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This is a draft of this journal article. Published as:

Yigitcanlar, Tan (2010) *Making space and place for the knowledge economy : knowledge-based development of Australian cities*.
European Planning Studies, 18(11). pp. 1769-1786.

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This is an electronic version of an article published in the journal European Planning Studies, which is available online at informaworldTM

Making Space and Place for the Knowledge Economy: Knowledge Based Development of Australian Cities

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***Abstract:** The impact of what has been broadly labelled the knowledge economy has been such that, even in the absence of precise measurement, it is the undoubted dynamo of today's global market, and an essential part of any global city. The socio-economic importance of knowledge production in a knowledge economy is clear, and it is an emerging social phenomenon and research agenda in geographical studies. Knowledge production, and where, how and by whom it is produced, is an urban phenomenon that is poorly understood in an era of strong urbanisation. This paper focuses on knowledge community precincts as the catalytic magnet infrastructures impacting on knowledge production in cities. The paper discusses the increasing importance of knowledge-based urban development within the paradigm of the knowledge economy, and the role of knowledge community precincts as instruments to seed the foundation of knowledge production in cities. This paper explores the knowledge based urban development, and particularly knowledge community precinct development, potentials of Sydney, Melbourne and Brisbane, and benchmarks this against that of Boston, Massachusetts.*

Keywords: *Knowledge economy; knowledge precinct; knowledge community precinct; knowledge-based industry; knowledge worker; knowledge-based urban development; knowledge city*

Introduction

Throughout the history, *knowledge* has always been a vital resource for creating and sustaining a strong economy, society and culture (Van Doren, 1992). Cities originally emerged as places of exchange of goods; nevertheless, production of these goods and the establishment of these cities relied heavily on knowledge. Today many of our modern cities are specialised havens for the production and exchange of knowledge and networks, as well as material goods. Furthermore, during the last few decades cities have become critical platforms for shaping and leveraging human capital into collective intellectual capital, which is one of the main triggers of knowledge production and innovation (Edvinsson, 2010). Knowledge has indeed played an important role in all aspects of human relations, including the economy. However, the question to be considered here is why the role of knowledge has recently emerged as constitutive and has increasingly displaced and modified those other factors that have until now been basic to social existence? According to Stehr (2000), the material foundation of social action is being displaced by a symbolic foundation, and capital largely deposed land from its formerly privileged position during the industrial revolution. Therefore, today knowledge diminishes the significance of material factors resulting in a new era dominated by *knowledge*.

Particularly in the era of *knowledge economy*, knowledge-related activities, including creativity as a tacit knowledge form, have become central for creating employment and wealth and sustaining economic growth (Ofori, 2003). The knowledge economy – which has been about 400 years in the making since the *age of enlightenment* – creates, distributes, and uses knowledge to generate value and gives rise to “a network society, where the opportunity

and capability to access and join knowledge, and learning intensive relations determine the socio-economic position of individuals and firms” (Clarke, 2001, 189). The main novel characteristic of the knowledge economy is the need to manage an intangible asset that, in contrast to material resources, does not depreciate through use but rather becomes more valuable the more it is used (Laszlo and Laszlo, 2006).

In the knowledge economy literature, the determinants of forming strong global and local economic conditions are the availability and cost of venture capital, free markets, libertarian culture and philosophy, and appropriate government macro, meso and micro economic policies (Leydesdorff, 2006). Additionally, the sustenance of contemporary economic activities requires a constant renewal of human and organisational capacities and the creation of supportive environments in which creativity, innovation, learning, and change can thrive (Knight, 1995). It is widely recognised that knowledge is a central element of not only economic development but also socio-spatial development (Yigitcanlar and Velibeyoglu, 2008; Yigitcanlar *et al.*, 2008a). Furthermore, in the 21st century, sustainable socio-cultural, economic and urban development is found to be highly associated with knowledge economies (Metcalf and Ramlogan, 2005), since, in the 21st century, urban development has become a central challenge for social knowledge innovations (Metcalf and Ramlogan, 2005).

The ongoing transformation of advanced economies from manufacturing to service-based and then to knowledge-based activities has important implications for cities and for the organisation of economic activities. Although, historically, the production of commodities involved combinations of manufacturing, service and knowledge functions (Daniel and Bryson, 2002), recent rapid advances in technology have established the infrastructure that has enabled the knowledge economy to scale up. During the last couple of decades the accelerating speed of knowledge production has played a critical role particularly in the

development of high-tech products. With the dawn of the knowledge economy, firms have increasingly used technology as their prime source of competitive advantage, while the economic wealth of cities is increasingly tied to their technological and knowledge-based competence (Martin *et al.*, 2001).

The development of the knowledge economy, and of globalisation, and international competitive pressure, has increased the importance of creativity and innovation in local economies (Porter, 2001; Baum *et al.*, 2009). Simultaneously, globalisation is accentuating local differences arising from local capabilities and environments (Hu *et al.*, 2005). New developments in globalisation and communications technology have prompted cities to focus their competitive strategies on facilitating innovation. This shift has increased the value of knowledge-based activity in such economies (Hu *et al.*, 2005). Knowledge-based production, however, generally clusters in areas with a rich base of scientific knowledge related to specific industries, i.e. *knowledge-based industries* (Baptista, 1996). This spatial imperative has tended to polarise such high growth activity in a limited number of, dominantly urban, areas of the world such as Silicon Valley, Boston and Cambridge (Preer, 1992; Kenny, 2000; Lipczynski *et al.*, 2005).

