Big City Analytics: Identifying Sydney’s economic, employment and population Centres of Gravity

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Key findings

Cities are engines of growth and innovation. While all cities have these key functions, the best cities organise themselves to maximise their potential. They ensure they have the public transport networks, housing densities, skills and governance needed to manage and leverage growth.

At the heart of effective ‘city performance-management’ must be the analytical tools which enable a better understanding of the key forces or trends shaping Australian cities. Committee for Sydney and PwC are seeking to elevate the importance of using emerging analytical tools to understand and manage city performance.

PwC has developed new analytical and visualisation tools to equip public policy makers with a fine-grained understanding of demographic and economic trends, required as a basis for effective policy and action. One tool, the Geospatial Economic Model (GEM) captures the macroeconomic trends that shape our country, then zooms in to see how this plays out in 2,214 ‘locations’ across Australia where business and government operate. Locations refer to socially and economically distinct areas that have, on average, a population of approximately 10,000 people.

Moving beyond a specific location to understanding how a whole city functions is undertaken by calculating the locations of the residential, employment and economic Centres of Gravity. This is the one point in the city where the residential, employment and economic pull of all the locations within the city are evenly balanced – the spatial average.

Applying these tools to Sydney uncovers four key trends about the city’s evolution and implications for future growth:

1. More than one CBD for Sydney?
   While Sydney’s CBD is Australia’s most important economic asset, contributing $64 billion to the economy in FY13, Sydney’s economic Centre of Gravity is located over 9km west in Concord, much closer to Sydney’s Second CBD, Parramatta. Our work shows that Sydney is the only major city in Australia where the economic Centre of Gravity is neither located in the CBD nor moving towards the CBD (an interesting trend in itself). In fact, Sydney’s economic Centre of Gravity has been consistently drifting away from the CBD in a north westerly direction over the past 13 years. This finding points to the importance of population driven economic growth in Western Sydney and the ongoing role of a network of key economic clusters which house high value add industries across Sydney.

   The pull between these two different economic drivers is diversifying growth away from the CBD and presents its own unique set of social and economic challenges and opportunities.

2. Connectivity for growth.
   Direct connectivity between Sydney’s economic clusters is crucial for realising the potential of the network. Our analysis demonstrates that strong economic returns are being generated from the policy and investment focus on Sydney’s Global Economic Arc, running from the airport in the South, through the CBD to the Hills district in the North. However, from a spatial perspective, this corridor represents an uneven targeting of investment, which is leading to a fragmentation of economic, employment and residential outcomes across Sydney. Have we overlooked Sydney’s east west axis, which aligns two major economic clusters, providing critical connectivity into Western Sydney, and this analysis suggests is comparatively better placed to form the economic spine of Sydney? What about Sydney’s South which has experienced lower rates of growth relative to other parts of Sydney?

3. The end of urban sprawl?
   The urban sprawl and greenfield development which defined Sydney’s growth during the 1990s and early 2000s is easing and showing signs of reversing. Higher density, infill development is accelerating and taking on a greater role in housing Sydney’s growing population.

4. Debunking (and clarifying) the jobs and housing imbalance in Sydney.
   The notion of a major imbalance between jobs (in the East) and housing (in the West) is incorrect. At the macro level, the distribution of jobs and housing is broadly balanced. Pronounced imbalances do however exist when looking at the high value add service sectors which have been driving Sydney’s economic growth. Localised imbalances also occur due to uneven transport services and accessibility. These nuances should be the focus of public debate and policy efforts.

This is a step change in the analytical tools available to understand, analyse and manage the growth of our cities. The results of this work make a significant contribution to policy development and civic dialogue in Sydney and all other Australian cities.
Cities are engines of growth and innovation. While all cities have these key functions, the best cities organise themselves to maximise their potential. They ensure they have the public transport networks, housing densities, skills and governance needed to manage and leverage growth. However, it is increasingly recognised that also at the heart of effective ‘city performance-management’ are the analytical tools which enable a better understanding of the key forces or trends shaping the city. Although there is now a large body of literature on ‘city analytics’ and measures of urban performance, there is not as yet a universally agreed assessment framework or set of indicators enabling us to identify the key factors of success or failure. There is a plethora of competing and often inconsistent city performance league tables or indices.

