Concern is growing that the space economies of South Africa’s cities are becoming more unequal, exacerbating historical racial and income divisions and/or generating new forms of spatial inequality (Sinclair-Smith and Turok 2012). Patterns suggested in the literature include: the economic marginalisation of former townships once reserved for black people (Naude 2008); the dispersal of economic activities (particularly office and commercial) from central cities to suburban locations (Beavon 2006; Goga 2003; Rogerson 1997); the development of new economic centralities on the periphery, but close to higher-income residential areas (see Chapter 18); and shifts in industrial location, with the decline of old manufacturing areas and the growth of new industrial spaces (Rogerson 2000). These patterns reflect socio-spatial changes noted internationally (e.g. Hall and Pain 2006), including the restructuring of economies and of particular economic sectors with globalisation, but particularly South African and city-specific dimensions are evident too (Sinclair-Smith and Turok 2012).

While strategic metropolitan spatial plans have hoped to restructure South African cities spatially to redress spatial inequalities, and there has been some success at the level of redistributing public investment, they have had little impact on the space economy. This is in part because the dynamics of urban space economies have been insufficiently understood and addressed by planning (Harrison et al. 2008; Todes 2008).

There is little systematic analysis of the performance of the Johannesburg economy or its space economy. Work that does stand out is that by Owen Crankshaw, Chris Rogerson and Wim Naude (2008). Indicatively, Crankshaw (2008) and Crankshaw and Parnell (2004),
using historical Census data on employment by sector, trace the growth of Johannesburg manufacturing through the mid 1900s, and its dramatic collapse after 1980. Over the years Rogerson has analysed various sectors of the local economy. Representatively, his 2000 analysis of manufacturing uses data from the Bureau for Market Research Industrial Registers to show, for example, that while manufacturing has continued to shed jobs, the number of industrial establishments has held steady, and that in fact the northern parts of Johannesburg have seen a ‘remarkable industrial surge’ (2000: 317). Naude (2008) builds from the American scholarship that seeks to determine whether unemployment rates in African American communities can be attributed to poor spatial access to jobs (Gobillon et al. 2007). His analysis confirms the spatial mismatch hypothesis for Johannesburg, showing that there has been a suburbanisation of jobs and that distance from work opportunities is a significant causal factor in explaining unemployment.

While valuable, the best of this scholarship is now dated, and much of it tends to focus primarily on the question of the shift from manufacturing to services, limiting a broader understanding of the space economy and how it is changing. In this chapter we address this gap by providing an overview of Johannesburg’s space economy and analysing its main patterns and trends in the period since 2001. We do this through three lenses. In the first section, we look at the overall structure of the Johannesburg economy and the spatial distribution of its main sectors, using firm-level data. In the second section we consider how changes in the built environment – specifically the location of industrial and commercial buildings – reflect key trends in manufacturing and commerce between 2001 and 2010. In the final section we examine the issue of the spatial distribution of employment opportunities through a preliminary analysis of changing patterns of home-to-work commuting from key suburbs. While necessarily indicative, with only a sample of areas being compared, this analysis consolidates the chapter with a sense of how access to employment is being reshaped over time.

One reason for the limited analysis of Johannesburg’s space economy may be the lack of easily accessible official statistics at municipal and sub-municipal level.¹ A number of private data companies (Quantec and Global Insight) have developed products that synthesise pictures of municipal Gross Value Added (GVA), employment and its sectoral composition.² These companies also provide sub-municipal spatial breakdowns of their data, but these are problematic in various ways.³ The Council for Scientific and Industrial Research (CSIR) has developed its Geospatial Analysis Platform drawing on these data, and provides spatial representations of GVA and employment based on 50 km² mesozones.⁴ The 2011 version of the Geospatial Analysis Platform has 33 mesozones for Johannesburg, which shows the main nodal areas, but it cannot show localised concentrations of jobs in small nodes, office and industrial parks, or along transport routes.⁵

While we draw on some of these data to provide an overview of aspects of the space economy, one of our aims is to build an analysis on three relatively new sources of data. Together these address some of the identified gaps and weaknesses in the more commonly accessible datasets. The first part of the chapter uses data from AfriGIS, which – in
partnership with Spatial Technologies and Matrix Marketing – has catalogued and spatially referenced business type, turnover and employment data for a large number of firms (AfriGIS 2010). The second section employs data from GeoTerraimage (GTI), which has translated satellite images for selected years into geocoded data on the land-use type of buildings. This enables an understanding of the location of industrial and commercial properties, including some subcategories of these, and of how this has changed over time. The third part of the chapter relies on the Gauteng City-Region Observatory’s (GCRO’s) Quality of Life Survey conducted in 2011, which has data on the origin and destination of some 2 500 home-to-work commuters and work seekers in Johannesburg.6 These datasets have their own limitations,7 but they enable a more fine-grained analysis of the space economy, and the predominant spatial shifts over time, than that allowed by the more conventional data available.

Economy and industry sectors in space
Spatial distribution of economic value and businesses

The introduction to this volume (Chapter 1) provided a brief overview of the Johannesburg economy, drawing on Quantec and Statistics South Africa’s population Census data. It pointed to the city’s relatively rapid growth between 1996 and 2011, at least compared to the national economy. Johannesburg was also relatively more labour absorbing than the national economy, and population Census-based unemployment rates dropped to a limited extent to 25 per cent in this period. Table 1.3 in the introduction, examining the sectoral composition of the economy, showed the growing dominance of the tertiary sector between 1996 and 2011. Tertiary growth was driven particularly by the finance, insurance, real estate and business services (FIRE) sector, and by wholesale and retail trade. Although manufacturing continued to expand, it dropped in proportional weight in terms of value added and employment, eclipsed by much more rapid growth in the other sectors.