Proximity helps generate and transfer knowledge more effectively. Therefore, new knowledge-based activities generally cluster in specific urban localities, such as vibrant and creative metropolitan areas. The main reason for such clustering is to benefit from the agglomeration of other knowledge-based industries and knowledge workers. The need for clustering characteristically leads these companies to be located in knowledge precincts (Audretsch, 1998). The proximity among companies achieved in such *knowledge precincts* is essential to stimulate learning and create compatible knowledge spill-over effects (Hu *et al.*, 2005). Knowledge precinct developments are built around advanced technological infrastructure and mature networks of innovation between people and organisations. Over the

last few years the importance of attracting and retaining knowledge workers has become widely understood. Local authorities started to invest more in the quality of life and place in order to attract such talented workers (Landry, 2000; Florida, 2005). These developments led to the formation of new generation knowledge precincts - *knowledge community precincts* (Yigitcanlar *et al.*, 2008d).

In the knowledge era, urban economies are being radically altered by dynamic processes of economic and spatial restructuring (Graham and Marvin, 1996). In advanced knowledge economies *knowledge-based urban development* has become a model for the (re)development of cities and their knowledge clusters (i.e. knowledge community precincts). Knowledge-based urban development is seen as a new form of development that potentially brings both economic prosperity and sustainable socio-spatial order to our cities (Yigitcanlar, 2007). However, in its infancy, knowledge-based urban development has lacked clear processes, mechanisms and tools to operationalise such desired development (Velibeyoglu and Yigitcanlar, 2009).

This paper aims to underline the knowledge-based development potentials of major Australian cities that are in a global battle with other urban conglomerations around the world to attract investment and talent. The paper analyses the context of knowledge-based urban development within the paradigms of the knowledge economy and of urban planning and development practice. It investigates the conditions and potentials for seeding knowledge production through knowledge community precinct developments in major Australian cities, namely Sydney, Melbourne and Brisbane. This paper also benchmarks the findings on these three Australian capital cities against Boston, Massachusetts, a world class knowledge city famous for its knowledge precincts which are undoubted dynamos of knowledge production.

Knowledge-based industries: a new strategic element of urban development

In the knowledge era, knowledge-based industries are now seen as a key to post-industrial socio-economic development in cities and regions, where knowledge-based industries are defined as: 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). However, until recently, there was no clear understanding of the nature of knowledge-based industries and of their locational requirements. Furthermore, there is limited knowledge of their effects on the complex local and regional urban environments, in which such industries are embedded, and of how they can function and flourish (Kunzmann, 2009).

As a result of the inevitable shift in local economies towards a knowledge economy in order to be able to compete and survive, more and more knowledge-based activities and their related developments have started to reshape urban environments (Cader, 2008). This has led to a growth in the influence of market forces on urban structures with local planning authorities being unable to orchestrate development because of the failure of traditional planning mechanisms to be able to cope with this new form of the economy. In practice, urban planners at the local level have little experience in dealing with the requirements of knowledge-based industries. This is mainly because traditional urban planning primarily aims to assign space for residential and commercial areas, industries, public infrastructure and services. Until now, in many parts of the world, knowledge-based industries did not receive particular attention in mainstream planning processes, mainly because they were rather heterogeneous entities, with unclear locational dimensions and quite diverse institutional responsibilities (Kunzmann, 2009).

In general, private enterprises, public and private universities, technology and science parks and research centres are the main components of local knowledge-based industries, and

they have their own local traditions and complex location rationales mostly driven by the market forces. This is one of the main reasons, why local authorities seem to have had only limited influence on the spatial development of knowledge-based industries. Nevertheless, with the clustering of knowledge-based activities and industries, their heterogeneous nature has started to become more homogeneous, within these emerging knowledge precincts. Moreover, the gradual transition from traditional land-use planning and zoning to strategic planning has eased the process of making space and place for knowledge-based industries (Kunzmann, 2009). Additionally, the rise of strategic planning has provided local authorities with a vision and an opportunity to have a greater say in the orchestration of their knowledge-based developments.

Knowledge community precincts: integration of knowledge-based industries into urban neighbourhoods

In contrast to traditional industries, knowledge-based industry complexes (i.e. knowledge precincts) are strongly interwoven into the fabric of the urban districts where they are located (Kunzmann, 2009). Such interrelationships are frequently neglected when planning or taking strategic locational decisions for knowledge precinct developments. Knowledge precincts are defined as integrated centres of knowledge generation, learning, commercialisation, and lifestyle that are created through a cooperative partnership between all tiers of government, the research and education community, private sector operators, highly talented professionals, and the public (Henry and Pinch, 2000). Knowledge precincts therefore tend to resist traditional planning approaches because they are so changeable and subject to so many external forces. New generation knowledge precinct developments, referred to as 'knowledge community precincts', need to provide room for living, working, learning, playing and

'cybering' within their boundaries, as exemplified by Crossroads Copenhagen, Helsinki Digital Village or Singapore One-North (Yigitcanlar *et al.*, 2008d).

Different countries have used diverse design, management and technological foci for their knowledge community precincts. For example, in South-East Asia, urban planners have taken more active roles than their North American and European counterparts, as in Singapore One-North. Additionally, those Asian cities aspiring to become a knowledge city (see Carrillo, 2006) have received considerable government funds for their knowledge community precinct initiatives, as at Hong Kong's Teleport, Singapore's Intelligent Island, and Malaysia's Multimedia Super Corridor (Brooker, 2005). The projects in Europe and the US, by contrast, tend to require less public support and are often organised and financed through public private partnerships, such as those developed around California's Silicon Valley and Massachusetts' Route 128. These partnerships have been formed with varying levels of public authority and involve both large multinational companies and small and medium enterprises (SMEs).