In this context the Committee for Sydney and Committee member PwC are in this Issues Paper seeking to elevate the importance of using emerging analytic tools to understand and manage city performance. Big city thinking requires big city analytics.

Building on findings from recent Committee reports

In several recent reports the Committee for Sydney has sought to identify some of the key defining trends of Greater Sydney’s development and some of the policy settings or investment decisions required to maximise its performance as a prime driver of the national economy. In Issues Paper 4, ‘Sydney: adding to the dividend, ending the divide’ we drew attention to the following:

• Sydney in 2014 rose to become the second fastest growing capital city in Australia, with the highest productivity of all cities. This is the ‘Sydney dividend for the nation’.

• Sydney’s CBD alone contributes as much in GDP to Australia as the mining sector and Sydney makes a massive tax contribution to the Federal Treasury.

• Meeting the challenges of managing Sydney’s growth requires support for, and investment in, a public transport revolution – including key Big City infrastructure projects such as the Second Harbour Crossing (Sydney Rapid Transit) and the light rail schemes for central Sydney and Parramatta.

For the Committee that also means that the Federal Government should itself increasingly look to co-invest in city mass transit projects of national economic significance – and not just leave all public transport funding to cash-strapped state governments.

• Although there is new momentum in Western Sydney – and the new opportunity of the second airport needs to be fully leveraged – there remains significant uneven spatial performance across Sydney.

• This is in part due to the challenging topography of the city with the location of Sydney’s CBD at the far eastern side of the metropolis while almost half of Greater Sydney’s population of 2 million people now live west of Parramatta.

• Greater Sydney’s future success will thus depend to a large degree on how truly polycentric and connected it becomes, with the need for a resolute focus on the integrated transport and land use planning required to develop the full potential of both of the Sydney CBD and also of the other key large urban centres such as Parramatta, Liverpool, Macquarie Park and Penrith. It is an innovative part of the work presented here that options for the further development of opportunities to the south of the CBD of Sydney may also need to be explored.
The need to understand and fix some of Greater Sydney’s structural challenges was demonstrated robustly in Issues Paper 4 when the contrast was made between the better distributed ‘effective job density’ found in Melbourne and that of Sydney.

This is in great part due to the easier location of Melbourne CBD, being more or less at the centre of its metro region and accessible by a large population from all angles - which also has a positive impact on housing affordability close to the CBD. However, the Committee perspective is not to passively concede the structural advantages of a competing city but to intervene in transport provision, planning and governance to improve further to performance of Sydney and its attractions to business and people.

**Understanding how Sydney works: the need for the right tools**

The basis of any effective process of intervention must be an understanding of how Sydney works at the moment. Given Sydney’s geographical challenges and dispersed development pattern, the reality of its polycentric nature by comparison with Melbourne needs to be firmly grasped and responded to creatively in policy and initiatives.

To be clear, the Committee’s view is that the health and vitality of Sydney’s CBD needs to be promoted and connectivity to it from all parts of Sydney needs to be enhanced. We also need to enable more people to live closer to the CBD than is currently the case as doing so will enable the higher value jobs there to be accessed more easily and enable enterprises to have access to a wider pool of labour. Sydney’s CBD is a prime example of the economic impact of agglomeration and thicker labour markets, and public policy must always seek to renew the bases of its success.

However, despite the welcome addition of Barangaroo and other new sources of high value employment space at the heart of the city, Sydney’s CBD will remain comparatively constrained. Except in growing upwards – and there is some capacity to do this – the CBD cannot expand its core area easily in the way Melbourne did through Melbourne Docklands and is again doing with the commitment to develop the extensive Fisherman’s Bend area as renewed high value employment capacity close to the CBD.

Essentially, public policy needs to both develop the existing CBD to its full capacity and develop other key locations in Greater Sydney for high value employment uses to supplement our CBD. It also needs to enable more residential development both close to the existing CBD and other high value employment centres. Furthermore, policy needs to have a strategic focus on significantly enhanced public transit provision to more effectively connect the key higher value employment centres in Sydney with the existing CBD and with their surrounding populations.

