

# **Clustering: concentration of the knowledge-based economy in Sydney**

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## **Introduction**

Sydney is Australia's top global city positioned in a global urban hierarchy as measured and ranked in an increasing number of global city literatures (Beaverstock, Taylor, & Smith, 1999; Friedmann, 1986, 1995; GaWC, 1998, 2009; Godfrey & Zhou, 1999; MasterCard Worldwide, 2008; etc.). Saskia Sassen, the author of the term 'global city', defines a global city's status from the perspective of its capacity to provide such 'producer services' as financing, banking, accounting, advertising, marketing and management consultancy and attests that these complexes of knowledge-based economy activities are usually located in central business districts (CBDs) of a few global cities (Sassen, 1995, 2001). This theorization of global city and the clustering of the knowledge-based economy in the central city area is supposed to be applicable to Sydney too given the scholarly consensus on Sydney's status as a global city. A group of researchers have testified the argument of Sydney's status as a global city and the clustering of advanced producer services or the 'financialization' of workers in Central Sydney (Baum, 1997; Daly & Pritchard, 2000; O'Connor & Stimson, 1995; O'Neill & McGuirk, 2003; Searle, 1996, 1998b, 2008). However, an empirical study of how the knowledge-based economy has been concentrated in Central Sydney compared to Metropolitan Sydney in a systematic manner, and how this concentration has shifted temporally, will contribute to the literature and help testify the theories.

This chapter aims to make an empirical contribution to understanding the clustering of the knowledge-based economy in Central Sydney. In order to measure to what extent the knowledge-based economy is concentrated in Central Sydney and how this concentration has changed over time, I used the Location Quotient (LQ) tool to compare the employment by industries in Central Sydney with Metropolitan Sydney in 1996-2006. The data of employment by industries were based on place of work and collected from Australian censuses in 1996 and 2006. The results indicate which industries are concentrated in Central Sydney, which industries with concentration fall into the category of the knowledge-based economy, and how the concentration patterns have shifted in a time series. Through systematically and temporally measuring the employment by industries in Central Sydney with reference to Metropolitan Sydney, the findings provide a holistic understanding of the concentration of the knowledge-based economy in Sydney, and testify and support the theories on the clustering of the knowledge-based economy in the central city areas.

## **Clustering and the knowledge-based economy**

The term 'knowledge-based economy' is not new. A full genealogy of it could trace back to the 1960-1970s when buzzwords like 'knowledge society' or 'information economy' were invented (Godin, 2006, p. 18). Its resurgence in the 1990s was a result of the advancement of new information and communication technology (ICT) and its popularity was largely attributed to the dissemination of the Organization for Economic Co-operation and Development (OECD). In 1996, the OECD stated that 'knowledge is now recognized as the driver of productivity and economic growth', and defined the knowledge-based economies as 'economies which are directly based on the production, distribution and use of knowledge and information' (OECD, 1996, p. 3). A shift to knowledge-based growth has been characterized by falling costs and rising efficiency in the transmission, retrieval, and analysis of information. According to the OECD (1996), the most distinguishing feature of a knowledge-based economy is the pervasive presence of knowledge as an input and an output throughout the economy. Thus, in a knowledge-based economy, the ability to create wealth is increasingly dependent on the effective management of knowledge, that is, 'the organizational capability to create, acquire, accumulate, disseminate, and exploit information and knowledge' (Gera & Mang, 1998, p. 150). The industries which fit the definition of the knowledge-based economy include: high- to medium-tech manufacturing; high-tech services; business services; financial services; health and education services; cultural and recreational services and international transport services (Brinkley, 2008).

The knowledge-based economies indicate more tendencies towards geographical concentration or clustering than traditional less or low knowledge-based economies, suggesting enhanced association between agglomeration and productivity performance (Gabe & Abel, 2010; Sonn & Park, 2010). There have been numerous scholarly literatures on the geographical clustering of business activities and industry production. However, not many offer explanations specifically in relation to the context of the knowledge-based economies, especially to the concentrations of such industries as advanced producer services occurring in particular regions and in particular parts of cities, like the central cities. The basic clustering theories of the localization externalities, including a large pool of specialized labour, a large number of specialized local providers of intermediate inputs and services, and the positive technological spill-over (Krugman, 1991; Marshall, 1927), help explain the new knowledge-based economies too. The advantages of geographical proximity, such as traditional external economies of scale out of shared physical infrastructure and reduced transaction costs, and enhanced circulation of knowledge as well as inter-firm collaboration and networking (Porter, 1998), makes no differentiation of applicability between traditional manufacturing industries and new knowledge-based industries. However, they are far from sufficient to explain the clustering of the knowledge-based economy with the fullest plausibility.