The technological foci of knowledge precincts can vary as widely as their financial ownership and organisational structures (Koh *et al.*, 2005). Some are structured around basic research, e.g. Cambridge Science Park; some concentrate on applied research, e.g. Singapore Science Park; others focus on the further development of high-tech manufacturing activities, either within their precincts or in the vicinity, e.g. Hsinchu Technology District in Taiwan; while others aim to develop knowledge community precincts that contain work, residential, education and recreation areas within the same development, e.g. Singapore One-North or Brisbane Kelvin Grove Urban Village.

Despite their differences in terms of design and management, knowledge community precincts have the following aspects in common: they contain high-tech enterprises, such as digital villages, and R&D and educational institutions; they provide living facilities that

promote creativity, cater for emerging lifestyle choices, and celebrate the experience of place; and they are guided and managed by partnerships between governments, real estate developers, educational or research institutions, and technology and business companies (MIT, 2005).

According to Felsenstein (1994), knowledge community precincts are generally established with two primary objectives in mind. The first is to become a seedbed and an enclave for technology, and to play an incubator role, nurturing the development and growth of new SMEs, facilitating the transfer of university know-how to tenant companies, encouraging the development of faculty-based spin-offs, and stimulating the development of innovative products and processes. The second is to act as a catalyst for regional economic development or revitalisation and to promote socio-economic growth.

Locating knowledge community precincts in vibrant urban areas is very important in order to provide high standards of quality of life and place to knowledge workers, where knowledge workers are defined by proxy measures as either the top three standard statistical occupational codes (managers, professionals, associate professionals and technical workers) or as those with graduate or higher levels of education (Brinkley, 2008). This quality of life and place can only be achieved through increased environmental quality, the availability of a range of lifestyle options and accessibility to urban amenities and other knowledge complexes. An affordable housing market, improved accessibility and mobility options, quality educational and health services and cultural, entertainment and sports facilities are among the key factors affecting knowledge workers and their families' location decisions. The provision of these, and of other household related requirements of knowledge workers, call for more holistic and longer-term strategic approaches to spatial development. Knowledge community precincts in a city are not ivory towers in the urban jungle, nor communities gated against visitors and burglars. They are, ideally, catalytic locations for

urban life. They are experimental life spaces for the next urban generation and laboratories for testing new forms of work-leisure-home lifestyles. These new knowledge community precincts clearly require a different approach to traditional strategic urban planning and development (Kunzmann, 2009).

Knowledge-based urban development: orchestrating the development of knowledge community precincts

To date, the structuring of most cities has proceeded organically, as a dependent and derivative effect of global market forces. Urban and regional planning has responded slowly, and sometimes not at all, to the challenges and the opportunities of the global knowledge city and the knowledge economy. The economic success of the knowledge-based development policies in a number of cities has led urbanists to consider whether similar policies could be applicable for the knowledge-based planning of urban regions. In recent years urban planning has consolidated its interest in the paradigm of post-modern social production under the rubric of “knowledge-based urban development” (Carrillo, 2004).

Knowledge-based urban development (KBUD) is a new form of development that potentially brings both economic prosperity and sustainable socio-spatial order to the contemporary cities of the 21st Century. On the one hand, KBUD is a powerful driver of economic growth and post-industrial development for cities wishing to participate in the knowledge economy (Yigitcanlar *et al.*, 2008c). Therefore, it can be regarded as an overall strategy to nourish the transformation and renewal of cities into knowledge cities and of their economies into knowledge economies (Yigitcanlar *et al.*, 2008a). On the other hand, KBUD is the initiation and provision of a knowledge incubation environment (knowledge and urban infrastructures) for entrepreneurs (knowledge enterprises) through public-private-academia partnerships, rather than the imposition of strict government control over development or

uncontrolled market-driven development. To achieve the overall goal of KBUD, that is creating a knowledge city purposefully designed to encourage the production, circulation and use of knowledge, effective strategic urban planning, development and management mechanisms are needed (Cheng *et al.*, 2004; Yigitcanlar *et al.*, 2008b).

KBUD transcends many areas of economic, social, urban policy and governance, and has four broad purposes (Figure 1).

[INSERT FIGURE 1]

First, KBUD requires a strong economic development strategy that codifies: technical knowledge for the innovation of products and services, including urban services; market knowledge for understanding changes in the economy; financial knowledge to measure the inputs and outputs of production and development processes; and human knowledge in the form of skills and creativity, within an economic model (Lever, 2002). It involves local economic development that is competitive and integrated with the global knowledge economy.

Second, KBUD requires effective education and skill building strategies in order to increase the skills and knowledge of residents and employees as a means of intellectual, human and social development (Gonzalez *et al.*, 2005). It requests an increased quality of life through the provision of necessary services and amenities, and investment in building human, intellectual and social capital systems.

Third, KBUD requires a strong spatial relationship among knowledge clusters (i.e. knowledge community precincts) in order to augment the knowledge spill-over effect that contributes significantly to the establishment and expansion of creative urban regions and supports linkages and networking between these clusters (Yigitcanlar *et al.*, 2008c). It also

entails quality of place and an urban development that is ecologically sensitive and sustainable.

Fourth, KBUD requires an institutional arrangement to oversee the development. Such an institutional or governance body should be a transparent, democratic, and visionary one equipped with a strong strategic organising capacity. Leadership and sustained public authority intervention to build knowledge-based urban development are necessary and require both long-term strategic planning and resources to give effect to policy decisions (Baum *et al.*, 2007).

