector in Mackay, and a group of companies joined together in a cluster type organisation - the 'Mackay Industry Network' (MAIN) - in an attempt to solve these problems, which included the skills shortages in their companies and the lack of needed skills associated with the national apprentice training system, which was not responding fast enough to the growth of the manufacturing industry. Under the national apprentice scheme, the skills areas of trainees were not well adjusted to the set of skills actually needed in the sector and there was a high rate of non-completions.

The 'Mackay Area Industry Network' (MAIN)[6] was formed by manufacturing and engineering firms in 1996 in response to the industrial changes occurring in Mackay. Engineering firms have dominated the sugar industry in the past, and there is a strong tradition of manufacturing and engineering services in the town. In the early to mid nineties, the sugar industry started to decline; there were some years of drought, and insect infestations in the crops. As a consequence, the industry as a whole started to slip away. The concern then for some of the companies in the engineering sector was that if the revival of the economy was going to be dependent upon the mining industry, the majority of Mackay companies would not be able to compete with the big companies normally associated with mining. There was a concern that the local companies would not have enough capacity in their businesses to cope with large-scale demand, and would consequently not be able to win the bigger contracts.

The network started operations with an industry forum and a feasibility study of the coal industry funded by the State Government. The 1997 study collected information from different mining corporations operating in the area, and the results showed that there was an expanding demand for manufacturing services from the coal industry, but it was very hard to determine if the local industry was going to respond to, or participate in, that demand. At that point, the Regional Economic Development Corporation (REDEC), an organisation financed by the State Government and the City Council, supported the cluster initiative by offering office space to allow the network to start operating, and providing funding of $120,000 for 3 years. There were 45 companies in the beginning and six 'champions' driving the process. The first action taken by the network was to apply for funding to employ a General Manager. The Federal Government's Department of Transport and Regional Services (DoTARS) provided $130,000 to pay for engagement of a General Manager to facilitate the network.

Early analysis by the General Manager indicated that the network would be very useful for accessing larger contracts, and that companies working in conjunction would be able to do buisness better and enchance access to information, thus enabling them to improve their businesses. Therefore, in the first 12 months, the network provided a lot of

[6] Information regarding this network was collected through in-depth interviews with MAIN staff and other organisations in Mackay from December 2006 to April 2007.

information on 'how to do good business' at monthly events. At the same time, the network set up the structure of the business as an incorporated not-for-profit organisation, with a Board of Directors and annual membership fees ranging from $700 to $2,000, depending upon the revenue of the company.

The companies involved in the network analysed the strategic needs required to remain competitive in Mackay under the mining boom, and how they would be able to maintain their level of employment under stiff competition. They decided to have three major areas of focus: (1) networking information; (2) skills; and (3) exports. The identification of 'skills shortages' as one of the key areas requiring assistance led to the establishment of the 'CARE program' – the most succesful activity of the network, as highlighted by MAIN staff:

> 'Skills' was highly significant because the employment of apprentices had dropped dramatically, the good training skills that came out in the late 80s-90s under the Federal Government didn't satisfy the needs of the engineering sector. They have skills that didn't work for most companies and so they just stopped taking apprenticess. Thus the nework identified that there was an opportunity for them to offer 'apprentice management' and to go further and become a good training organisation. So a company employs the apprentice and we come in and take over the administration; let's say that we become the 'apprentice master'; we solve all the problems that need to be solved to get the apprentice in place. The company is happy because they have the employee, they own their loyalty and they only deal with an organisation to get all the administration sorted out.
>
> This has been a big success and ensured our sustainability as a network, because that is from where we get all the income. We work with many companies, not just the ones that are part of the network. It is a good arrangement because the companies do not need to put on extra staff to do the administration side for the federal government; they can put their people to doing their job and we get the extra burden of the administration of apprentices. Things like training them to work on the floor space, going to TAFE for training etc. We have 2-3 staff working on this. The program resulted in a stronger workforce, especially it stopped the drop-off apprentices, which was a problem over here. The retention rate is 90-95% which is nothing like the average. Alongside this, we developed very useful relationships with other training organisations such as TAFE' (Interview, December 2006).

MAIN acts as an intermediary agent connecting industry with education agents; they organise all bookings for their apprentices, and they also focus on the types of gaps prospective employers might have in the near future. The role of the program is not to train – other organisations such as TAFE do that - but rather it is to organise the logistics of training courses and inductions that the Technical Colleges or other organisations deliver. MAIN also take care of the basic information needs of apprentices, explaining the expectations of the job from inside the workplace; important information on which companies are usually too busy to expend time. The MAIN CARE program has also been able to introduce hard-to-reach people from long-term unemployment, Indigenous backgrounds and women into the workforce, although this is not the focus of the program.

Local Partnerships

The MAIN CARE program, although driven by the private sector, is a strategy designed in cooperation with the Australian Industry Group, the Mackay Regional

Economic Development Corporation (REDEC)[7], Department of Education, Training and the Arts (DETA), and the TAFE technical college. The implementation of the strategy is coordinated by an Apprentice Master who liaises with public and private organisations, coordinating all inductions into apprentice programs in collaboration with the Technical College. The program also looks after all management and OHS aspects of the deployment of apprentices into the workplace. MAIN CARE uses a 'consortium' type model of delivery, where the professional services of educational institutions, support from government, and partnerships with industry, result in recruiting new apprentices, managing apprentices and trainees in the companies, and training the workforce. Total turnover of this program in 2006 was $700,000.

The success of the MAIN network and the CARE program follow a 'cluster business model', with a General Manager and a Board making financial decisions and member companies and organisations providing strategic directions. The role of the General Manager has been instrumental in the success of the CARE program, together with a strong driving force provided by the companies that constitute the network and the support of public organisations. Some of the mechanisms used to encourage local partners to agree to a common skills strategy are exemplified by one of interviewees:

> 'Key Activities for the cluster are found through some common need. For example, for MAIN is has been the need for skilled workers; companies needed an apprenticeship program because they didn't have the capacity to manage this on an individual basis. The cluster has to identify what the potential benefits are, and they need to show that the investment in developing the cluster is going to assist the development of that industry in the region in a way that individual companies on their own would not be able to do. This is exactly what the CARE program has done and the model they have developed can be applied across the board to other starting clusters.
>
> It is very important for government to assist clusters to get established, because it is very hard to ask businesses to invest in another business structure that might die, or that they don't know whether it is going to help to built their own business; so I think it is appropriate that governments provide some start-up - about 2 years' assistance in some form to get them up and running and to help them to transition to self-management'. (Interview data, 2006).

The case of the MAIN network highlights the importance of providing the private sector with mechanisms for participation in designing solutions to their labour market imperatives. MAIN started to address the skills shortage evident in the trades area some years in advance of the Queensland Skills Plan, although the analysis undertaken by MAIN companies regarding the impact of the mining boom on business was much less sophisticated than the analysis conducted by the Government. However, as the companies involved in MAIN based their strategic analysis and planning on the impact the direct local

[7] Mackay REDEC is responsible for facilitating the economic development of Mackay and the Whitsunday region. Mackay's statistical division covers 8 shires, from the coast to the hinterland areas, where the coal mining is located. REDEC is the region-wide agency and then each of the shire councils have an economic development unit. REDEC is not part of the Queensland Government, however it is funded by the Queensland Government. The Queensland Government has a strong development focus across the State of Queensland, but they do not necessarily have much detail on the situation in each regional area. The Government therefore funds these REDEC to provide the regional focus for the state-wide planning.

market had on their day-to-day work, they were able to move quickly and design a solution that targeted trades as the core skills of their businesses. As the network includes state and local organisations that are involved in the Queensland Skills Plan, they benefit now from the analysis and strategies proposed in the Plan and are aware of the opportunities for extended partnerships with local agencies, such as Skilling Solutions Queensland, that might provide a more tailored service for apprentices programs for SMEs. Nevertheless, MAIN CARE is likely to continue operating on behalf of the manufacturing sector in Mackay, because most of the companies are small and the benefits of the cluster model are evident.

5.2 City of Playford's Innovative City Economic Plan

The South Australian City of Playford launched its Economic Plan, *An Innovative City*, in September 1999. The area has an array of industries, but the core ones appear to relate directly to manufacturing. These include the automotive, engineering, electronics, information technology, defence, plastics, food processing and horticultural industries. Between 2001 and 2003, more than 200 companies participated in several key projects (Genoff 2003).

The economic plan was based around a strategy designed to develop new overseas markets, to enhance Playford's innovation system, and to connect with the national innovation system. The plan focused on facilitating clusters and/or networks, and since then the following have being implemented:

- Food Cluster Strategy - Produce Direct Australia Pty Ltd is a network of exporting companies employing approximately 350 people. The different firms specialise in exporting horticultural products to various Asian-based markets.
- Engineering alliance – An alliance of 14 companies has been set up to target export markets and investments. The project is undertaken in partnership with the Engineering Employers Association of South Australia.
- Grape growers and Wine producers' network – This initiative comprises 40 companies, 20 of which have formed an export network.
- Engineering network – Three local companies and Playford Council are actively working together to help these firms enter new markets, particularly in the US and the Middle East.
- Engineering alliance –Comprising two companies, which have tendered for a $5m export contract in South America and are also exploring other opportunities in China.
- Setting up of a virtual network of advanced manufacturing companies that have located at a disused factory building. So far this initiative has created approximately 120 new jobs. (Genoff 2003).