The knowledge-based economy has witnessed significant cost reduction and efficiency improvement in transmitting and transacting knowledge and knowledge-related products and services through the mediation of the ICT. Nonetheless, the predicted 'death of distance' or 'death of cities' did not occur in a digital age, and has not indicated any sign of taking place in the foreseeable future either. Conversely, agglomeration of the knowledge-based economy persists and is becoming even denser. Two strands of theories specific to the context of the knowledge-based economy have been posited to explain this seemingly counter-intuitive phenomenon. Both strands of theories are centred on the characteristics and behaviours of the knowledge workers, the actors of the knowledge-based economy, to justify the non market-based externalities of the clustering of the knowledge-based economy.

One strand of theories is related to the indispensability of the face-to-face contact in today's knowledge production process. Storper and Vehables (2004) suggest that the face-to-face contact is an important mechanism for co-ordinating economic activities, particularly those

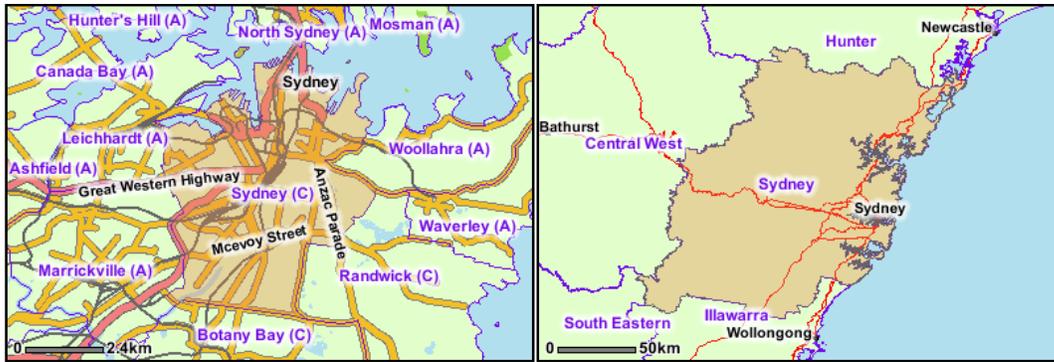
embedded in tacit knowledge and creativity in which people learn by doing and being around others. This important role of the face-to-face contact in the knowledge-based economy is attributed to the unique behavioural and communicational properties which give the face-to-face contact specific advantages as a technology of communication, coordination, and motivation. The major properties of the face-to-face contact include: it is an efficient communication technology; it allows actors to align commitments and thereby reduces incentive problems; it allows screening of agents; and it motivates effort (Storper & Venables, 2004, pp. 353-357). This kind of human capital externalities differs by particular types of workers. The knowledge acquisition required to drive innovation nowadays implies ever more frequent interactions between agents in order to share knowledge (McCann, 2007). In contrast to the knowledge-based activities which often require direct and instant contact to solve unforeseeable uncertainties, the knowledge spill-over facilitated by the face-to-face contact is of less importance to low-skilled labourers and personal service providers (Gabe & Abel, 2010).

The other strand of theories is related to the diversity and the necessary density to generate diversity, which contribute to the productivity of the knowledge workers, or creative talents. Diversity in cultures and expertises leads to a high degree of knowledge production and diffusion, and diversity promotes tolerance to new ideas (Florida, 2002a; Jacobs, 1969). Urban areas with density offer higher degree of diversity of specializations, and more favourable environments of innovation and knowledge production. An expert can easily contact people with similar or different specialties to exchange ideas and generate knowledge in large cities, especially the central city areas. Workers of the knowledge-based economy, who are mostly college educated and have particular creative talents, tend to congregate to capitalize from the benefits of clustering (Florida, 2002a, 2008).