The new light rail project centred in and around Parramatta is a significant step forward in this regard. But more will need to be done to ensure even more efficient and faster heavy rail connectivity on the line from the CBD through Parramatta so that the two CBDs can be more closely - and speedily - connected. The analogy is with the old financial centre of London and the new one created in Docklands at Canary Wharf, which did not succeed until a public transport link was created. This enabled a business person to get from one centre to the other in less than 15 minutes with services so speedy and frequent that they didn’t have to know the timetable.

With such links centres can act together and form a single economic agglomeration even when they are spatially separate. Sydney needs such an approach to deliver on the aspirations of the new Metro strategy. The Committee looks to the next iteration of the Long Term Transport Masterplan to take this view and prioritise the projects which deliver a fast strategically crucial rail link between Parramatta and Sydney CBD. Such an approach is vital if we are to overcome some of Sydney’s structural challenges and achieve the kind of transport and land-use planning integration required to maximise performance in our polycentric city.

Public policy needs to both develop the existing CBD to its full capacity and develop other key locations in Greater Sydney for high value employment uses to supplement our CBD.
It is as a contribution to this necessary understanding of the key forces at work in our city that we publish this latest Issues Paper in collaboration with Committee members, PwC. PwC has developed new analytical and visualisation tools to enable public policy to have that more fine-grained understanding of key demographic and economic trends required as a basis for effective policy and action.

This Issues Paper for the first time sets out key findings from this work and offers policy and decision makers new insights into the economic and demographic forces shaping Sydney and other Australian cities. The Committee would like to thank PwC for making this work available to us and collaborating on this Paper. This work offers a step change in the analytical tools available to understand, analyse and manage the growth of our cities. It can help decision-makers design better policy and can help inform the civic dialogue about Sydney and indeed the future of all Australian cities.

Because of the Committee’s desire to be a platform for a better and more engaged civic dialogue about the future of Sydney – and because the work itself is innovative – our approach with this report is to set out the findings and use these as prompts for some key questions. Please review and respond. We will be distributing the Paper widely and seek the fullest engagement of our diverse membership and public and private sector stakeholders in responding to those questions. In this process of engagement we will then be able to shape even better tools for understanding and managing our city.

Lucy Turnbull
Chair
Committee for Sydney
Understanding city performance

This methodology introduces the advanced evidence base and analytical tools required for not only understanding, but managing the ongoing growth of our cities.

The foundations of this approach require granular economic data to measure the historical performance of areas within cities. PwC’s Geospatial Economic Model (GEM) provides this granular evidence base by calculating economic output in a manner consistent and reconcilable with the Australian Bureau of Statistics (ABS) for 2,214 areas across Australia. The time series for GEM tracks changes in these areas over the past 14 years.¹

This dataset provides invaluable insights into the performance of specific locations within our major cities. More importantly, it incorporates a vast spectrum of social, demographic, infrastructure and industry data, allowing ‘on-the-ground’ impacts of policy and investments to be tested and learnt from.

Moving beyond a specific location to understanding how a whole city functions is achieved by calculating the locations of the residential, employment and economic Centres of Gravity (or CoG). This is the one point in the city where the residential, employment and economic pull of all the locations within the city are evenly balanced – the spatial average.

Identifying Centres of Gravity

The Centre of Gravity is where the pull of the economic, employment and residential forces within the city are evenly balanced. For example, in a city where there are only three small areas, each of equal distance apart and of equal economic activity, the Centre of Gravity would be in the very middle (below image). If areas had different levels of economic activity, the location of the Centre of Gravity would be pulled towards areas with greater economic activity (right image). This is a simplified example for a city with three small areas; Sydney’s economic, employment and residential Centres of Gravity are calculated based on over 230 small areas (ABS Statistical Area Level 2 geographical classification).

The image below shows the Economic, Employment and Residential Centres of Gravity (CoG) for Sydney in FY13 and their movement over time.