The plan has been very successful in promoting a cohesive manufacturing cluster in an area of industry decline. The key contributing elements are presented in the box below.

Box 12: City of Playford learning model

Dedicated talent and solid industry analysis: One specialist was hired to prepare the *Innovative City* economic plan. The plan was acknowledged as a leading policy document in the state. The document provided new directions for clustering and ways of thinking about innovation. The plan constituted a model in terms of economic thinking and new strategies for economic development. Over time, the team grew to the equivalent of 2.5 people. A basic initial input-output analysis and location quotients analyses provided the foundations on which to build on manufacturing strengths.

Strong local leadership: Council had a long-term vision for the area, with strong commitment from both the Mayor and the CEO. Local leadership is needed for the process of political engagement, politically obtaining funding from national agencies, and also delivering of results on the back of very good analysis.

Public funding for projects: $120,000 grant from DOTARS in 1999-2000 to start the cluster business-supply-chain plan. A second grant of $120,000 in 2000 for the food-processing cluster. 1 million dollars in 2004 from DOTARS in specific projects.

Promoting business alliances: Formation of a $230 million food global company in 2002 The food global company was formed from the investment of two companies that were initially competitors, but that formed a network specifically to enter into the Asian market.

Media focus and political recognition: Periodic media releases highlighting succesful alliances providing models and solutions of economic development. The media changed the by-line of the area from a focus on public housing, single mothers and poor living conditions, to being leaders for solutions on rebuilding the manufacturing industry. Over the years, there have continued to be front-page stories, but there are also now editorial columms.

Policy networks: 'Play for Partnerships', a group of state and federally elected members, covering both sides of local politics. The group sets performance targets, which create outcomes that determine what local government provides for the city. The 'whitefield group' brings together Mayors and CEOs of 7 Councils. The group has been very important in terms of delivering an infrastructure plan for the region. Connecting the Councils is important for attracting investment and exploring global markers.

Linking clusters: In terms of the manufacturing area it is necessary to strengthen the companies. Manufacturing inputs cover many industries. The strategy is designed to figure out who are the manufacturing companies and which ones are receiving more inputs. This enables scrutiny of the cycle between both clusters and understanding of how integrated they are, or if more companies are linked to other industry sectors. The best idea is to look at the standards of advanced manufacturing, because they have the greatest potential for growth. Australian advanced manufacturing companies are very good, because they are lean and quite efficient, and it is also important to note that they are the compaines that are exporting.

Source: Interview data, 2006

As can be seen from the box above, key elements of success in Playford City relate to activities in the industry, policy and media environments. However, as indicated by a Senior Council Manager, the critical initial step is the preparation of a solid document with an in-depth analysis of the region, based on which actions can be planned:

> 'In my opinion, 'you are what you eat' and if you don't do the hard yards and you don't think about what industries you have, what sort of policies and strategies need to build in that critical mass, you end up with a very standard document and you don't know what opportunities are available. After this document was produced, we commissioned a company to do a very basic input-output analysis and location-quotients. This work allowed us to focus on the key areas, which are basically engineering (advance manufacturing), plastics, automotive (Holden), food processing. We have some of the

> largest companies operating here; we have Holden, we have a company that supply half of the Australian market of car batteries, we have R&D companies in plastics, and we have some of the most technological food processing companies in Australia. All of these industries were neglected and the strategy provided a focus to find funding for facilitating the development of the manufacturing sector. We have a critical mass of 50-60 companies, half are not in Playford but are part of the same economic corridor' (Interview data, 2006).

The strategy of changing the way the media portrays manufacturing areas is also important, because the key role of manufacturing industries can be neglected:

> 'The key message here is strategies are driven by the 'flavours of the month' and these are biotech, ICT, nanotechnology and the creative industries. That is all very well but the reality is that at the sub-regional level we forget that manufacturing is both a producer and a consumer of goods and services and that is why even if this area is named as a rust-belt it is acutally part of the solution. We focus on supply-chains and suply-chains begin locally and end internationally. If local councils don't focus on that they end up focusing just on small business starts-ups. Anything beyond that is suply-chain clusters which are regional, national and international' (Interview data, 2006).

The role of local Councils is controversial because there are shared responsibilities with state government agencies, but turning the focus of this role onto facilitating industry development and local clusters can be extremely helpful:

> 'Other Councils around Australia do not see this as a role for local government; they think it is a role for the estate government, but we see a major failure of the South Australian government on producing opportunities for growth and economic development so we try to address that failure by providing support for these companies. The issue here is also 'leadership', there has to be a vision. If you don't have a strong vision for where the region is going and what is driving the region then you would end up with a second-rate strategy. This is important because the Mayor and the CEO here have a very strong vision and now we are doing all the urban regeneration of the city. The key quote for me is 'Innovation happens in networks and companies when they rely on core competencies of other companies as much as they do on their own competencies' and that refers to the full competence of the supply-chain. This, of course, is a problem for traditional economics because the individual organisation is at the centre of development. The reality now is that no matter how big you are, it is the combined competencies that reach the global market. We need to understand the drivers within each supply chain. Each company is different, each supply-chain is different. Each company CEO is unique and has a different way to do business. Each CEO knows that supplier companies require certain things and with some of them they work quite closely, with others they don't. It is the 20/80 % rule. 20% of your customers give you 80% of your income. With some of these suppliers they want to get close, because they realise there is always money to be made. We cannot have employment creation without investment so we do need the investment to come here' (Interview data, 2006).

The dynamics of cluster development are complex and the experience of Playford points to the extensive effort that needs to be spent on creating small partnerships around specific projects:

> 'The food global company was formed from the investment of two companies. We first ran a workshop between 10 companies and in that workshop we understood we were in front of

> potential collaborators. After that meeting of 10 companies, we had another meeting with 7 companies and out of these we were left with 3 companies that formed a network. The issue here is that companies at meetings compete against each other. When you understand that companies can work with each other and collaborate, the action happens outside the workshop. This is because the 'collaboration deals' cannot be done in a meeting, they have to be negotiated individually. Why would you sit in a room with a competitor, hold hands and say 'I am going to break into a new market'. This doesn't happen and it will never happen. And that is why the workshops of clusters don't get traction. Some consultants are fantastic at getting people together and letting them know how the clusters work. After that the companies need to work it out individually. So we did that outside of the workshop, one-by-one, so I got the companies eventually together and we expended time with the accountants, and the CEOs formulated a financial strategy and a business plan for the new 1 million dollar company that now has the critical mass to be at the forefront of technology. They have the best processing plan probably in the world. They are digitally processing potatoes – 35 tonnes at hour including washing and packaging and sorting. So every potato gets digitalled. Why they come together is because they have to get into Asia so that was the 'glue' to bring the competitors together' (Interview data, 2006).

Outputs of the strategy are not measured in terms of employment, although employment and productivity are analysed together:

> 'We don't track employment. Employment right now is very strong, the companies are strong. In 2 years time when there is a downturn will companies lose jobs? – yes. Some of the investments that have been made also reduce job losses. The issue here is that in terms of manufacturing development, productivity improvement means job losses. And that is part of doing business. The issue is, can you get the fundamentals around the region so that investments create the seed of new labour? During this 10 year investment cycle we have strong employment creation so that also means that our productivity growth has gone down a little bit. It is very, very complex. And it is absolutelly misguided if you said we have created the conditions for economic development' (Interview data, 2006).

Outputs, however, can be measured in terms of knowledge intensive services activities (KISA) provided by Council. The box below presents KISA produced by the 2.5 (full-time equivalent) Council staff dedicated to strategic industry development:

Box 13: KISA by Playford Council

- Annual conference with about 300 companies
- Individual company interviews to promote collaboration
- Business Enterprise Centre. Council funds $20,000 and another $100,000 received from the estate government
- $1 million dollar CAD-CAM centre run by Council, with 20-30 companies using these computers for advanced manufacturing design. Companies pay for training. The project pays for 1 engineer P/T.
- Collaboration with 'Centre for Advance Manufacturing Design' located at University of South Australia, who have a desk at Council specifically for innovation projects.
- Connection to broader programs – infrastructure planning as part of major regional strategy looking at roads, knowledge infrastructure etc.
- Preparation of grants applications in collaboration with industry
- Analysis work for industry – R&D, industry evaluation, and business plans
- Large events where information is disseminated and where individual attention is given to creating global networks with the interested companies. For example, 40 companies recently formed a wine association.

Source: Interview data, 2006

5.3 i3Net and HunterNet

Two manufacturing cluster initiatives were analysed in the Greater Sydney Metropolitan region: the Illawarra Innovative Industry Network (i3Net), located in Wollongong; and HunterNet, a manufacturing engineering network located in Newcastle. Both networks are located in regions with a substantial heavy manufacturing past developed by the BHP Steel Works Company. Both regions have experienced a steep decline in their manufacturing demand; Newcastle closed their steel works plant at the end of the 1990s and Wollongong's steel works have significantly reduced their operations. Selected features from these two networks are discussed in this section.

i3Net aims to promote Illawarra industrial firms to local, national and international business markets. i3Net is a relatively new initiative, having only appointed a Business Development Manager in May 2005. The Illawarra region has a history of being a heavy industrial centre, with many of i3Net's 13 core member companies providing project management in the blast furnaces, continuous casters, rolling mills, steel superstructures, mining infrastructure and equipment, and offshore oil rigs industries. There are 57 other businesses that are linked to the network, but which are less involved in i3Net activities.[8]

The network developed from the Australian Industry Group (AIG), based on a collection of engineering and manufacturing companies that wanted to join and develop as a group. The main companies pushing for this amalgamation were SMEs of less than 100 employees that were relying on the steel industry and coal mining as their main operating sectors. The network started with the strong interest of just five companies that wanted to create a business environment in conjunction with the core business they already had with the large Blue Scope Steel Company. In the year 2000-01 there was a feasibility study and a survey undertaken of 60 local companies. The study was financed by the State and Regional Development Department (DSRD), Wollongong Council and AIG and resulted in a profile of the companies. Out of the 60 companies involved, 15 companies formed the network, which was primarily focused on trade exports, but which quickly moved from there into development of the six key strategic objectives presented in Box 14 below.