## **Methodology**

I used the LQ analysis to measure the clustering of the knowledge-based economy in Central Sydney in relation to Metropolitan Sydney in 1996-2006. The LQ analysis is widely used 'to identify the concentration of an industrial sector in a local economy relative to a larger reference economy' (Blakely & Bradshaw, 2002, p. 122). Employment is the most used variable in the LQ analysis which defines a ratio of employment shares: the local industry's share of total local employment compared with the industry's employment share in a wider reference region (regional, national, or even international) (Klosterman, 1990). An  $LQ > 1$  indicates a higher than average degree of specialization in that sector locally compared with the reference region, and is interpreted as an indicator of concentration and competitive advantage (Spencer, Vinodrai, Gertler, & Wolfe, 2010).

Geographically Central Sydney and Metropolitan Sydney are respectively represented by Sydney Local Government Area (LGA) and Sydney Statistical Division (SD) in the Australian Statistical Geography Standards (ASGS) 2006 classified by the Australian Bureau of Statistics (ABS) for census data purposes.<sup>1</sup> The geographies and comparisons of Sydney LGA and Sydney SD in area, population and employment are shown as follows:



**Figure 1** Maps of Sydney LGA and Sydney SD (Australian Bureau of Statistics)

**Table 1** Specifications of Sydney LGA and Sydney SD (Australian Bureau of Statistics)

Locality	Area	Population (2006)	Employment (2006)
Sydney LGA	29 km <sup>2</sup>	180,474	357,767
Sydney SD	12,428 km <sup>2</sup>	4,148,570	1,736,824
LGA's Share in SD	0.23%	4.35%	20.6%

The implementation of the research includes the following steps:

1. I collected the 1996 and 2006 census data on industry of employment for Sydney LGA and Sydney SD from the ABS. The census data was based on the place of work and collected by two digit industry subdivisions in the Australian and New Zealand Standard Industrial Classification (ANZSIC) 1993.

2. I calculated the LQs for all the industry subdivisions in Sydney LGA in 1996 and 2006 by the equation:  $LQ_i = \frac{e_i}{e_T} \div \frac{E_i}{E_T}$  ( $e_i$  = employment in industry subdivision  $i$  in Sydney

LGA,  $e_T$  = total employment in Sydney LGA,  $E_i$  = employment in industry subdivision  $i$  in Sydney SD,  $E_T$  = total employment in Sydney SD).

3. I selected the industry subdivisions with  $LQ > 1$  and employment share (that is  $\frac{e_i}{e_T} > 1$  per cent in Central Sydney in 2006<sup>2</sup>, and calculated the selected industry subdivisions' employment changes and LQ changes in 1996-2006 respectively.

4. I displayed the results in three modes to interpret clustering: to what extent the knowledge-based economy was concentrated in Central Sydney, and how the concentration shifted over the period 1996-2006.

- Mode 1: All concentrated industries of employment (with  $LQ > 1$  in 2006) are listed according to their LQs in 2006 from the highest to the lowest (displayed in Table 2);
- Mode 2: All concentrated industries of employment (with  $LQ > 1$  in 2006) are plotted in the Growth Share Matrix diagram measuring employment shares, LQs and employment changes developed by Information Design Associates with ICF Kaiser International (1997) and ICF Consulting (2000). The Growth Share Matrix diagram simultaneously conveys information about the sizes of employment (in 2006), the

employment changes (in 1996-2006), and the LQs of employment (in 2006) for concentrated industry subdivisions ( $LQ > 1$  in 2006) in Central Sydney by aligning employment changes along the horizontal axis, aligning LQs along the vertical axis, and plotting individual industries with 'bubbles' proportional to the numbers of their employment shares (displayed in Figure 2);

- Mode 3: All concentrated industries of employment (with  $LQ > 1$  in 2006) are plotted in the Relative Share Matrix diagram measuring employment shares, LQs and LQ changes developed by Hu (2009). The Relative Share Matrix diagram simultaneously conveys information about the sizes of employment (in 2006), the LQ changes (in 1996-2006), and the LQs of employment (in 2006) for concentrated industry subdivisions ( $LQ > 1$  in 2006) in Central Sydney by aligning LQ changes along the horizontal axis, aligning LQs along the vertical axis, and plotting individual industries with 'bubbles' proportional to the numbers of their employment shares (displayed in Figure 3).

5. I interpreted the displayed data results to summarize to what extent the knowledge-based economy was concentrated in Central Sydney in different modes, and how the concentration patterns had shifted in 1996-2006.