Source: PwC's GEM

- **9.3km**
  - Distance between the Economic CoG and the CBD

- **283.9m**
  - Movement in the Economic CoG between FY01 and FY13

- **11.0km**
  - Distance between the Employment CoG and the CBD

- **249.0m**
  - Movement in the Employment CoG between FY01 and FY13

- **15.1km**
  - Distance between the Residential CoG and the CBD

- **148.1m**
  - Movement in the Residential CoG between FY01 and FY13
Sydney’s Centre of Gravity

Understanding the evolution of our cities using advanced analytical techniques allows us to focus attention on the interconnectedness and functioning of a city as a whole, rather than individual investments or specific locations within a city. This is achieved through our Centres of Gravity methodology.

In Sydney, this has led to four strategic observations:

• More than one CBD for Sydney?
• Connectivity for Sydney’s growth
• The end of urban sprawl?
• Debunking (and clarifying) the jobs and housing imbalance in Sydney.

These are discussed in detail below.

Being strategic, the implications should be considered through the wide spatial and temporal lens which is needed for big city thinking. The implications are not meant to be tactical: these details should be examined via the appropriate processes.

1. More than one CBD for Sydney?

Sydney’s economic Centre of Gravity is located near Concord. Over the past 13 years it has steadily moved towards the North West. The location and movement of the CoG reveals the pull of population driven economic growth in Western Sydney away from the traditional economic drivers in the East. It also underpins the evolution of a growing network of economic clusters across the city.

Sydney’s CBDs

Sydney’s economic centre of gravity is a contrast between the importance of Sydney CBD at a national level and the local forces playing out within Sydney.

At the national level, the Sydney CBD is Australia’s most valuable economic asset:

• Annual output in FY13 was $64 billion dollars, significantly more than the Tasmanian and ACT economies combined

• Output per worker is higher than any other major urban area

• It is Australia’s foremost business centre and gateway to international companies and trade.

However, Sydney is the only major city in Australia where the economic Centre of Gravity is neither located in the CBD nor moving towards the CBD (an interesting trend in itself, see Appendix A for the analysis and results of the other major Australian cities). In fact, Sydney’s economic Centre of Gravity has been consistently drifting away from the CBD over the past 13 years. Our work shows that:

• The CBD, which houses the greatest number of jobs and produces 20% of all of Sydney’s economic output, is over 9km away from the economic centre of Sydney. This is significantly further than other major cities in Australia.

• The centre of gravity has been consistently drifting North West over the past 13 years, away from the CBD, pulled by the growth of Western Sydney and locations to the north like Macquarie Park.

• The economic centre of gravity for Sydney falls close to the geographic centre of the city. This can be viewed as a comparative advantage, allowing 360 degree access across the metro area, and indicates a far more decentralised pattern of growth than other cities in Australia.

While the functioning of the Sydney CBD will continue to be of national significance given its absolute economic scale, the importance of this population driven growth in Western Sydney and the network of economic activity across Sydney is sufficient to pull Sydney’s economic centre of gravity 9km westwards, and keep it moving in this direction.
Network of economic activity

The clusters that form Sydney’s network of economic activity are shown in Figure 2. This not only shows the relative size of each economy within this network, but also highlights the growth of these over the last five years.

The implications of this network of economic activity are threefold:

- Resilience – the economic resilience of a city will become increasingly important as Australia moves through a period of structural economic change and global economic conditions remain both subdued and uncertain. There is a strong argument that a wider distribution of both the location and industry composition of the economy increases the level of resilience a city has to external shocks. It also promotes more equal access for the city’s residents to employment opportunities and services. This is in contrast to a city where economic activity is concentrated in one centre with a specific industry focus, meaning shocks can reverberate more forcefully through the city and its population.

- Agglomeration – the counterargument to resilience is that a greater geographical and industry dispersion hinders the ability to realise the agglomeration and innovation benefits associated with tightly concentrated industry clusters/specialised centres of complimentary industries. Hence, the trade-offs between realising agglomeration benefits and resilience opportunities is one that is continually grappled with in big city thinking and urban planning.

- Connectivity offers a way to overcome this trade-off – a number of geographically dispersed economic clusters can still realise agglomeration benefits if transport links between them allow for rapid and seamless connectivity. Transport effectively reduces the geographic distance between the economies and can carry the knowledge and ideas that underpin Sydney’s knowledge-based economy.