[8] (http://www.i3net.com.au/index.pl?page=7, accessed 21 Dec 2006)

Box 14: i[3]Net Strategic Objectives

- To provide the tools, processes and coordination to enable networking between organisations and to act as a channel of communication between the network and external organisations.
- To maintain and grow the membership base of the network to optimise its effectiveness as a network and its business development opportunities.
- To expand member company business capability and confidence through increased access to knowledge, network contacts, skills and resources.
- To expand member company market focus through enabling better understanding of alternate market opportunities, by sharing knowledge, expertise, skills and costs.
- To provide tools to professionally market and encourage the network, member firms and the united capability of the Illawarra regions' manufacturing and engineering industry to business markets and the community.
- To act as the focal point to support the active pursuit of new business opportunities both locally, outside the region, and internationally, to extend the customer base of member companies & the local engineering & manufacturing industry.

Source: Interview data, 2006.

By this time, there were several champions behind the efforts to develop i[3]Net; the main ones being the Australian Industry Group, two local companies and the State and Regional Development Department (DSRD), which is an unusual combination of private-public partnership designed to further cluster development. This partnership was instrumental in obtaining funding that would allow the network to undertake a feasibility study to forecast governance needs and potential growth of i[3]Net. Three key factors arose from the study: (1) the need for a full time resource; (2) significant opportunities for the network; and (3) the need for sustained involvement of companies. The results of this report assisted in gaining further funding for a full-time network broker, who was then able to reverse a situation of rapid membership shrinkage.

The companies' part of the network offered different services to the steel and mining sector. These cover the areas of IT, engineering, environmental equipment, automation & control, etcetera, and 75% of these companies are linked to Blue Scope (who does not participate in the network). At the governance level, the network has a Board of Directors, membership fees and monthly meetings. Each board member is aligned with a strategic objective that needs to be pursued. The activity of the network fluctuates with the activity of Blue Scope (the main company operating in the area): if there is a strong demand for suppliers, everybody is very busy and consequently network activity is low. When things are quiet, the need for the network is reasserted and therefore its activity level rises (Interview data, 2006). One of the major roles of the network is to organise knowledge intensive service activities (KISA) for members (see Box 15 below).

Box 15: KISA by i[3]Net

- Compile profiles of core capabilities from each company;
- Prepare promotional marketing materials for the network;
- Representation of i[3]Net to significant customers, thereby raising the profile of individual companies;
- Building a 'virtual community' website, developed with funding from DEST;
- Information services to external groups that research i[3]Net after meeting one of the member companies;
- Investigation of new regional markets such as 'New Caledonia', WA, China, Thailand, and India, within the traditional sectors of steel mining & metals manufacturing;
- Investigation of new sectors such as defence;
- Bidding for group contracts by forming network companies;
- Collaboration with local regional organisations to facilitate 'export missions' to China and other countries;
- Facilitating regional networks to access public funding and support from the following organisations: Illawarra Regional Development Board, Wollongong City Council (Economic Development), DSRD, DEST and ACC.

Source: Interview data, 2006

HunterNet was formed in 1992 in Newcastle as a Co-operative (Ltd) of SME manufacturing, engineering and consulting companies. The Hunter area has a long association with the mining and manufacturing industries. However, by the early 1990s, many companies found themselves competing in a more global environment largely due to changes in the national and international markets, and there was a strong need to join forces in order to survive within this environment. The network consists of 44 member companies.

The network primarily plays a role as a training provider. For example, the 'Innovate the Hunter' and its associated 'Export Awareness' training program aims to assist engineers and manufacturers in securing export markets. Much of this training aspect is handled by the *HunterNet Group Training Company*, which was established by members to support local enterprises that were lacking the resources necessary for the provision of structured 'on-the-job' training programs.[9] Highlights of this activity and other KISA are presented in Box 16 below.

Box 16: KISA by HunterNet

- HunterNet plays a prominent role as a training provider. For this reason, the HunterNet Group Training Company was established by the Co-operative members. This initiative consolidates on and off-the-job learning for apprentice training. Apprentices and trainees are employed by the HunterNet Group Training Company on behalf of companies, which guarantee their positions for the duration of their training. During the apprenticeships, they are placed in different member companies across a number of industries and firms.
- Organisation of other initiatives such as the 'Innovate the Hunter' scheme and its 'Export Awareness' training program, which is aimed at assisting engineers and manufacturers to work towards securing export markets.
- Maintenance of the HunterNet website, which acts as an information conduit for member and other interested organisations, by providing information on national and international conferences, new products, management courses, job-related practices and other related fields.

Source: Desktop research http://www.hunternet.com.au/ and Interview data, 2006

[9] (HunterNet, http://www.hunternet.com.au/ accessed November 2006)

5.4 Summary

This chapter discussed four learning models: the Mackay Area Industry Network (MAIN), the City of Playford's *Innovative City* Economic Plan, the i^{3}Net cluster in Wollongong, and the HunterNet engineering network in Newcastle. The four networks emerged in response to changing conditions in the global market, decline of the manufacturing sector, or acute skill shortages that threatened the growth of the companies.

The 'Mackay Industry Network' (MAIN) was formed in the mid-1990s, in an attempt to solve the skills shortages experienced by the participating companies, when it became evident that the national apprentice training system was not responding fast enough keep p with the growth of the manufacturing industry. MAIN acts as an intermediary agent, connecting industry with education agents; they organise all bookings for all their apprentices, and they also focus on anticipating the type of skills gaps prospective employers may have in the near future. The MAIN network example highlights the importance of providing the private sector with mechanisms for participation in the design of solutions to their labour market imperatives. MAIN started to address the skills shortage existing in the trades area some time in advance of the Queensland Government's Skills Plan. Because these companies based their strategic analysis and planning around the direct local market impacts on their day-to-day work, they were able to move quickly and design a solution that targeted trades as being the core skills needed by their businesses. MAIN is likely to continue operating for the benefit of the manufacturing sector in Mackay, as most of its 50 active companies are small, and the advantages of the cluster model are evident.

The second learning model is the South Australian City of Playford's 1999 Economic Plan, *An Innovative City*. The economic plan was based around a strategy designed to develop new overseas markets, to enhance Playford's innovation system, and to connect with the national innovation system. The plan focused on facilitating clusters and/or networks in the manufacturing sector and today there are more than 200 firms associated with the manufacturing cluster. Key elements of success relate to industry, policy and media environments such as: engagement of dedicated staff who coordinated an initial industry analysis; strong Council leadership; public funding for projects; promotion of business alliances; engagement with media to portrait the key role of modern manufacturing; promotion of policy networks; and linking clusters nationally and internationally.

KISA facilitated by the development of the strategy are: the organisation of conferences and events; networking services; business development services; design services; economic development consulting services ; and preparation of grant proposals and research services.

The third learning model, i^{3}Net, is a new manufacturing network that started in 2005 in Wollongong, which is in the Illawarra region, south of Sydney. The Illawarra has a history of being a heavy industrial centre, with many of i^{3}Net's 13 core member companies providing project management in the blast furnaces, continuous casters, rolling mills, steel superstructures, mining infrastructure and equipment, and offshore oil rigs industries. There are 57 other businesses that are less involved in i^{3}Net activities, but which are still linked to the network.

KISA facilitated by the network refer to: secretarial services, such as compiling company profiles outlining core capabilities; marketing and promotional services; website maintenance and information diffusion services; research services for means of entering new markets or new industry sectors; networking services and alliance formation; facilitation of overseas fact-finding and contact missions; and facilitation of regional networks to access public funding and support.

The fourth learning model, HunterNet, was set up in 1992 in Newcastle as a Co-operative (Ltd) of SME manufacturing, engineering and consulting companies. The Hunter area has a long association with the mining and manufacturing industries. However, by the early 1990s, many companies found themselves competing in a more global environment, largely due to changes in the national and international markets, and there was a strong need for these companies to join forces in order to survive in that environment. The network has 44 member companies.

HunterNet plays a prominent role as a training provider. For this reason, the HunterNet Group Training Company was established by the Co-operative members. This initiative consolidates both on and off-the-job training for apprentices. The network also organises other initiatives, such as the 'Innovate the Hunter' scheme and its associated 'Export Awareness' training program, which is aimed at assisting engineers and manufacturers in securing export markets. The network also maintains the HunterNet website, which acts as an information conduit for member and other interested organisations.