## Results

Of the total 69 industry subdivisions by the ANZSIC 1993, 16 industry subdivisions had LQs more than 1 and employment share more than 1 per cent in 2006 in Sydney LGA. That is to say, these 16 industries were concentrated in Central Sydney compared to Metropolitan Sydney as measured by employment. The analysis and interpretation is thus focused on these 16 industry subdivisions.

The 16 subdivided industries are mostly services industries and can be categorized into three broad groups according to the nature of the services: commercial services; cultural and media services; and public and amenity services (see Table 2). The commercial services refer to the highly specialized services for business activities (finance, insurance, business, and property services). The cultural and media services are those services which are informing, educating and entertaining people. The public and amenity services refer to the government administration, infrastructure and amenity services such as government administration, transport, communication and urban amenities (accommodation, cafes and restaurants). Judged by the nature of products and services of the three industry groups, industries in both the commercial services group and the cultural and media services group well fit the definition of the knowledge-based economy. The commercial services group, the cultural and media services group, and the public and amenity services group respectively accounted for 42 per cent, 7 per cent, and 22 per cent of total employment in Central Sydney in 2006. In total the three concentrated industry groups accounted for around 71 per cent of Central Sydney's total employment, among which the knowledge-based economy accounted for almost 50 per cent of the total employment and almost 70 per cent of the concentrated employments of industries in Central Sydney in 2006.

Table 2 lists the concentrated industry subdivisions by the sequence of their LQs in 2006 from the highest to the lowest. Industry subdivisions in the commercial services are the most concentrated in Central Sydney, especially in finance and insurance services. Though the industry subdivision Business Services in the commercial services group does not have a high LQ value (1.7), its employment share of 20.71 per cent guarantees its strong position as a clustered industry in Central Sydney. Some industry subdivisions from the other two services

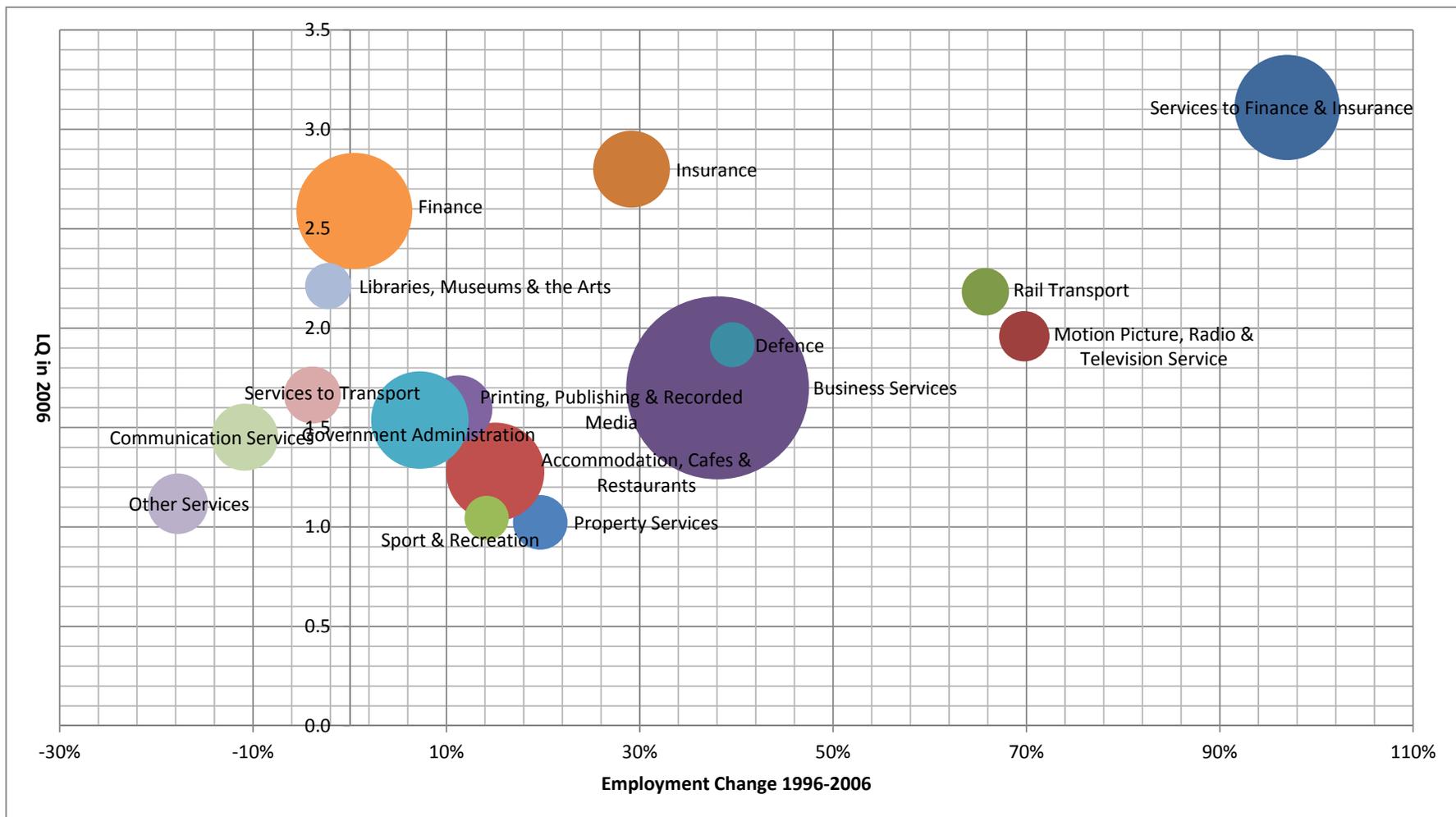
groups indicate quite high LQs in 2006, however, their considerably small employment shares (Libraries, Museums & the Arts, 1.32 per cent; Rail Transport, 1.39 per cent; Motion Picture, Radio & Television Services, 1.58 per cent; Defence, 1.24 per cent) impact their bases as being industries with clustering.