This network of economic activity, combined with uneven residential growth, reinforces the need to approach Sydney through a multi-centric urban management strategy. It also underpins the need for this strategy to deliver seamless connectivity, ensuring people and ideas can move easily to, and between, these clusters.
2. Connectivity for Sydney’s growth

Seamless connectivity can be understood through two lenses: examining direct connectivity between major centres and by looking at the performance of key economic and transport corridors in Sydney.

Direct connectivity between economic clusters

The proximity of the Centres of Gravity to Parramatta reinforces its natural competitive geographical advantage at the heart of Sydney’s residential, employment and economic activity. Analysis of transport connectivity supports this competitive geographical advantage, although it also flags challenges to fully realising the potential of the location.

Figure 3 shows these average public transport and private vehicle trip times between Sydney’s Regional Cities or selected Major Growth Centres identified in the Sydney metropolitan strategy – A plan for growing Sydney. Parramatta has the greatest connectivity with other Regional Cities and selected Major Growth Centres. The average public transport and private vehicle trip time from Parramatta to these other centres is 36 minutes and 26 minutes respectively.

Despite being relatively geographically far from the other Regional Cities and selected Growth Centres, the Sydney CBD has the second lowest average public transport trip time at 40 minutes. This aligns with the historic development of Sydney’s public transport networks which can be compared to a hub and spoke mechanism, with the Sydney CBD being the hub.

However, this ‘average’ level of connectivity hides important challenges to realising the potential of Sydney’s economic network:

1. Trip times – Fast connectivity is crucial. Despite Parramatta having the lowest average trip times between the major economic clusters of 36 minutes, it can be argued that this level of connectivity is not sufficient to promote agglomeration between the locations. Even the average 30-31 minute trip time between the CBD and Parramatta is a barrier to the rapid connectivity required to transfer ideas and knowledge between these locations. Overseas examples, such as London’s subway and rail network, suggest that connectivity in the order of 15 minutes or less is required.

2. Ease of trip – Easy, direct access is crucial. Average trip times can mask the lack of direct connectivity between all locations, notably Macquarie Park. Here, a range of bus services, some requiring transfers is required. Timetable, route complexities and reliability add further barriers to the ease and speed of trips and hence act as a barrier to realising the full potential of Sydney’s economic network.

3. Capacity – Sufficient capacity at the right time is crucial. Theoretical road and public transport connectivity becomes eroded when capacity constraints are added. Inability to access services, crowding or unreliability due to heavy traffic conditions all act as further barriers.

Figure 3: Average driving and public transport trip time from Major Regional Cities/Growth Centre to other five Major Regional Cities/Growth Centres (minutes)

Notes: Public transport trip times calculated using Transport for NSW trip planner based on the average minutes from origin to destination at 9am and 3pm on a weekday (excluding walking and waiting time). Average private vehicle trip time is estimated for a trip at 1pm during the weekday using Google Maps.

2 Public transport trip times calculated using Transport for NSW trip planner based on the average trip time from Town Hall Station to Parramatta Station on a weekday morning.
In summary, the connectivity required to realise the potential of Sydney’s economic network needs to be direct, fast, easy to access at all times and reliable. Our work indicates that the core connections are established, with Paramatta best placed to take advantage of this connectivity. However, the speed, ease of access and reliability of connection between these locations still remain as barriers.

Performance of Sydney’s economic and transport corridors

Returns are being generated from the policy and investment focus on Sydney’s Global Economic Arc, running from the airport in the South, through the CBD to the Hills district in the North. The planning and transport investment focus on this corridor has concentrated economic activity, jobs growth and housing development within proximity to this arc. This result underscores the importance of not only consistent planning direction but also the role public transport investment has played in originally shaping this corridor and more recently, maximising its potential.

However, from a spatial perspective, this corridor represents an uneven targeting of investment, which is leading to a fragmentation of economic, employment and residential outcomes across Sydney. Does the focus on one, strategically well placed corridor deliver better returns than a broader view of investment and economic development across the Sydney basin? This discussion raises two important points in understanding the evolution of Sydney:

A) Have we overlooked Sydney’s East West Spine?