6. Conclusions and Local Policy Suggestions

Key Policy Suggestions

- Strengthen the Liverpool, Bankstown, and Fairfield 'SWS manufacturing triangle' with a manufacturing support partnership between the three Councils to discuss the facilitation of a 'cluster'.
- Initiate the process by leading the first event, engaging firms and partner councils in a 'metals industry manufacturing summit'.
- Facilitate the engagement of a F/T cluster facilitator, initially funded by a public program (e.g. DSRD).
- Focus on four strategies for cluster development:
  - Cluster governance with dedicated professionals;
  - 'Core' KISA delivery (business planning advice, accounting and finance, IT services, marketing and promotion and research and development);
  - Training and skills upgrade in core areas related to global competition;
  - Branding the 'SWS manufacturing triangle', to attract a new generation of talent and firms, keep existing firms and stimulate the creation of manufacturing service firms.

This study focused on understanding core manufacturing competitiveness in the City of Liverpool and South West Sydney, both in terms of industry specialisation and innovation intensity, in order to provide key elements necessary for the development of an industry cluster. Several conclusions can be drawn from this analysis.

First, manufacturing is undergoing a major transformation. Manufacturing production is changing in OECD countries, with increasing focus being placed on high-value added services. Manufacturing production has become more and more integrated at the global level and value-chains can cross countries and continents, resulting in a growing fragmentation of production. However, the much-discussed decline in employment is due to productivity growth, not to the transfer of activities to non-OECD countries, and therefore the future of manufacturing relies on specialisation of production, which requires advanced skills and where the price of the workforce is not a key factor. Manufacturing activities are already blurred, with multiple specialised services occurring throughout the production process, the value-chain, and frequently within the manufacturing firm. Identifying these services and adding value to them will assist in the transformation of the industry into a more knowledge-based production industry.

Secondly, the diversification of the value-chain brought international attention to the competitive advantage of clusters; which have been defined as concentrations of highly specialised skills and knowledge, institutions, rivals, related businesses, and sophisticated customers within a particular nation or region (Porter 2000). Clusters need a strong industry capability base from which to start, but then they thrive on knowledge, innovation activities and alliances, and therefore local institutions can play a large role in supporting clusters initiatives, facilitating their development and branding the region within which they operate.

Third, the study found evidence of three strong manufacturing concentrations in the South West Sydney 'Manufacturing Triangle' of Liverpool, Fairfield, and Bankstown: metal products; petrol, coal and associated products; and wood and paper products. *Metal Products Manufacturing* has a high level of employment, high level of production (39.1% of the entire Sydney metropolitan area), strong local growth component despite strong negative whole-industry growth, and a large number of companies involved in the industry in South West Sydney (many based in Liverpool). *Petrol, Coal, Chemical and Associated Product Manufacturing* has the highest levels of employment and the highest levels of actual job growth in the 1996-2001 period. *Wood and Paper Product Manufacturing has* strong local concentrations of corrugated paperboard containers manufacturing and mattress manufacturing.

Fourth, the in-depth analysis of five South West Sydney metal firms showed there are high levels of innovative activity at an incremental level in product, service and organisational innovation. In line with international trends in the reform of manufacturing, the metals firms produced and utilised multiple services across the whole manufacturing process. Their knowledge intensive service activities (KISA) concentrate on sales, logistics and distribution, safety and OHS, and marketing and promotions; especially before and during the manufacturing processes. KISA are a mix of in-house and externally purchased services, which are accessed more frequently from the Sydney metropolitan area than from the local area.

Fifth, regarding the specific advantages of clusters, firms noted the potential for circulating customers across the cluster, the attraction of more business into the region from different parts of the value-chain, the nurturing of local sources of expertise and talent, the potential access to new jobs circulating through the cluster, and the potential to make the industry as a whole more sustainable. Firms already place an important role on their collaboration networks, with the main actors being customers and suppliers and other parts of the industry group to which the firm belongs.

Sixth, the analysis of learning cluster models indicates there are four main elements of successful manufacturing clusters. One important element is the training of apprentices for the member companies as a means of recruiting new talent and customising learning. In some cases, the cluster creates its own training company for this purpose. Another element is the promotion of alliances, to create bigger, stronger and more sophisticated competencies, usually involving 2-3 companies from within the cluster. The new company or alliance usually pursues new markets (e.g. in Asia) or new industry sectors (e.g. defence). Another key element is the provision of secretariat services to organise meetings, overseas missions and marketing projects. A final element refers to the delivery of more sophisticated intellectual services (KISA) such as R&D and business development advice,

and political services such as lobbying governments for funding for specific projects and infrastructure. Clusters constitute an excellent platform for delivering KISA that are customised to the needs of the firms within a particular industry sector and within a particular business space. Critically important to cluster development is the employment of a full-time facilitator right from the early stages of the cluster. The facilitator is usually funded via public programs for 2-5 years or until the cluster becomes self-funded.

These conclusions are not without their challenges. The reform of the manufacturing industry has implications for the labour market, which needs to absorb the shift of manufacturing workers across to services. One of the roles that government institutions play is facilitation of this shift and helping displaced workers to find a place in the changing labour market. Clusters can adapt and over time they can generate more sophisticated products and services, which can absorb part of the shifting workforce.

Another challenge is to retain manufacturing industries in our cities and regions, because manufacturing continues to be a strong producer of technological change and innovation activity. To achieve this goal *the link between manufacturing and KISA can help to bring high added value activities to traditional manufacturing sectors such as metals fabrication.* Another aspect requiring attention is the need to modernise the firm floor space in such a way that it will appeal to the young, so that attracting a new generation is possible. Factories will need to re-think the way they design their floor space and ensure the environment is clean, quiet and safe, including pleasant interior spaces, ergonomic tools and modern IT facilities. The nature of the jobs will also need to change to become more interesting, challenging, requiring specialised skills and providing good opportunities for employee self-development in organisations that are currently flat.

A final policy consideration regards linking local clusters with other clusters both nationally and internationally. Especially in the case of manufacturing, the value-chain is integrated at the global level and key knowledge circulates throughout the whole value-chain.

6.1 Policy Suggestions

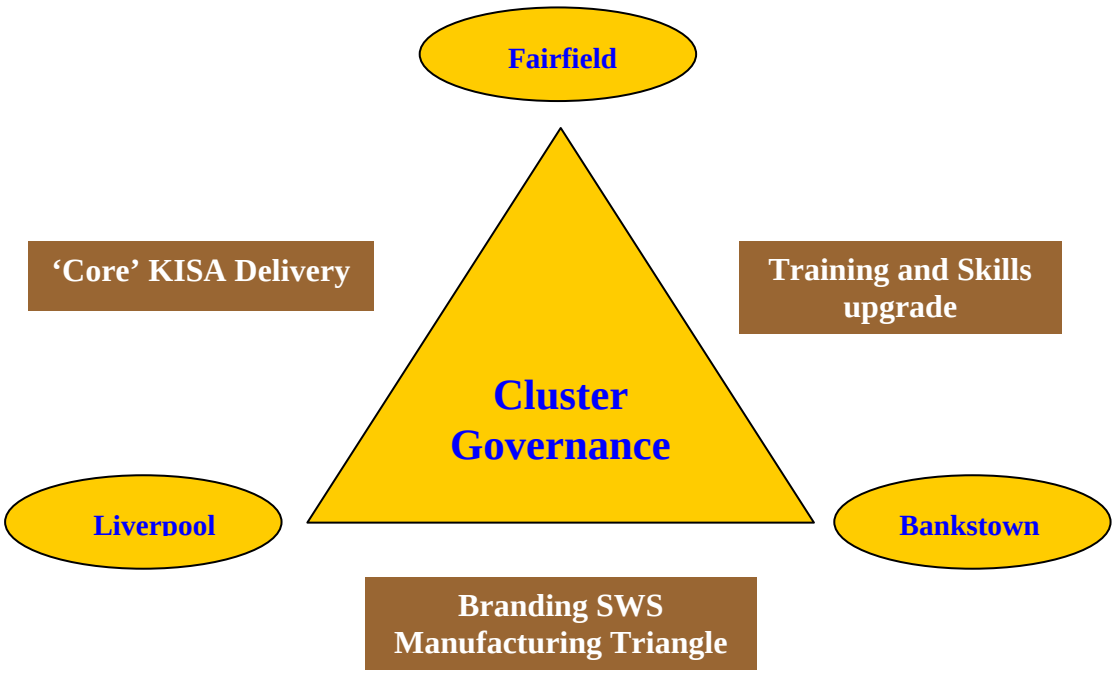
The main recommendation of this study is for the Councils of the 'SWS manufacturing triangle' (Liverpool, Bankstown and Fairfield) to form a 'manufacturing support partnership' to facilitate the development of manufacturing clusters (e.g. fabricated metals). Facilitating clusters can have a positive impact on addressing skill shortages at the local level, which can result in the creation of skill-hubs for the current and future needs of the industry. However, clusters need a regional focus to better reflect the extension of economic activity and interactivity through the value-chain. They also need resources that can be shared across the region.

Companies need support to initiate these collaboration structures, and dedicated professionals are needed for the task. It is too hard for companies, especially those in declining areas, to obtain capital with which to create the organisational structure needed by such clusters. This is where governments and local agencies can provide assistance, and through support of clusters and networks, enable creation of skills-hubs and innovation

spots. The investment required is usually small, and the solutions that companies come up with together are usually very well tailored to the local operating context. State programs, such as those lead by the Department of State and Regional Development (DSRD), are well placed to support cluster development in collaboration with local Councils.