Silicon Valley in Northern California, Route 128 surrounding Boston, and Silicon Hills in Austin, Texas, are among the most prominent examples of KBUD. The accomplishments of these developments were based mainly on a knowledge network that encompassed both regional learning institutions and profit industry research teams, and the knowledge, in the form of innovation, produced was adopted and developed economically by proximate knowledge-based industries operating in the milieu of the precinct (Castells and Hall, 1994; Markusen *et al.*, 1999; Yigitcanlar and Han, 2010). The success of Silicon Valley, Route 128 and Silicon Hills has inspired KBUD developments around the world in the belief that it is a royal road to competitive advantage, and the new form of local socio-economic and urban development in the knowledge era (Ku *et al.*, 2005). Such successful KBUD policy implementations in the US have been followed by other successful exemplars (e.g. Singapore One-North, Brisbane Kelvin Grove Urban Village) that have shown that knowledge cities can be engineered by promoting knowledge community precincts (Chan and Lau, 2005; Yigitcanlar *et al.*, 2008b).

Like those in Boston and Sydney, many traditional knowledge precincts around the world either emerged organically or were purposely located in and around white collar office or university precincts which were, not unnaturally, close to the well-heeled knowledge

worker suburbs. However, in the new knowledge era many cities that are pursuing KBUD had no choice other than using urban planning as a tool to develop their own creative and knowledge environments and spaces from scratch.

One good example of the orchestration of a knowledge community precinct's development is the One-North development in Singapore. Contrary to many *organically developed* North American and European knowledge precincts, One-North is a *planned* knowledge community precinct. The KBUD concept of One-North is as notable, therefore, as the actual details of its development. It shows, in the broadest terms, how a very successful South East Asian city state intends to compete in the global knowledge economy. One-North is a long term plan committed to 20 years of development, and focuses on three apparently separate industries that are, however, on closer inspection increasingly inter-related, namely ICT linked to both bio-science and media production (Baum *et al.*, 2007; Yigitcanlar, 2008). Other successful examples of the orchestration of the development of knowledge community precincts include Barcelona@22, Helsinki Digital Village, Copenhagen Crossroads, and Zaragoza Digital Mile, all of which indicate that KBUD can indeed be orchestrated and that such developments can contribute to the competitiveness of their cities (Yigitcanlar *et al.*, 2008d).

Knowledge based development of major Australian cities: a comparison with Boston

There have been several attempts at developing knowledge community precincts as incubator organisations of knowledge production in Australia (TIAC, 2002). Particularly during the last decade, major Australian cities have aimed to increase their knowledge concentrations and have developed policies to align their local economies to the global knowledge economy. Most recently led by Melbourne, but followed by Sydney and Brisbane, KBUD policies have been integrated into the future development plans of these cities.

The literature reveals that there are a number of broad foundations that support KBUD (Yigitcanlar *et al.*, 2008a; 2008b). While it is recognised that every city is different, and therefore requires different combinations of knowledge qualities to grow, there are a number of uniform characteristics for a successful KBUD (Yigitcanlar *et al.*, 2008c). For example, the Strategic Plan of Barcelona's major KBUD characteristics are: accessibility; cutting edge technology; innovation; cultural facilities and services; and quality education; as well as world class economic opportunities (Barcelona City, 2003). Similarly, Van Winden *et al.* (2007) build upon Barcelona's KBUD elements and provide a framework of those characteristics that structure a successful KBUD. The layers that comprise a successful KBUD include:

- a) Knowledge base: including educational institutions and R&D activities;
- b) Industrial structure: affects the progress and development of a knowledge city;
- c) Quality of life, place and urban amenities: ensure that the KBUD has necessary elements and that knowledge workers are attracted to provide a strong knowledge base;
- d) Urban diversity and cultural mix: as instruments in encouraging creativity;
- e) Accessibility: encourages and facilitates the transfer and movement of knowledge, people, goods and services;
- f) Social equity and inclusion: minimised social disparity and negative tensions;
- g) Scale of a city: larger knowledge cities tend to offer a greater knowledge pool and greater diversity and choice for knowledge workers and businesses.

These foundations of KBUD also need a strong organising capacity to build on such foundations with a broad partnership of public, private, academia, and community interests (Yigitcanlar *et al.*, 2008c). The establishment of these foundations facilitates the development of knowledge industries and human capital programmes, which generate and attract talented

workers and businesses. In this perspective, a number of fundamental KBUD pillars, foundations and key features have been highlighted (Figure 2). Those that have emerged as fundamental criteria or key features of a successful KBUD are: (a) knowledge industry structure; (b) knowledge worker structure; (c) cultural diversity; (d) connectedness; (e) quality of life and place; and (f) knowledge community precincts; (g) an effective governing body to orchestrate KBUD.

[INSERT FIGURE 2]

The purpose of this comparative study is to provide some basic understanding for further, more in-depth analysis of KBUD of Australian cities. To simplify the analysis, global and local economic conditions, such as the availability and cost of venture capital, and government macro-micro economic policies and so on are not taken into account. This empirical study's key comparison elements are mainly based on the recently expanding knowledge based development literature which could be seen as the limitation of the study (i.e. Yigitcanlar et al., 2008a; 2008b; Metaxiotis et al., 2010). In order to explore and evaluate the generic KBUD potentials of Sydney, Melbourne and Brisbane, and to benchmark them against Boston, the research focuses on the abovementioned seven important features of KBUD.

Data and methodology

The methodology used in this research includes literature review, best practice analysis, government policy document content analysis, and statistical analyses of the fundamental data that provide a comparison between the three major Australian cities, Sydney, Melbourne

and Brisbane, and Boston. Urban centres and localities in Sydney, Melbourne, Brisbane and Boston metropolitan areas were selected to form the study area boundaries.