All three of Sydney’s Centres of Gravity are aligned along an east west axis between the Sydney CBD and Sydney’s second CBD, Parramatta. This work suggests that from a spatial perspective, this east west axis, aligning two major economic clusters and providing critical connectivity into Western Sydney, is comparatively better placed to form the economic spine of Sydney.

This East West Spine has the potential to provide greater access to jobs and economic activity to a wider number of Sydney residents. However, despite this spatial advantage, realising this potential requires the concerted planning and transport investment focus that has led to the success of the Global Economic Arc.

B) What about the South?

Sydney’s South and South West, the spatial opposites of the Global Economic Arc, have not been experiencing the same rate of growth as other parts of Sydney (although there have been pockets of strong growth in this region). In addition, over the past 13 years, none of the Centres of Gravity have drifted southward: all movements have been to the North East or North West.

This does not mean that there has not been growth in southern Sydney. Rather, it means that this growth has been more than offset by faster growth in the North East and North West as economic activity and housing growth have been drawn to these locations.

Investments like the South West Rail Link and planning policies like the Western Sydney Employment Area have not (yet) resulted in the same levels of growth that transport and investment in employment areas have delivered in the North and North West.

This may just be a matter of timing, with the South/South West positioning for future growth. However, the promise of future growth potential, especially around Sydney’s second airport at Badgerys Creek [which should not be regarded as the silver bullet or single economic catalyst for the South West], should not detract from immediate challenges the region faces and opportunities that can be capitalised upon.

The region requires an overarching economic vision that recognises its unique industry mix, employment characteristics and competitive advantages, and how these are seamlessly interwoven into the wider fabric of Sydney’s economy.

Without a vision, continual monitoring and action, there is a real possibility that the economic and the social potential of the South/South West will not be capitalised upon. This would further fragment the characteristics of areas within the greater Sydney region.

3 Or looking to be established in the case of the Paramatta Light Rail.
4 The existence of the North Shore Line, investment in the Airport Line and the Epping to Chatswood Rail Link helped shape this corridor. Future delivery of the North West Rail Link and further planning on the Sydney Rapid Transit Network, which includes a second Harbour Crossing, will help maximise this potential of this corridor.
3. The end of urban sprawl?

Urban sprawl is a phenomenon in growing cities characterised by protracted growth of the urban area in a radial pattern around its major centre[s]. Our work suggests that the urban sprawl and greenfield development which defined Sydney’s growth during the 1990s and early 2000s is easing and showing signs of reversing. Higher density, infill development is accelerating and taking on a greater role in housing Sydney’s growing population.

This is shown by the limited movement of the residential centre of gravity. Over the past decade, the residential centre of gravity has only moved 148 metres east-north east, reflecting the pattern of development in Sydney. This is a very small movement compared to other major cities, with Melbourne moving over four times this distance. In the case of Sydney, this finding points to a relatively mature city footprint and a shift in the patterns of growth. In other cities, the greater shifts in the residential centre of gravity have been driven by uneven patterns of growth or geographic [Greenfield] expansion of the city footprint, both of which are responding primarily to planning decisions.

Within Sydney, this shifting of the growth pattern is also shown in housing trends. Figure 4 shows the decline in new developments of houses concurrent to the growth of higher density residential developments over the past three decades. The number of new other residential units exceeded the number of new houses for the first time in 2003, remaining at around the same level since then.

Both the centre of gravity work and building activity data indicate that high density, infill development is becoming the modus operandi for Sydney’s growth. Infill development, underpinned by urban renewal offers the most efficient, environmentally sustainable and economically productive pattern of urban growth. Greenfield development will of course still occur and play an important role in delivering a certain segment of housing stock. However, its contribution to the overall growth requirements of Sydney will diminish. Following this pattern of growth should continue to see Sydney’s residential Centre of Gravity remain stable.

Figure 4: Number of houses and other residential units completed each quarter in NSW

Source: ABS Cat. No. 8752.0 – Building Activity, Australia, Sep 2014

Note: A house refers to a detached building consisting of only one dwelling unit. Other residential refers to flats, apartment units, attached townhouses, semi-detached houses and duplexes.