There are four key strategic areas of cluster development: cluster governance; core KISA delivery; training and skills upgrade; and branding the South West Sydney manufacturing triangle (see Figure 18 below). *Cluster governance* is at the centre of the plan, because both the literature and the analysis of firms and successful learning models noted the importance of having dedicated professionals (usually a full-time facilitator and a cluster Board), and a good management and strategic structure to guide the process over time.

Figure 18: Key elements of cluster development



'Core' KISA delivery refers to the cluster acting as a platform for the use and production of knowledge intensive service activities, specifically those that are more related to the core capabilities of the firms and to the core of the innovation process. These activities relate to business planning advice, accounting and finance, IT services, marketing and promotion, and research and development. Good cluster governance would understand the changing needs of the firms and whether or not the core KISA remain unchanged or need to be updated.

Training and skills upgrade refers to the need to focus on customising training so that it targets the core competencies of firms and those skills that are needed to meet changing business demands. Industry clusters provide a 'thinking business space' in which

to develop potential solutions to skills shortages, lack of attraction of new talent, and the challenges of up-skilling and re-skilling the workforce.

Branding South West Sydney manufacturing triangle (cities of Liverpool, Bankstown and Fairfield) addresses the need to link clusters across broader economic spaces. It also encourages other firms to perceive the area as a solid manufacturing base, focusing on high value added activities. These activities have the potential to create a challenging environment with which to attract a new generation, retain current manufacturing workers and enterprises in the area, and stimulate the creation of new enterprises, focused on providing specialised manufacturing services to the region and other manufacturing regions nationally and internationally.

Two actions are needed for branding the manufacturing triangle. One is to communicate with the firms and bring them together to discuss the possible development of a cluster. A parallel action is to prepare a memorandum of agreement between the Councils so that existing regional resources can be used and a new grant to State or Federal agencies can be prepared for a full time cluster facilitator. A ‘metals industry manufacturing summit’ organised by the Councils could facilitate this process of engagement. The role of local Councils as facilitators of cluster development is relevant to the reform of manufacturing in cities, and involves providing a solid leadership for industry and employment local policy.

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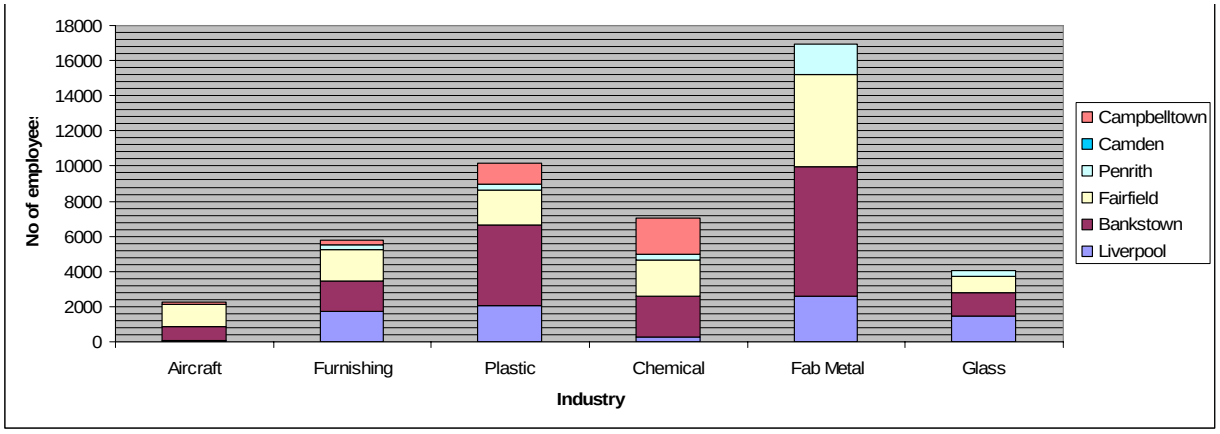
Appendix A – Analysis of potential industries (using Kompass)

To better understand the industrial makeup and manufacturing capability in South West Sydney and also to help identify the main manufacturing hubs in the Liverpool Local Government Area (LGA), this study utilised business data categorised under ANZSIC related classes, creating a thorough breakdown of all manufacturers, categorised by industry, LGA, suburb, postcode, number of employees and when available annual revenue. To help out with the process, this study identified several potential industries of interest. They are:

- Aircraft
- Furnishing
- Plastic products
- Other Chemical products
- Fabricated Metals
- Glass and glass products

The size of any industrial sector is strongly reliant on the size of its workforce. By and large, Bankstown appears to dominate manufacturing in the South Western Sydney region, followed by the Fairfield and 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 jobs generated.

Figure 19: Number of employees per industrial sector

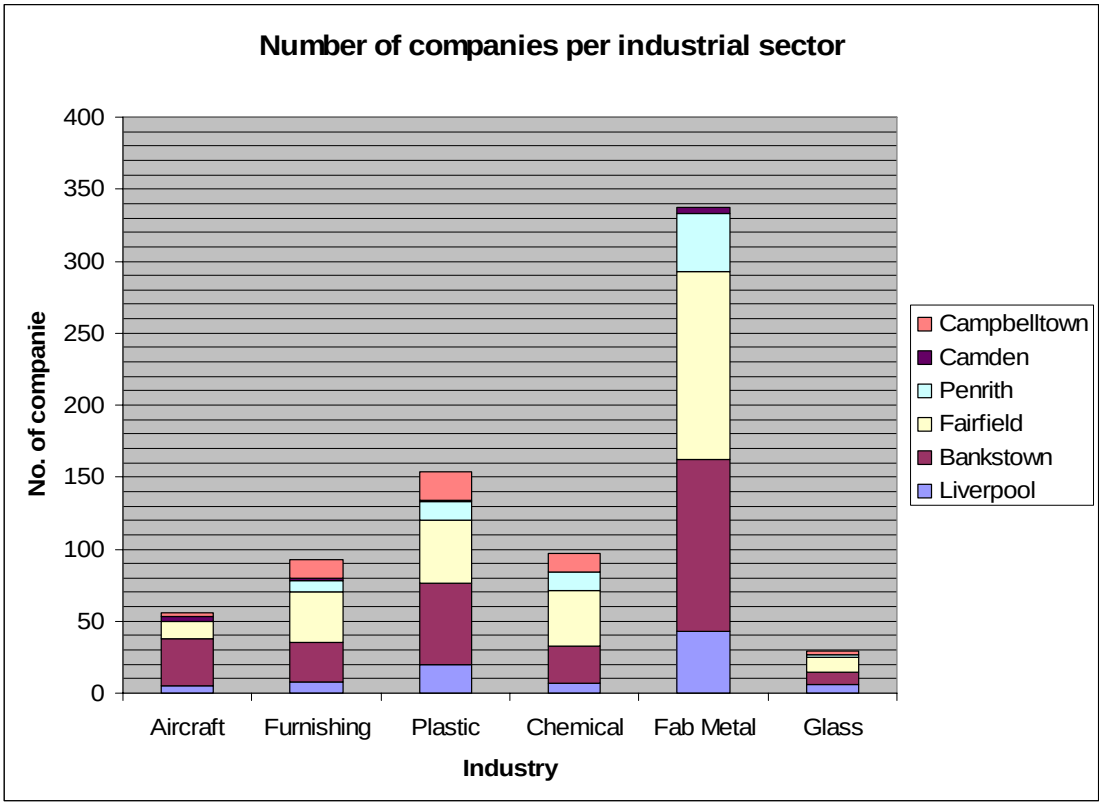


Source: Kompass Australia, 2005

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 that 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.

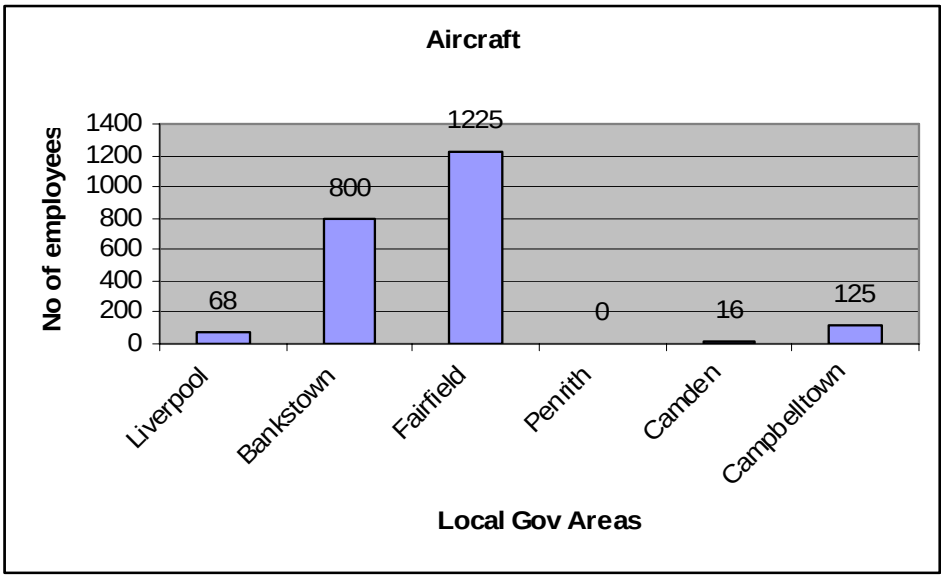
Figure 20: Number of companies per industrial sector



Source: Kompass Australia, 2005

The Aircraft industry:

Figure 21: Number of employees working in the Aircraft industry



Source: Kompass Australia, 2005

By any standards, the aircraft industry enjoys a high level of prestige, largely due to its association with not only the traditional glamour of flight and travel, but also its association with sophisticated manufacturing technology and the high technology industry. This category includes aircraft manufacture and maintenance, including engine components, electronic and safety equipment, and cabin furnishings.