The data used for the statistical analysis are obtained from the 2006 ABS Census, the 2000 US Census, the 2006 US Census estimate, the relevant literature and government policy documents. The salient knowledge based development features of Sydney, Melbourne and Brisbane, which are compared with those for Boston, are listed in Table 1 and discussed below under seven sub-headings.

[INSERT TABLE 1]

Knowledge industry structure

In terms of overall economic structure, New South Wales is the strongest State among all Australian State and Territories, followed by Victoria and Queensland. However, when compared with the innovation giant of Massachusetts, New South Wales, with its \$360 billion Gross State Product, has only slightly more than two-thirds of Massachusetts's Gross State Product. At the State level New South Wales also dominates Victoria and Queensland in R&D expenditure and per capita R&D investment. These R&D figures are between eight to 19 times higher for Massachusetts than for the three Australian States. A similar pattern is also observed in State-wide private business investment. Within Australia, the unemployment rate is lowest in Queensland and its capital Brisbane. This is comparable with that of Massachusetts and its capital Boston at 4.2 percent (ASTRA, 2008; ABS, 2009). Sydney, with almost half of the top 500 Australasian Enterprises, is a clear leader among other Australian cities in attracting and retaining large international enterprises. Knowledge-based industries consist of information media and telecommunications; financial and insurance; professional, scientific and technical; education and training; health care and social

assistance; and arts and recreation services. In knowledge-based industry firm ratio to all firms, Sydney and Melbourne lag behind Brisbane (19.17%), but with only a small margin between them. Knowledge-based industries constitute almost one-third (31.39%) of the industries. International business visitor numbers show that Boston receives more than double those for Sydney, Sydney double those for Melbourne and Melbourne double those for Brisbane (ABS, 2009; US Census Bureau, 2009).

Knowledge worker structure

Knowledge workers consist of professionals and managers in the fields of: information media and telecommunications; financial and insurance services; professional, scientific and technical services; education and training; health care and social assistance; and arts and recreation services. Sydney, followed by Melbourne and Brisbane has the highest share of knowledge workers, but Boston has almost double Sydney's ratio of knowledge workers to all workers (43.30%). Research and education institutions play a crucial role in attracting and also training knowledge workers. Melbourne, with its nine universities is far ahead of Sydney's five and Brisbane's three universities. However, with most of its universities in the Ivy League, eight of the universities in Boston attract more annual R&D income (over \$2.5 billion) than do any of the Australian cities. The tertiary education student population ratio favours Brisbane over Melbourne and Sydney with over six percent, but this is still far below Boston's figure of almost ten percent. Brisbane, with over 21 percent, has a higher proportion of university graduates than do Sydney and Melbourne but this is still far below Boston's 35 percent. Brisbane has the youngest median age of 34 for the Australian cities Australia followed by Sydney and then Melbourne, but this is still below Boston's lower median age of 33 (ASTRA, 2008; ABS, 2009; US Census Bureau, 2009).

Cultural diversity

For all three Australian capital cities and for Boston their most common denominator is their cultural diversity. Cultural diversity figures for the Australian cities show Sydney's lead over Brisbane and Melbourne with over 41 percent of workers born overseas. This is close to the figure of 45 percent for Boston. However, in terms of the overall overseas born population, the Australian capital cities exhibit a higher cultural mix than does Boston, as a result of national differences in immigration policy. In Australia, Brisbane has the highest overseas born level at over two-thirds of its population (67.74%), followed by Melbourne and Sydney. Also, with its sub-tropical climate and booming economy over the last decade, Brisbane has experienced considerable interstate migration, whereas this has been insignificant in Melbourne and Sydney. By contrast, and for quite some time, overseas migrants' settlement preferences have been for Sydney, Melbourne and Brisbane respectively (ABS, 2009; US Census Bureau, 2009).

Connectedness

Connectivity to the internet is a key requirement for building knowledge societies and for networking knowledge workers online. Broadband infrastructure and fast access to the internet are very important factors affecting the locational decisions of knowledge workers and industries (Graham, 1999; Hackler, 2003). The household broadband users' ratio is highest in Sydney, with over 21 percent, followed by Melbourne and Brisbane, whereas almost one-third of Bostonians enjoy broadband connections (ABS, 2009; US Census Bureau, 2009). Connectivity to the internet also provides access to online services such as e-government. Beyond having positive impacts on education, skill development and commerce, the provision of e-government services is associated with a range of beneficial outcomes including the potential to foster strong and robust political debate, enhanced civil society and

strengthened relations between citizens and those who govern (Baum *et al.*, 2006). Australian States and capital cities provide a range of government services online and Australia is ranked as the sixth e-government service provider, whereas the US is ranked first in the world (Waseda University, 2007).

Quality of life and place

As the literature indicates, quality of life and place is a major attractor for knowledge workers (Florida, 2005; Yigitcanlar *et al.*, 2007). One of the key determinants of quality of life and place is the level of accessibility provided by local sustainable transport systems, such as public transport, cycling and walking. The use of sustainable transport modes is very poor in Australian cities compared to the over 45 percent usage level in Boston. Sydney only reaches half of this figure, Melbourne about one-third and Brisbane less than one-third. In their research Baum *et al.* (2007) found that housing and rental affordability and rental availability are among the key factors in attracting knowledge workers. One of the biggest struggles for Boston has always been the housing affordability issue. This issue results in higher property prices as compared to the Australian cities but, surprisingly, the lower rents in Boston compensate for this disadvantage to a certain degree. Among the three Australian cities median house prices are highest in Sydney followed by Melbourne and Brisbane. The ranking for median weekly rents is Sydney, Brisbane and Melbourne respectively. Australian cities have low rental ratios, the lowest being 14 percent in Melbourne. Boston's rental market share is almost 60 percent.