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5 Note: A house refers to a detached building consisting of only one dwelling unit. Other residential refers to flats, apartment units, attached townhouses, semi-detached houses and duplexes.
Debunking (and clarifying) the jobs and housing imbalance in Sydney

The notion of a major imbalance between jobs (in the East) and housing (in the West) is incorrect. At the macro level, the distribution of jobs and housing is broadly balanced, as evidenced by the relative proximity of the residential and employment Centres of Gravity.

Jobs which follow population growth, such as in the retail sector, education sector and to some degree public services, are also well balanced. Strong population growth in Western Sydney has therefore resulted in strong local growth of these industries.

Pronounced imbalances do however exist when looking at the high value add service sectors which have been driving Sydney’s economic growth. These remain concentrated in the East. Localised imbalances also occur due to uneven transport services and accessibility.

These nuances should be the focus of public debate and policy efforts.

Sydney’s employment Centre of Gravity is located just south of Sydney Olympic Park at Homebush Bay. This also happens to be one of Sydney’s fastest growing employment areas:

Since 2013, the number of jobs in Homebush Bay – Silverwater has increased by close to 50%. This has meant the location is now Sydney’s 7th largest employment area and second largest in Western Sydney.

Over the past 13 years, the employment Centre of Gravity has been consistently pulled north by the development of the Macquarie Business Park, Norwest Business Park and the Hills district. The number of jobs in Parramatta, Liverpool and Penrith has also grown significantly over this 13 year period, but the pull to the direction of any of these locations has been moderated by concurrent growth in the Sydney CBD.
Sydney in numbers (FY13)

4,344,423 residents

$324.9 billion in economic output

21.4% of the national economy

1,647,176 employees

$197,272 output per employee

68.9% of the NSW economy

Source: PwC Geospatial Economic Model (GEM)
Appendix A: Centres of Gravity for Australia’s major cities

Centres of Gravity: Melbourne

The image below shows the Economic, Employment and Residential Centres of Gravity (CoG) for Melbourne in FY13 and their movement over time.

- **6.7km**: Distance between the Economic CoG and the CBD
- **7.7km**: Distance between the Employment CoG and the CBD
- **9.4km**: Distance between the Residential CoG and the CBD
- **746.0m**: Movement in the Economic CoG between FY01 and FY13
- **545.0m**: Movement in the Employment CoG between FY01 and FY13
- **88.4m**: Movement in the Residential CoG between FY01 and FY13
Melbourne in numbers (FY13)

- **Residents**: 4,154,488
- **Employees**: 1,567,479
- **Economic Output**: $262.9 billion
- **Output per Employee**: $167,725
- **Share of National Economy**: 17.3%
- **Share of VIC Economy**: 78.8%

Source: PwC Geospatial Economic Model (GEM)
Centres of Gravity: Perth

The image below shows the Economic, Employment and Residential Centres of Gravity (CoG) for Perth in FY13 and their movement over time.

- **3.5km**: Distance between the Economic CoG and the CBD
- **181.4m**: Movement in the Economic CoG between FY01 and FY13
- **3.6km**: Distance between the Employment CoG and the CBD
- **119.3m**: Movement in the Employment CoG between FY01 and FY13
- **5.7km**: Distance between the Residential CoG and the CBD
- **118.3m**: Movement in the Residential CoG between FY01 and FY13
Perth in numbers (FY13)

- **1,871,993** residents
- **735,021** employees
- **$132.6 billion** in economic output
- **$180,402 output per employee**
- **8.7%** of the national economy
- **52.7%** of the WA economy

Legend

Largest economies by gross output (AU$ million) – 2012/13
Growth rate - 2012/13

Map
- Colour indicates economic output in 2012/13
- Height of bar represents intensity of economic output in 2012/13 (output per square metre)

- **Perth City** 2013 – $28,461m
  Growth 4.6%
- **Osborne Park Industrial** 2013 – $3,834m
  Growth 3.1%
- **Subiaco Shenton Park** 2013 – $3,808m
  Growth 4.9%
- **Nedlands - Dalkeith - Crawley** 2013 – $3,750m
  Growth 28.5%

Source: PwC Geospatial Economic Model (GEM)
The image below shows the Economic, Employment and Residential Centres of Gravity (CoG) for Adelaide in FY13 and their movement over time.
Adelaide in numbers (FY13)