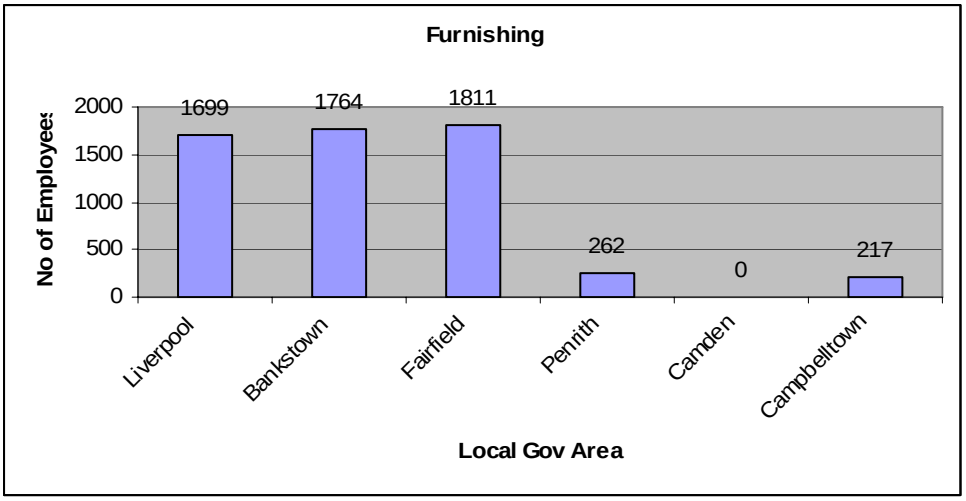
Statistics clearly show that a considerable concentration of associated firms predominate in Fairfield, with 1,225 employees working in that LGA. Bankstown follows relatively closely, with 800 employees, despite its local domestic aerodrome. While Fairfield may have the bulk of aircraft industry jobs, this employment is dominated by only 12 firms, the largest of which is General Electric International Inc, which hires 600 workers, and Thorn Lighting Private Limited, which has another 350 employees.

However, Bankstown, with a more modest 800 employees, has a much more diverse array of firms than Fairfield. There are 33 aircraft related firms in Bankstown, relating to maintenance, repair, components, tooling and sales. The largest firm in Bankstown is Australian Aerospace Limited, with 300 employees and $303m in annual revenue.

Liverpool has a much more modest array of only 5 aircraft-related firms, employing 68 people. The largest firm has a $5-10m annual turnover.

The Furnishing industry

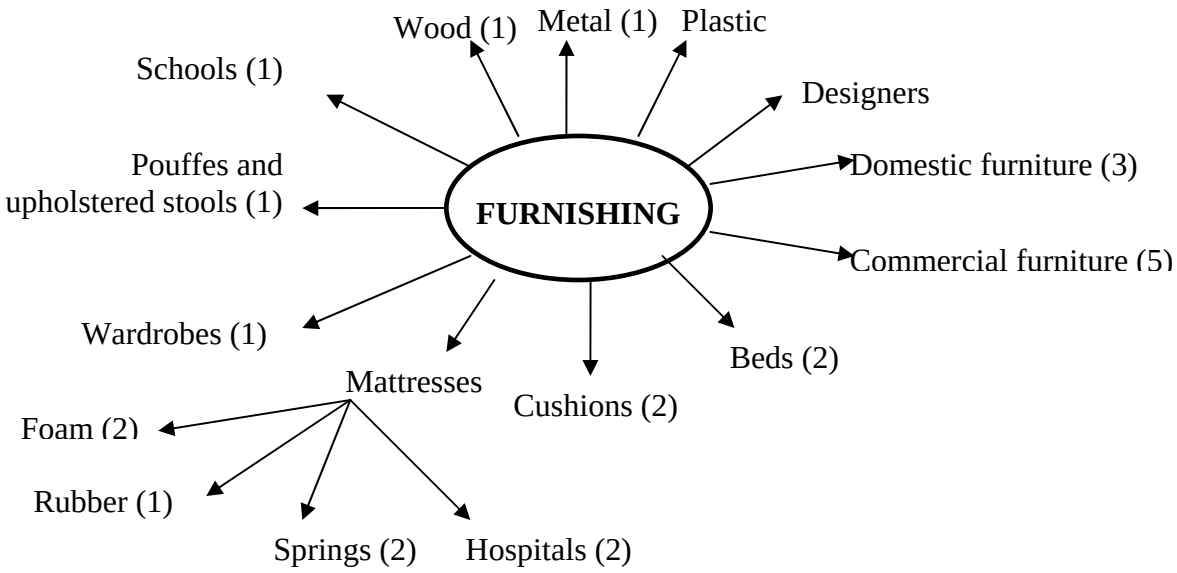
Figure 22: Number of employees working in the Furnishing industry



Source: Kompass Australia, 2005

The furnishing industry encompasses largely domestic and commercial furniture manufacturing. Fairfield has 1,811 people employed in the furnishing industry. They are closely followed by Bankstown with 1,764 and Liverpool with 1,699 people. While these 3 areas have relatively similar numbers of workers in their corresponding areas, the diversity of companies is more apparent in Bankstown and Fairfield than in Liverpool. In Bankstown and Fairfield there are 35 and 27 furnishing firms respectively. However, Liverpool has only 8. The size of Liverpool's industry is largely due to one very large firm, Stegbar Private Limited, which employs 1,350 people and has an annual turnover of $176m.

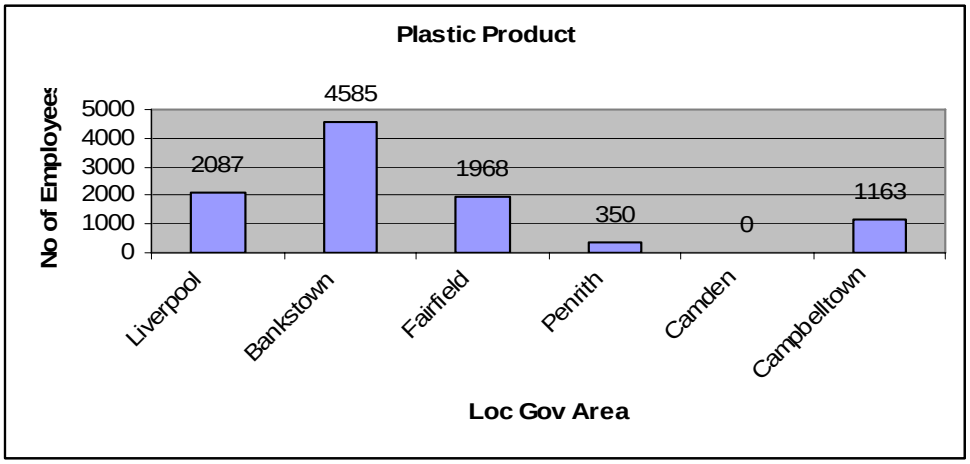
Figure 23: Map of Furnishing Industry product outcomes



Industry	Products
Wood, metal and plastic products	Furniture materials
Designers	
Domestic furniture	Beds and bases, wardrobes, chairs & tables, wardrobes
Commercial furniture	Hotel, restaurant, industrial & laboratory, display systems, theatre, sports complex, passenger terminals, religious buildings
Cushions	Seat, orthopaedic, pouffes & upholstered stools
Mattresses	Foam filled, spring, children, caravan, waterbeds
Schools	Blackboards, markerboards
Hospitals	Mattresses