There are a number of international city ranking studies conducted around the world to pin-point cities' strengths and weaknesses in attracting talent and investment. In a study conducted by Mercer (2008), with regard to personal safety, the highest ranking being the safest, Sydney and Melbourne share 29th place, Brisbane is 49th and Boston is not even in the

first 50. The same study ranks cities by their cost of living, the highest being the most expensive. In this ranking Brisbane is ranked 57th, Melbourne 36th, and Sydney 15th being the most expensive city in Australia; Boston was only 99th. With regards to overall quality of life the study points out that Sydney in 10th position leads Melbourne, Brisbane and Boston respectively (Mercer, 2008). The Global University City Index rates cities based on their scale and liveability, using criteria including the number of world-class universities with an internationally diverse population and their investment and performance in education and research. In 2008, in this study Boston ranked second, Melbourne fourth, Sydney fifth, and Brisbane fell just outside the top 20 (RMIT University, 2008).

Knowledge community precincts

Knowledge precincts represent an ideal seed environment for knowledge production in metropolitan areas where government institutions and private developers play an important role in the development process. In other words, what matters most for the development of such knowledge-based precincts is the meeting of minds between innovative developers and regulators.

The analysis of knowledge community precincts and their elements and processes is still an under researched area, and the extraction of lessons and new directions from existing examples requires further detailed exploration. Australian knowledge precinct policy dates back to early 1980s (Joseph, 1997). Since then many knowledge precincts have been developed, e.g. Macquarie University Research Park in Sydney, La Trobe R&D Park in Melbourne, Brisbane Technology Park. There is no clear understanding of what components a knowledge community precinct actually needs to include in order to generate highly innovative knowledge flows and innovation outputs comparable to those produced by Silicon Valley, Route 128 and Silicon Hills. However, examples of successful knowledge community

precincts do exist in Australian cities. Parkville Knowledge Precinct, encompassing the University of Melbourne and the university's residential campus in Melbourne, and Kelvin Grove Urban Village in Brisbane are among the limited examples of knowledge community precincts, although they do not measure up to Boston's Route 128 precincts. The Australian Technology Park, in Sydney, according to its new master plan has the potential to turn into a knowledge community precinct by linking the development with surrounding residential areas (RWA, 2006).

An effective governing body

Some economists argue that strategic planning instruments offer little guidance to the success of knowledge based developments. However the geography of knowledge producers and users does matter for the development of our cities and for the attraction of talent and investment. Therefore, knowledge strategies need to be linked to the development and planning priorities of local areas or regions so that support policies can be more effectively designed and implemented. It is important to develop KBUD development strategies in concert with the relevant authorities to provide for knowledge production and the augmentation of the knowledge economy. However, this research does not thoroughly scrutinise the capabilities of the relevant governing institutions, rather it briefly scans whether these authorities are equipped to handle the planning and the creation of the necessary spatial arrangements for the development of the knowledge economy and the concomitant KBUDs.

Three Australian cities, Sydney, Melbourne and Brisbane, have planning and strategy development authorities and mechanisms in position for providing space and promoting place for knowledge-based activities. However, in all of these Australian cities there is room for improvement in the orchestration of KBUD through newly established dedicated authorities.

In Sydney, the Department of Planning and Natural Resources developed the *Sydney Metropolitan Strategy* in order to improve its position in the knowledge economy. This KBUD strategy has formed the basis for important policy decisions such as the identification of pockets of potential knowledge production areas across the Greater Sydney Region (DPNR, 2005). The New South Wales Government also has plans for establishing a dedicated Innovation Council and Secretariat to drive the implementation of KBUD (NSW Government, 2006).

In Melbourne, Department of Infrastructure prepared *Melbourne 2030*, focusing on planning for sustainable and knowledge-based growth and change across metropolitan Melbourne and the surrounding region in its 30-year plan. This plan aims to create opportunities for innovation and the knowledge economy within existing and emerging industries related to research and education (DOI, 2002). In addition, in 2005, the Office of Knowledge Capital in Melbourne was established in partnership with Melbourne City Council and nine Victorian Universities to drive the evolution and promotion of Melbourne as a global knowledge city (OKC, 2009).

In Brisbane, the Smart State Council and the Department of Infrastructure and Planning developed the *Smart State Strategy* and the *South-East Queensland Regional Plan* both of which adopt a KBUD policy. This policy identifies investments in research, development, technology diffusion and commercialisation of ideas, and includes investments in knowledge, skills, diversity, creativity and connectivity as the key mechanisms to achieve increased productivity and a better quality of life (SEQRP, 2005; Smart State Council, 2007).

As in Australia, the Boston Metropolitan Area Planning Council developed the regional urban and economic development plans, *MetroPlan* and *MetroFuture*, which emphasise the focusing of KBUD in and around the Route 128 biotech and education clusters (MAPC, 2008).

Conclusion

In the knowledge era, Australian cities need to adjust their local economies so as to be compatible with the global knowledge economy, and to develop strategies to become more competitive in order to succeed in the global competition for attracting investment and talent. The research reported in this paper has shown the relatively high potential of Sydney, Melbourne and Brisbane to achieve thriving KBUD development – or becoming the Boston of the Southern Hemisphere, although at this stage they are not in the same league as Boston. In the knowledge economy, urban areas in Australia can and should pursue knowledge-based development. Success in development of this type will raise standards of living in the region and expand economic opportunity for its residents. However, more questions than answers are currently raised about what constitutes a KBUD, and whether such development is more about the attraction of knowledge-based industries and knowledge workers to lifestyle choices or about the ways in which working places and spaces are designed. The ways, forms and conditions of knowledge community precinct development still need to be clarified through, for example, case studies where systematic investigations of hard and soft features, including urban design, physical infrastructure, design for knowledge-based industry activity interactions and innovation infrastructure can be undertaken.