Figure 2 and Figure 3 visually display the results in Table 2. Both Figure 2 and Figure 3 provide information of the LQs, employment shares of the clustered industry subdivisions, but respectively display their employment changes and LQ changes in 1996-2006. The two diagrams better illustrate how these clustered industries are compared with each other and had changed over the one decade period 1996-2006. Measured by sheer employment shares, top industries in Central Sydney are business services (21 per cent), finance (8 per cent), services to finance and insurance (7 per cent), and accommodation, cafes and restaurants (6 per cent) as contrast to the top industries measured by LQs, which are services to finance and insurance (3.11), insurance (2.80), finance (2.59), and libraries, museums and the arts (2.21). Figure 2 indicates that the majority of the clustered industries in Central Sydney had employment growth in 1996 and 2006 except for two industries which lost employment numbers modestly. Figure 3 indicates that half of the 16 concentrated industries in Central Sydney increased their degree of clustering with positive LQ changes while the other half industries decreased their degree of clustering with negative LQ changes in 1996-2006. The different patterns of employment changes and LQ changes of the clustered industries occur because the LQ changes depend on the employment numbers of the industries in Metropolitan Sydney region too. Figure 3 also indicates that, overall, industries with higher LQs tended to have positive LQ changes in 1996-2006, denoting an increasing trend of clustering of their employments. This increasing trend of clustering happened to established commercial services industries such as Finance, Insurance, and Business Services, as well as new creative cultural and media services such as Motion Picture, Radio & Television Services, and Libraries, Museums & the Arts, all of which are categorized as the knowledge-based economy.