The Plastics industry

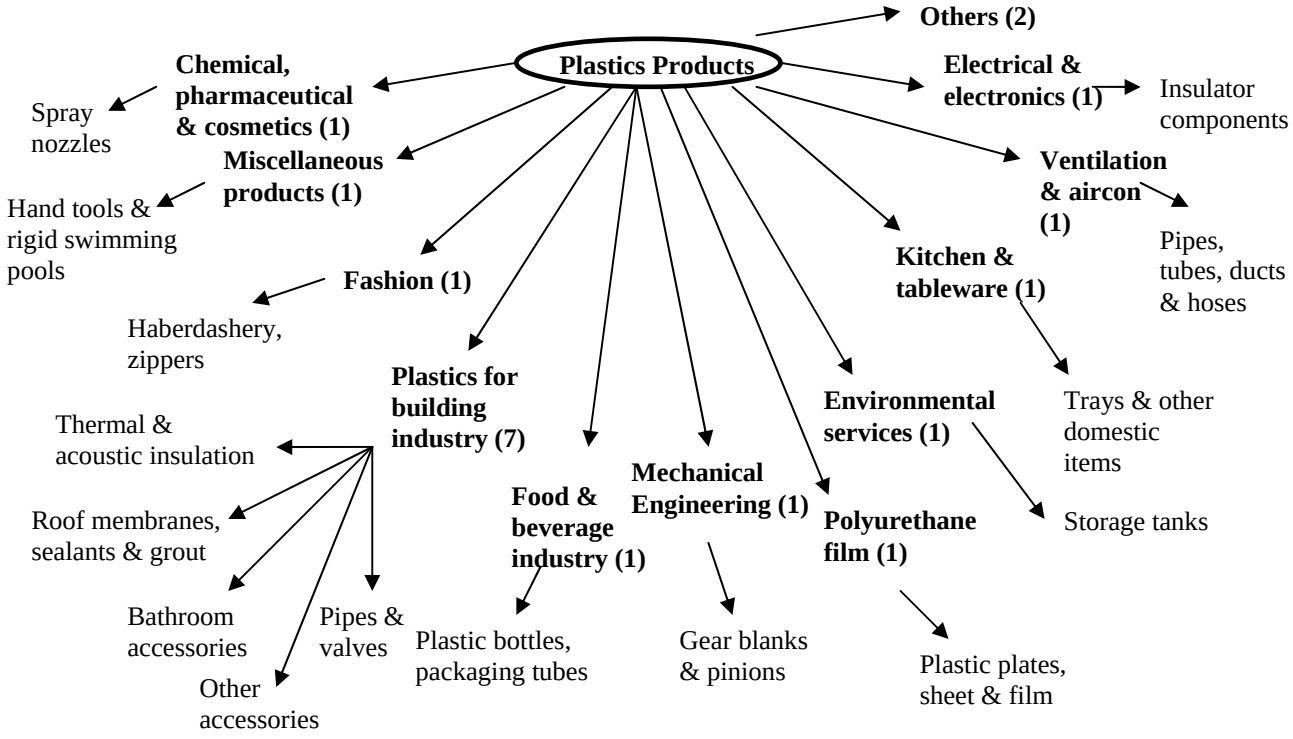
Figure 24: Number of employees working in the Plastics industry



Source: Kompass Australia, 2005

Plastic product manufacture includes products such as lamination, plastic recycling, glass fibre, pipes, tubes, hoses, casks, drums, containers, packaging, bottles, bags and other components for the transport and building industries, for domestic use, for the engineering, electronics, medical and retail industries. Bankstown dominates this sector, hiring approximately 4,585 people, followed by Liverpool with 2,087 and Fairfield with 1,968. Despite the relatively similar employment numbers for Liverpool and Fairfield, Liverpool (20) appears to have a considerably smaller pool of firms than Fairfield (44). Campbelltown does not lag far behind with 1,163 employees, but the numbers taper off with 350 at Penrith and none in Camden.

Figure 25: Map of Plastic Industry product outputs

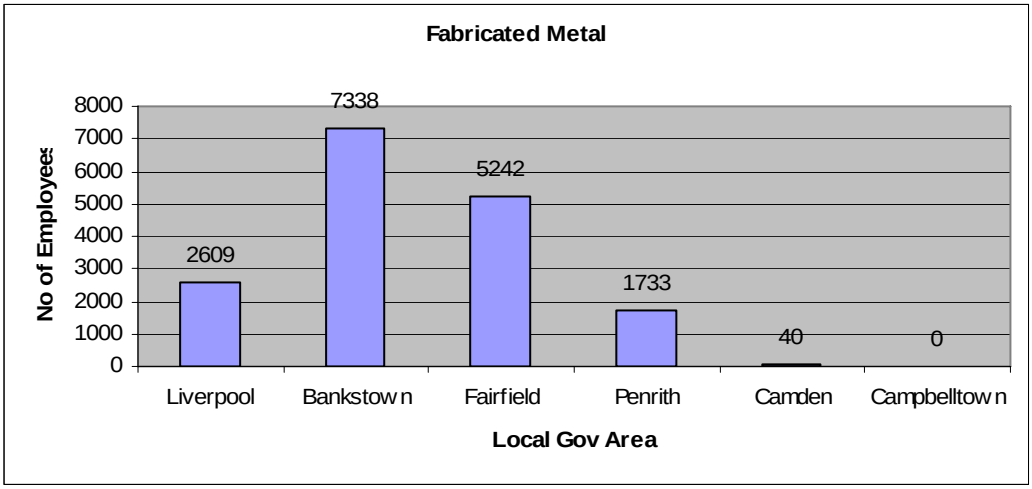


Industry Products

Chemical, pharmaceutical & cosmetic	Spray nozzles, plastic, chemical resistant
Fashion	Haberdashery articles, plastic – zip fasteners
Mechanical Engineering industry	Gear blanks & pinions, wear strips for converyors
Kitchen articles and tableware	Trays and other domestic items
Electrical and electronics industry	Electrical insulator components
Pipes & Valves	Valves, cocks, taps and fittings
Environmental Services	Storage tanks, glass fibre reinforced plastic
Ventilation and air conditioners	Pipes, tubes, ducts and hoses
Plastic products for building industry	Thermal and acoustic insulation, roof membrane, sealants and grouts
Food and beverage industry	Plastic bottles and packaging tubes
Polyurethane film	Plastic plates, sheet and film and polyurethane
Others	Bathroom accessories, plastic based coating for metals

The Fabricated Metals Industry

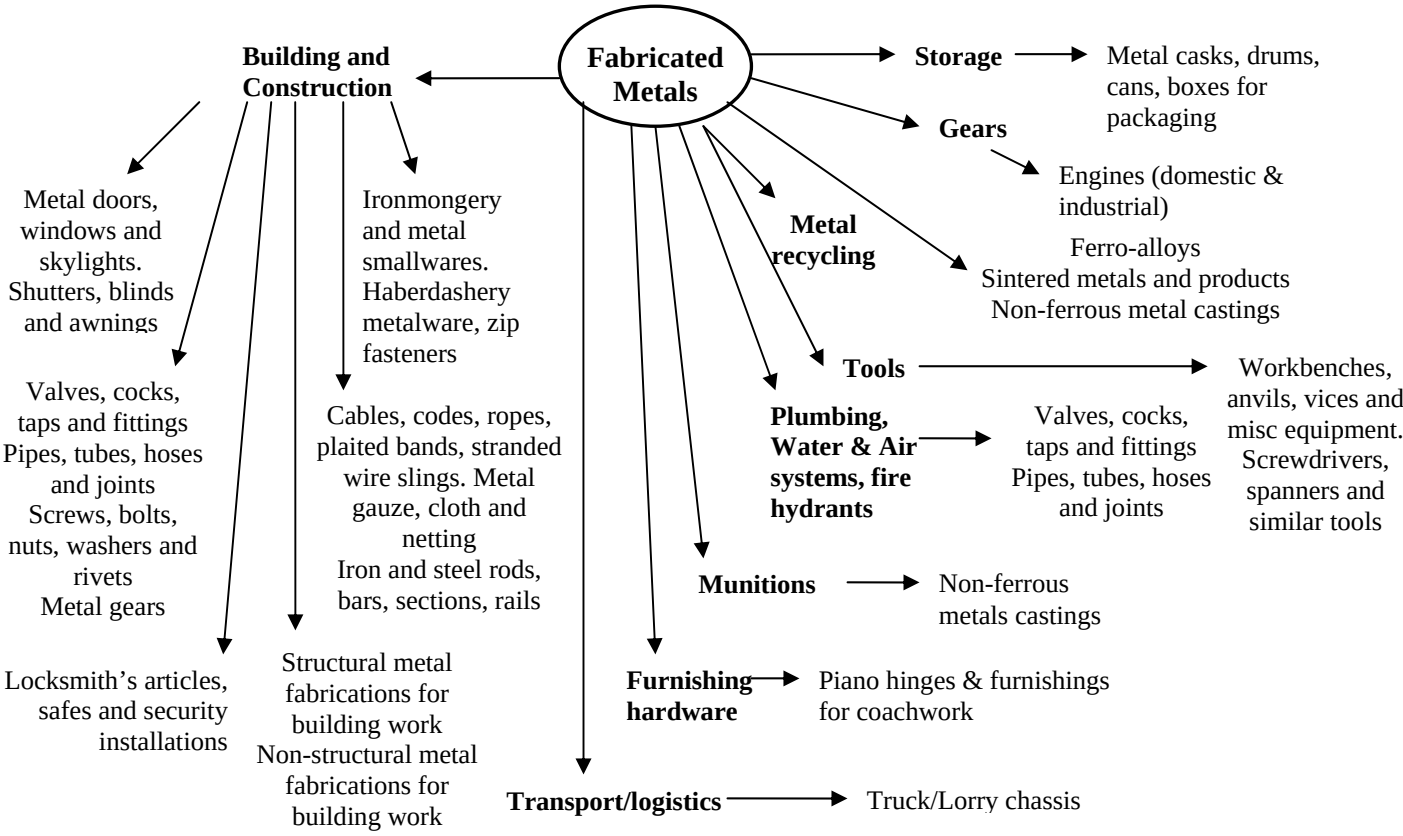
Figure 26: Number of employees working in the Fabricated Metals Industry



Source: Kompass Australia, 2005

The Fabricated Metals category encompasses a vast array of manufacturers. It covers products such as iron, steel, non-ferrous metals, castings, pipes, valves, tanks, sanitary and household articles. The Fabricated Metals industry is the largest employer. By far the bulk of the jobs are located in Bankstown (7,338), followed by Fairfield (5,242), Liverpool (2,609) and Penrith (1,733). The large number of Bankstown jobs is held by only about 119 firms, while Fairfield's lesser amount is sustained by a higher 131 firms. This is largely due to at least 12 Bankstown-based firms hiring in excess of 200 people each. In comparison, there are only 5 firms that hire in excess of 200 people in Fairfield.