Policy makers also need to be aware of the global economic, scientific and technological conditions operating in the world today. There is increasing competition from other regions to attract scientists and industrial talent; knowledge carriers and whole teams are often targeted by other players who seek to move institutions and knowledge bases. Therefore, planning and commercial strategies can certainly be structured to enhance the relevance of knowledge produced in a certain space. However, the conditions which foster high intensity knowledge traffic are much more complicated than, for instance, the strategic

use of land. A different set of skills is needed to develop knowledge networks where ideas can be trialled and discussed. Government policies, at the local level, have a critical role to play in ‘fostering the conditions’ where intellectual vitality is developed through intensive collaboration networks that attract and retain knowledge carriers, i.e. agents, firms and workers. Partially this emphasis on the ‘local’ responds to the view that local institutions, businesses and organisations are partners in fostering local development and are part of the local innovation system where they are embedded.

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Figure 1. Pillars of knowledge-based urban development

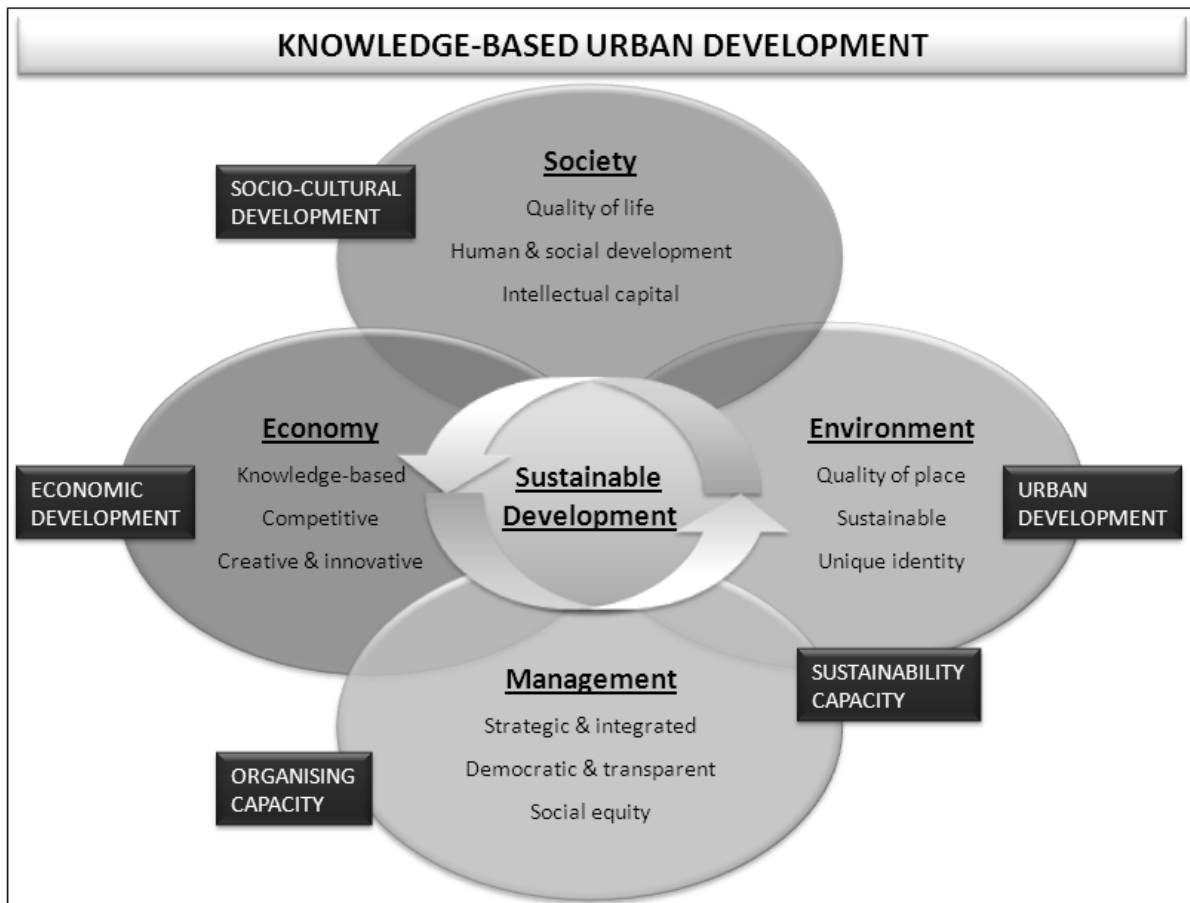
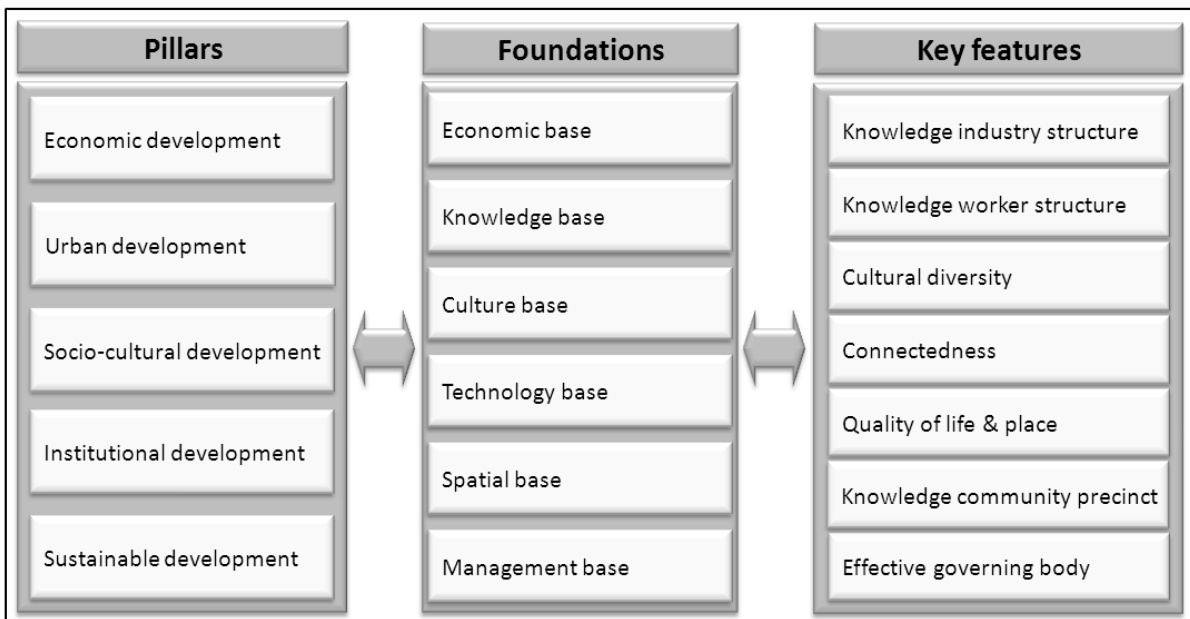