- **1,263,017** residents
- **$72.7 billion** in economic output
- **4.8%** of the national economy
- **483,027** employees
- **$150,416** output per employee
- **77.1%** of the SA economy

Adelaide

Source: PwC Geospatial Economic Model (GEM)
The image below shows the Economic, Employment and Residential Centres of Gravity (CoG) for Brisbane in FY13 and their movement over time.
Brisbane in numbers (FY13)

2,143,339 residents

$143.4 billion in economic output

9.4% of the national economy

832,066 employees

$172,381 output per employee

49.1% of the QLD economy

Brisbane

Source: PwC Geospatial Economic Model (GEM)
The image below shows the Economic, Employment and Residential Centres of Gravity (CoG) for Canberra in FY13 and their movement over time.

- **2.5km** Distance between the Economic CoG and the CBD
- **731.6m** Movement in the Economic CoG between FY01 and FY13
- **2.7km** Distance between the Employment CoG and the CBD
- **593.2m** Movement in the Employment CoG between FY01 and FY13
- **3.5km** Distance between the Residential CoG and the CBD
- **1572.2m** Movement in the Residential CoG between FY01 and FY13
Canberra in numbers (FY13)

- 417,516 residents
- $35.4 billion in economic output
- 2.3% of the national economy
- 202,254 employees
- $174,811 output per employee

Canberra

Kingston – Barton
2013 – $2,233m
Growth 0.2%

Phillip
2013 – $1,875m
Growth 1.7%

Civic
2013 – $5,559m
Growth 3.8%

ACT – East (Fyshwick)
2013 – $2,878m
Growth 2.6%

Source: PwC Geospatial Economic Model (GEM)
PwC’s Geospatial Economic Model (GEM) is a powerful tool for understanding the key forces shaping Australia’s cities

The Australian economy grew at 2.5% in FY14. However, this number hides the fact that across Australia, 35% of small area economies shrank, while 7% of small economies expanded by more than 10%.

Australia has become known as the patchwork economy. To stay competitive, business and governments increasingly need to understand the differing economic performances of the ‘patches’ that make up our cities and regions. PwC’s GEM is a powerful tool for policy analysis – providing unique insights to help governments make informed decisions about the management of Australia’s cities.

A fine-grained understanding of economic, social and demographic trends is critical for effective management of Australia’s cities

PwC’s GEM provides insights across 2,214 small areas covering Australia through a number of data lenses including economic, social and demographic factors [Figure 6]. This helps governments understand and analyse cities from different dimensions, and allows them to sharpen productivity, investment and strategic planning decisions.

Going further, knowing how the areas have performed since 2001 and are likely to perform out to 2020, combined with the economic, industry, social and demographic trends that drive this, provides a step change in the quality and granularity of information required to realise the potential of our cities.
Insight Analytics

GEM is developed and maintained by PwC’s Insights Analytics team – a multi-disciplinary team of analysts, economists, mathematicians, scientists and engineers that work with data to derive new insights to improve decision making. An example of this is our recent collaboration with Local Government Professionals Australia (NSW) to build a new local government performance management tool. This tool helps NSW councils better communicate, control and manage their internal business performance with their stakeholders. The valuable insights from this work enable key decision makers to evaluate their business performance against other entities as well as monitor business improvement, within their organisation, over time. By also providing the context of the economic performance of their areas, we are able to provide management teams with a rich view of their organisation’s capability, and relative performance, in key areas.
Contacts

Dr Tim Williams  
Chief Executive Officer, Committee for Sydney

Sophie Newsome  
Manager, Communications, Committee for Sydney

commitee@sydney.org.au  
www.sydney.org.au

Joseph Carozzi  
Sydney Office Managing Partner, PwC
joseph.carozzi@au.pwc.com

Rob Tyson  
Director, Economics & Policy and GEM Project Lead, PwC
rob.tyson@au.pwc.com

Stuart Shinfield  
Partner, Insight Analytics, PwC
stuart.shinfield@au.pwc.com

Jeremy Thorpe  
Partner, Economics & Policy, PwC
jeremy.thorpe@au.pwc.com

www.pwc.com.au/consulting/analytics/gem.htm  
pwc.com.au/bigcityanalytics

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