Figure 27: Map of Fabricated Metals product outputs

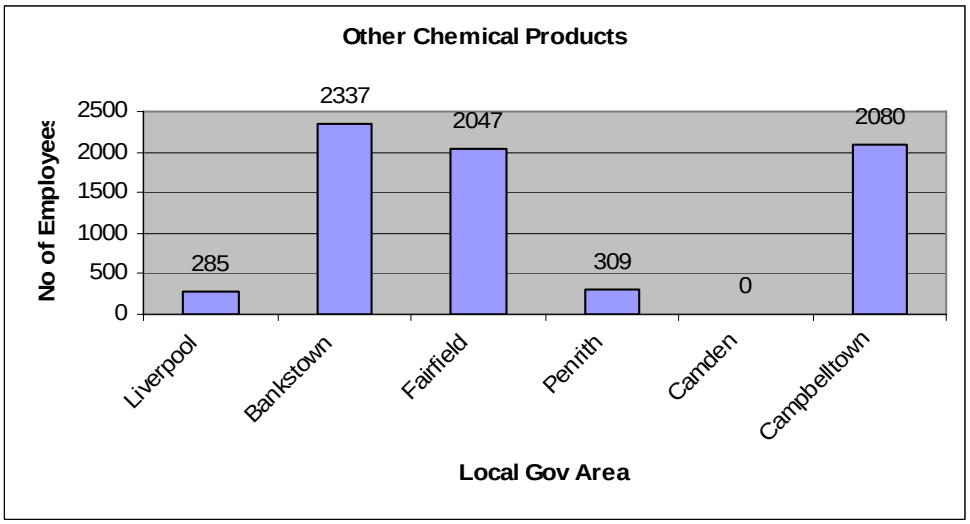


Industry Product

Building and Construction industry	Metal doors, windows etc, Ironmongery & metal small wares, Valves, cocks, taps and fittings, Locksmiths articles, Cables, codes & ropes, Structural metal & non-structural metalwork for building work.
Storage	Metal casks, drums, cans boxes
Gears	Engines (domestic and industrial)
Metal recycling	Reselling to metal manufacturers
Tools	Workbenches, anvils, vices and similar tools
Plumbing, water & air systems, fire hydrants	Valves, cocks, taps & fittings. Pipes, tubes, hoses and joints
Munitions	Non-ferrous metals casting for guns
Furnishing hardware	Piano hinges & furnishings for coachwork
Transport/Logistics	Truck & Lorry chassis

The Chemicals Industry

Figure 28: Number of employees working in the Chemical Products Industry

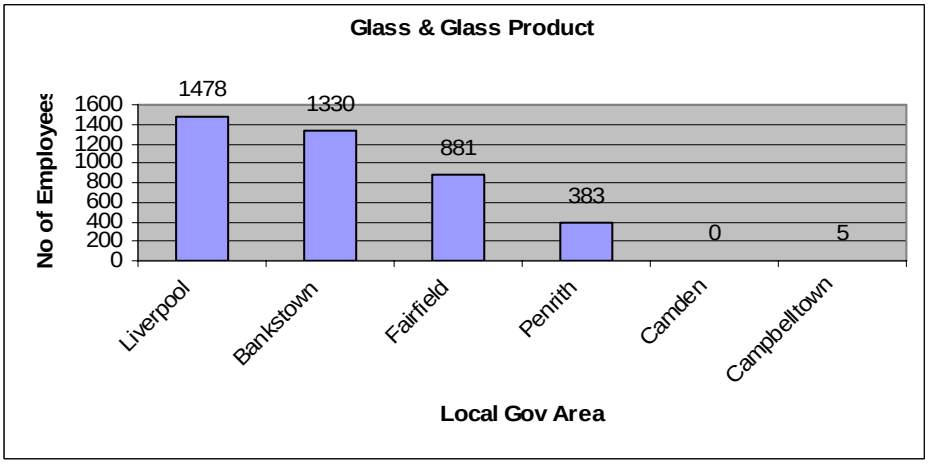


Source: Kompass Australia, 2005

This category involves the production of pharmaceuticals, fertilisers, fungicides, herbicides, disinfectants, detergents, cosmetics, pigments, adhesives, pyrotechnics, organic and inorganic acids, various metal compounds, alcohols, amines, vitamins, natural and synthetic oils. This sector is largely dominated by Bankstown (2,337), Fairfield (2,047) and Campbelltown (2,080). Liverpool holds approximately 285 chemical industry-related jobs and is only slightly overshadowed by Penrith with 309.

The Glass Products Industry

Figure 29: Number of employees working in the Glass Products Industry



Source: Kompass Australia, 2005

This category includes firms that manufacture flat glass, rods, tubes, beads, bulbs, fibres, insulators, containers, laboratory and medical, optical, domestic, decorative, handmade glassware and mirrors. This is the only area where Liverpool dominates the region, having

approximately 1,478 employees, followed closely by Bankstown with 1,330 employees, Fairfield with 881 and Penrith with 383. Despite the large number of jobs, the industry is dominated by a relatively small group of firms across the region. In Liverpool, the glass industry comprises only 6 firms, with 9 firms in Bankstown, 10 in Fairfield, 2 in Penrith and another 5 in Campbelltown. In Liverpool, Stegbar Private Limited alone hires 1,350 people, with the remaining five firms employing less than 130 people in total. A small employer profile exists in Bankstown, with 1,145 people working for Windscreens O'Brien and the remaining 8 Bankstown firms employing only around 185 people. The situation is slightly more balanced in Fairfield, with three out of the ten firms employing more than 100 people each.

Appendix B – The Australian Apprentices Scheme

Australian Apprenticeships Scheme

'Australian Apprenticeships' is a scheme directed towards attracting people to trades. It combines training and employment, which lead to a nationally recognised qualification. The apprenticeships are available to anyone of working age and do not require any entry qualification. In March 2006, there were 403,600 Australian Apprentices in training[10]. Since 1 July 2006, the 'Australian Apprenticeship Incentives Programme' has provided financial incentives to employers that employ and train an apprentice or trainee. A summary of the scheme and the latest incentives is provided in Box 17.

Box 17: Australian Apprenticeship Scheme and Incentives Programme

Key facts

- Combination of paid work and structured training that can be on-the-job, of-the-job or a combination of both;
- Training is 'competency based', which means training can be completed faster if the required level of skills is reached;
- Existing skills and prior experience are recognised and course credit granted, potentially reducing formal training time;
- Available for 30+ age group;
- Available full-time or part-time; also available part-time in many schools;
- Leads to nationally recognised qualifications and skills, which provide the basis for further education and training;
- Available in different certificate levels and more than 500 occupations in traditional trades, as well as a diverse range of emerging careers in most sectors of business and industry;
- Free service to employers and apprentices by Australian Apprenticeship Centres in most Australian regions.

Key Funding Incentives for Employers are:

- For up-skilling Certificate II, III, IV, Selected Diploma and Advanced Diploma;
- To employ an apprentice in an eligible Innovation Training Package qualification;
- To employ an apprentice in an endorsed Australian school-based Apprenticeship;
- To employ apprentices aged 45 years or more; apprentices from rural and regional areas and apprentices from declared drought areas;
- To retain school-based apprentices after completion, and for recommencement of trades Certificate III or IV;
- Incentives for mature age apprentices on successful completion;
- Additional assistance for employers of Australian Apprentices with a disability;

Key funding Incentives for Apprentices are:

- Up to 36 months of Living Away from Home Allowance (LAFHA);
- 'Trade Learning Scholarships' provides two tax exempt AUD 500 payments if the Apprenticeship is undertaken with a small/medium enterprise or Group Training Organisation;
- Eligible for Youth Allowance (including Austudy for over 25s and ABSTUDY);
- The 'Tools for your Trade' initiative provides up to AUD 800 for the purchase of trade tools.

Source: Australian Government, July 2006

[10] National Centre for Vocational Education Research, www.ncver.edu.au (retrieved 10/06/2007)

In addition to the Australian Apprenticeship Incentives Program, on 12 October 2006, the government released the 'Skills for the Future' package, worth AUD 837 million over five years, as a set of initiatives focussed on the need for continuous upgrading of skills of the workforce. These initiatives include:

- Apprentice Wage Top-Up – a tax free payment of AUD 1,000 per year for first and second year apprentices under 30 in trades facing skills shortages;
- Business Skills Vouchers worth up to AUD 500 available to apprentices or newly qualified tradespersons in traditional trades as a contribution towards the cost of undertaking accredited business skills training;
- Incentives for Higher Technical Skills of at least AUD 4,000 for Diploma and Advanced Diploma qualifications, particularly in engineering fields;
- Financial Support for Mid-Career Workers (aged 30 or more) to upgrade their skills through an apprenticeship in a trade occupation in high demand. The payment is made to either the employer or the apprentice – AUD 150 per week (AUD 7,800 per annum) in the first year and AUD 100 per week (AUD 5,200 per annum) in the second year;
- Support for Fast Track Apprentices program, to help apprentices reach their qualification sooner, while still meeting all the requirements of employers and industry.[11]

[11] Department of Education, Sciences and Training, www.dest.gov.au (retrieved 15/06/2007).