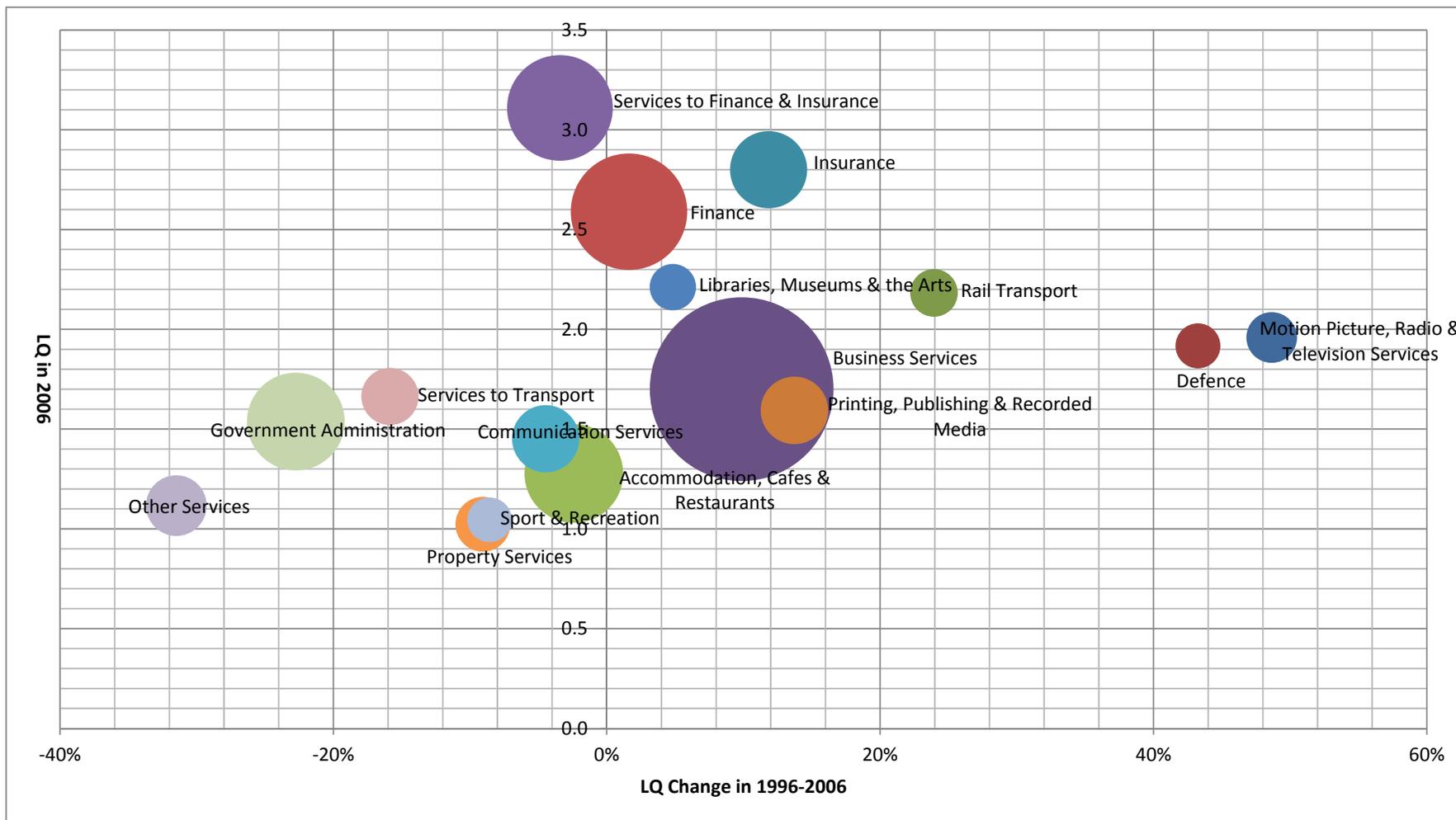
**Table 2** Measuring Employments of Industry Subdivisions and their LQs in 1996 and 2006