Figure 2. Knowledge-based urban development frame of analysis



KEY FEATURES	SYDNEY		MELBOURNE		BRISBANE		BOSTON	
	#	%	#	%	#	%	#	%
Population	2,937,160	n/a	2,743,991	n/a	1,335,658	n/a	574,283	n/a
Area (sq.km)	12,143	n/a	7,694	n/a	1,327	n/a	125	n/a
Density (person/sq.km)	242	n/a	357	n/a	1,007	n/a	4,579	n/a
Knowledge Industry Structure								
Gross State Product (\$ million)	359,883	31.80	267,966	23.70	214,027	18.90	504,771	2.58
State R&D Expenditure (\$ million)	3,331	33.04	2,954	29.31	1,273	12.63	24,443	5.54
State R&D Investment (per capita in \$)	509	n/a	599	n/a	326	n/a	3,787	n/a
State Private Business Investment (\$ million)	38,982	24.90	36,252	23.17	33,423	21.36	42,050	11.05
Location of Top 500 Australasian Enterprises	225	45.00	133	26.60	46	9.20	n/a	n/a
Knowledge-Based Industry Firms	79,965	18.13	61,782	17.56	19,131	19.17	14,737	31.39
International Business Visitors	886,700	51.30	402,731	23.30	229,885	13.30	1,969,106	10.27
Unemployed Population	103,511	4.60	96,566	5.00	23,478	4.20	22,248	4.20
Knowledge Worker Structure								
Knowledge Workers	376,202	22.18	321,570	20.34	143,278	17.40	123,850	43.30
Major Research and Education Universities	5	n/a	9	n/a	3	n/a	8	n/a
University Student Population	169,187	5.76	166,526	6.07	83,935	6.28	56,900	9.90
Residents with University Degree	616,613	20.99	545,375	19.88	281,192	21.05	134,252	35.50
Median Age	35	n/a	36	n/a	34	n/a	33	n/a
Cultural Diversity								
Cultural Diversity at Workplace	703,014	41.45	529,886	33.51	300,348	36.46	254,981	44.40
Overseas Born Population	1,518,231	51.69	1,587,563	57.86	904,802	67.74	151,836	25.80
Overseas Migrants	114,670	6.89	188,594	6.00	89,692	5.74	24,120	4.20
Inter-State Migrants	59,622	1.75	84,384	2.67	94,144	6.02	13,783	2.40
Connectedness								
Connectivity (via broadband)	625,606	21.30	554,657	20.21	231,790	17.35	184,919	32.20
Government Services Online (local e-government portal)	yes	n/a	yes	n/a	yes	n/a	yes	n/a
Quality of Life and Place								
Accessibility (sustainable transport use)	378,679	22.33	237,075	15.00	117,412	14.25	126,229	45.30
Housing Affordability (median house price)	542,000	n/a	451,000	n/a	420,300	n/a	655,000	n/a
Rental Affordability (median weekly rent)	483	n/a	352	n/a	375	n/a	350	n/a
Rental Availability (rental stock)	94,876	20.41	59428	14.01	42335	21.14	340459	59.28
Cost of Living (international city ranking)	15	n/a	36	n/a	57	n/a	99	n/a
Personal Safety (international city ranking)	29	n/a	29	n/a	49	n/a	50+	n/a
Quality of Life (international city ranking)	10	n/a	17	n/a	34	n/a	37	n/a
Global University City Status (international city ranking)	5	n/a	4	n/a	20+	n/a	2	n/a
Knowledge Community Precincts								
Existing and Emerging Knowledge Community Precincts	yes	n/a	yes	n/a	yes	n/a	yes	n/a
Effective Governing Body								
Dedicated Authority to Orchestrate KBUD	yes	n/a	yes	n/a	yes	n/a	yes	n/a
Effective Knowledge Based Urban Development Strategies	yes	n/a	yes	n/a	yes	n/a	yes	n/a

Table 1. Salient knowledge based development features of Sydney, Melbourne, Brisbane and Boston