Industry subdivisions (ANZSIC93)	Sydney LGA Employment 1996	Sydney SD Employment 1996	Sydney LGA Employment Share 1996	Sydney LGA LQ 1996	Sydney LGA Employment 2006	Sydney SD Employment 2006	Sydney LGA Employment Share 2006	Sydney LGA LQ 2006	Sydney LGA LQ Change 1996-2006	Sydney LGA Employment change 1996-2006
■ 75 Services to Finance & Insurance	12,453	19,429	4.06%	3.22	24,528	38,292	6.86%	3.11	-3%	97%
■ 74 Insurance	10,120	20,304	3.30%	2.50	13,070	22,659	3.65%	2.80	12%	29%
■ 73 Finance	29,675	58,508	9.68%	2.55	29,815	55,898	8.33%	2.59	2%	0%
● 92 Libraries, Museums & the Arts	4,818	11,472	1.57%	2.11	4,711	10,340	1.32%	2.21	5%	-2%
◆ 62 Rail Transport	2,996	8,547	0.98%	1.76	4,966	11,046	1.39%	2.18	24%	66%
● 91 Motion Picture, Radio & Television Services	3,319	12,652	1.08%	1.32	5,635	13,964	1.58%	1.96	49%	70%
◆ 82 Defence	3,186	11,961	1.04%	1.34	4,447	11,262	1.24%	1.92	43%	40%
■ 78 Business Services	53,668	174,253	17.51%	1.55	74,085	211,570	20.71%	1.70	10%	38%
◆ 66 Services to Transport	7,472	18,986	2.44%	1.98	7,184	20,966	2.01%	1.66	-16%	-4%
● 24 Printing, Publishing & Recorded Media	9,006	32,284	2.94%	1.40	10,022	30,526	2.80%	1.59	14%	11%
◆ 81 Government Administration	19,590	49,435	6.39%	1.99	21,011	66,326	5.87%	1.54	-23%	7%
◆ 71 Communication Services	11,145	36,849	3.64%	1.52	9,935	33,227	2.78%	1.45	-4%	-11%
◆ 57 Accommodation, Cafes & Restaurants	18,580	71,304	6.06%	1.31	21,377	81,233	5.98%	1.28	-2%	15%
◆ 96 Other Services	9,831	30,302	3.21%	1.63	8,083	35,141	2.26%	1.12	-31%	-18%
● 93 Sport & Recreation	3,826	16,813	1.25%	1.14	4,368	20,289	1.22%	1.05	-9%	14%
■ 77 Property Services	5,511	24,610	1.80%	1.12	6,597	31,306	1.84%	1.02	-9%	20%
...										
Total	306,469	1,539,593	100.00%	1.00	357,767	1,736,824	100.00%	1.00	0%	17%

Note: Commercial services ■; Cultural & media services ●; Public & amenity services ◆.



**Figure 2** Measuring Employment Shares of Industry Subdivisions, LQs and Employment Changes



**Figure 3** Measuring Employment Shares of Industry Subdivisions, LQs and LQ Changes

## Discussion

The results of the data analysis show that the knowledge-based economy was on a trend of increasing clustering in Central Sydney in 1996-2006 in two broad groups of industry subdivisions: the commercial services, and the cultural and media services.

Sydney has been Australia's urban leader for its capacity of providing advanced commercial services since the 1980s. Sydney was the main urban beneficiary of Australia's increasingly globalized commodity and financial markets (Searle, 2008) as the central locus of international corporate headquarters and financial offices. By 1988, Sydney had 150 head offices of international institutions (43 in Melbourne) and 155 of the 185 Australian head offices of foreign banks (Daly & Stimson, 1992). In 1997 and 1998, some 61 multinational corporations set up Asia Pacific regional headquarters in Sydney, more than four times the total for any other Australian or New Zealand city (Daly & Pritchard, 2000). Comparing Sydney's employment structure with overseas cities indicates that Sydney's performance in finance and business services in the mid 1990s was approaching that of New York and London in the mid 1980s (Searle, 1996). A study done by the accountancy firm Price Waterhouse Coopers in 1998 compared Sydney with seven international cities (New York, London, Frankfurt, Singapore, Atlanta, Vancouver, and Kuala Lumpur) and concluded that Sydney was performing reasonably well across a wide range of measures (Price Waterhouse Coopers, 1998). Hall (1995) placed Sydney in the ranking of sub-global cities then, but other scholars including Searle (1996), O'Connor and Stimson (1995), Lepani (1995), Newton (1995) and Baum (1997) argued that Sydney's economic characteristics of finance and producer services were indicative of its emergence as Australia's global city in the late 1980s and early 1990s. Geographically, these advanced commercial services indicating Sydney's growing status as a global city were concentrated in Central Sydney. The findings of this research reveal the continuing growth and clustering of these advanced commercial services of the knowledge-based economy in Central Sydney in the period 1996-2006.

Saskia Sassen defines a global city's status as its capacity to provide 'producer services' such as financing, banking, accounting, advertising, marketing and management consultancy and attests that these complexes of the knowledge-based economy are usually located in CBDs of a few global cities (Sassen, 1995, 2001). Searle (1998a) investigates changes in producer services location in Sydney based on an analysis of four industries of management consultancy, insurance, graphic design and data processing and concludes that 'globalisation appears to have reinforced the traditional central city focus of Sydney's producer services sector' (Searle, 1998a, p. 237). Forrest (1996) examines the spatial clustering of the journey to work in Sydney and points out a decreasing dependence on the central city as a focus of employment other than those employed in the business, finance and information service sector. Research by O'Neill & McGuirk (2002) indicates that the surge of finance-based economic activities in Central Sydney helped sustain Australian economic prosperity in the late 1990s. The findings of these researches converge to point to the clustering of the advanced producer services in Central Sydney. This research has strengthened the literature by making a systematic analysis of the concentration of the knowledge-based economy in Central Sydney in 1996-2006, and supporting the argument for Sydney as a growing global city.

Apart from the increasing clustering of the commercial services, especially the producer services as discussed above, Central Sydney's growing role as a knowledge-based economy centre is also seen in its increasing concentration of the cultural and media services in 1996-2006. This is indicative of some forms of urban functional transformations towards a hub of cultural and media services undergoing in Central Sydney. The clustering of the creative

industries of cultural and media services in Central Sydney and Sydney's capacity of providing such services in a global context were attested by other researchers from different approaches too. Searle and Valence (2005) find an emerging inner Sydney multimedia cluster including graphic design, advertising and related media. They base their study on an empirical analysis of the multimedia firms' geographical locations in metropolitan Sydney area and observe the high concentration of the new information industry in Central Sydney as part of a shift towards an information economy (Searle & Valence, 2005). Set in a global context, Sydney's performance in the knowledge-based creative industries of cultural and media services was impressive too. In the index ranking global cities' capacity of providing producer services released by the Globalization and World Cities (GaWC) program at the Loughborough University, Sydney ranked the fifth in advertising performance of major global cities (Taylor, 2008, p. 56). Sydney's performances in other categories of producer services, however, were less impressive in a global context, such as accountancy, banking and financing, insurance, law, and management consultancy. Florida's (2002b, 2005) theory of creative class provides an explanatory framework for the increasing clustering of the creative cultural and media services in Central Sydney. The creative workers required by the new knowledge-based economy driven by the information technology are urban lifestyle class (Florida, 2002b) and they are globally mobile electronic migrants (Blakely, 2001; Florida, 2005). Sydney's cityscapes – built and natural lifestyle environment, and social tolerance and cultural diversity – are important assets of the city's competitiveness for a creative economy and creative city (Gibson, 2006; Throsby, 2006).

## Conclusion

In this chapter I measured to what extent the knowledge-based economy was clustered in Central Sydney and how the clustering patterns of the knowledge-based economy had shifted in 1996-2006. Key findings include 1) the majority of the clustered industries in Central Sydney are knowledge-based services; 2) apart from the public and amenity services which support the local as well as the regional/national economy, the concentrated knowledge-based economy in Central Sydney basically fall into two broad groups – commercial services, and cultural and media services; 3) the clustering of the commercial services and cultural and media services in Central Sydney was on a growing trend in 1996-2006. This chapter adds to the literature on the clustering of the knowledge-based economy in Sydney, and testifies Sydney's status as a growing global city as measured by its capacity of providing the knowledge-based producer services and new creative industries with clustering in central city area.

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## Endnotes

<sup>1</sup> Sydney LGA is the jurisdictional area of the local government City of Sydney which is very small in area (29 kms) and population (180,474), and is generally regarded as Central Sydney encompassing the core CBD and its surrounding area. There is not a metropolitan level of jurisdictional government in Greater Sydney. In practice, the geographical classification of Sydney Statistical Division (SD) defined by the Australian Bureau of Statistics (ABS) for census data collection purpose is used to refer to the metropolitan Sydney area which covers 43 LGAs in total.

<sup>2</sup> One industry with LQ>1 in Central Sydney indicates its employment concentration in a relative sense, that is, relative to the industry's employment in the reference region of Metropolitan Sydney. However, one industry with LQ>1 does not necessarily indicate its employment concentration in an absolute sense. There are industries with very high LQs, but very small employment sizes. For example, the industry subdivision of Services to Mining had an extremely high LQ of 2.53 in Central Sydney in 2006, however, its employment share was 0.09 per cent – too low an employment share to justify its concentration of employment. So only industry subdivisions with LQ>1 and employment share>1 per cent in Central Sydney in 2006 are regarded as industries with certain degree of concentration of employment compared to Metropolitan Sydney.