How is this fast-growing and tertiarising economy distributed spatially? The CSIR’s 2011 mesozone analysis shows that the two mesozones contributing the largest share of GVA cover the CBD and the areas immediately to the east and west of this along Main Reef Road, with 11.3 per cent and 10.2 per cent of the total GVA respectively. Sandton and Rivonia make up 10.1 per cent of the total. Soweto is divided into three mesozones, one of which also includes Eldorado Park, which accounts for 6.7 per cent of GVA. The CSIR’s analysis of employment8 shows the highest concentration of manufacturing employment in the mesozones around the CBD, and to the east and south, with a range of between 15 000 and 50 000 in each. There is a smaller aggregation in Midrand. Finance and business services jobs are concentrated in the CBD and around Sandton.

While providing a useful view, the size of the mesozones makes it impossible to discern at a fine grain how economic activity concentrates in specific nodes or along corridors, and how there might be wide disparities in access to economic opportunities even across a relatively small area. Furthermore, while they are spatially referenced, these data on
economic value added and derived estimates of associated employment are not a depiction
of the location of actual businesses and jobs.

A sharper picture is provided by firm-level data from AfriGIS, which estimates that Jo-
hannesburg had 13,580 firms in 2010, 44.4 per cent of the 30,597 companies across Gauteng. Plate 26 (in the colour section) is a ‘heat map’ of AfriGIS data showing the distribution of businesses across Gauteng and in Johannesburg, and their relative concentration in particular places. The map visually demonstrates the importance of Johannesburg within the regional space economy, but also highlights that the city forms part of a larger core area encompassing parts of the neighbouring municipalities, in particular Ekurhuleni. Tshwane, especially in and around the old Pretoria area, has a comparatively lower but still significant number of businesses, while it is starkly evident that the south of the province has virtually no economy apart from a small concentration in Vereeniging and Vanderbijlpark.

The multiple peaks on the map show that businesses aggregate in a number of defined
nodes. Some of these peaks, such as the inner city of Johannesburg, are broad at the base as well as high, indicating significant concentrations over quite a large area. Other peaks are higher and narrower, showing intense concentrations of firms in some very small nodes.

Plates 27 and 28 focus on Johannesburg. Plate 27 – portraying AfriGIS data on the number of firms per square kilometre across the city – shows that the CBD remains the largest single amassing of business, but also clearly illustrates the pattern of multi-nodal development. Sandton has emerged as a major centre for the city (see Chapter 18), and there are also several nodes and economic concentrations along highways and main arterials, including the old east-west corridor through the CBD; a growing corridor along or close to main routes north of the CBD (e.g. Rosebank, Fourways, Midrand); and in north-western areas such as Randburg and Kya Sands. Beyond this, considerable dispersal of business activity is evident, at least in the north. Conversely, while some businesses are locating in former township areas, especially Soweto, concentrations there are low. (Plates 1 and 2 provide a visual reference for most of the place names mentioned in this chapter.)

Plate 28 shows employment concentrations at the same scale as Plate 27. On the one hand this map suggests a more concentrated pattern than for firm numbers, in that there are fewer strong red ‘peaks’ in evidence, implying that the aggregation of firms only translates into equivalent high job numbers in certain places. On the other, this can be interpreted as a pattern of dispersal. Large numbers are still employed in the areas demarcated as green, and even areas excluded from the map, shown as blank, may have up to 100 employees per km².

Here too the CBD emerges as the dominant node, with significant concentrations in Sandton/Wynberg/ Marlboro and the Epsom Downs/Bryanston East/Sloane cluster of business parks. Interestingly, some nodes that seem significant from a business numbers perspective are less important here, such as Midrand, Kya Sands and Strydompark. This might suggest their relative capital intensity and lower employment levels. Other centres, most notably Rosebank, appear more dominant here, but it is intriguing that a similar node such as Randburg disappears from this map. A possible explanation for this can be found in the apparent concentration of employment north of the Western Bypass near Woodmead,
a zone which has no presence at all in Plate 27. This is Eskom Holding’s MegaWatt Park, where the AfriGIS dataset has recorded all 32,000 employees of this major parastatal as employed at the company’s head office, regardless of where they actually work in power stations or depots across the country. At one level this can be read as an aberration that renders the AfriGIS mapping of employment nonsensical. But assuming that the same pattern holds for other firms, it means that the employment map signals where companies tend to locate their head offices. The implication may be that Randburg does not attract significant corporate head-office investment, even though it is important from the point of view of number of firms, while the reverse is true of Rosebank.

**Sectoral composition and distribution**

Perhaps the most important aspect of the AfriGIS data is that it categorises firms into the standard industrial classification codes, not just at the first level of major divisions such as mining or manufacturing, but all the way down to the fifth level. This enables a remarkable picture of how different sectors of the economy are arranged in space.

Plates 29 to 31 show the distribution of firms in the three main sectors – manufacturing, FIRE, and wholesale and retail trade – and Plate 32 shows firms in the construction industry which, although smaller than the other sectors, is growing fast in an interesting spatial pattern. Plate 29 shows manufacturing firms, which AfriGIS estimates at 2,520 in Johannesburg, 34.4 per cent of the provincial total. As might be expected, many manufacturing enterprises coagulate in areas zoned as industrial, with the pattern being very similar to that shown in Plate 33, based on GTI data of industrial land use per building, and which can be taken as one of the best available depictions of actual manufacturing sites in Johannesburg. This suggests that on the whole the office functions of manufacturing firms collocate with sites of production, with some exceptions that we discuss later.

It is apparent that the old east-west ‘mining belt’ remains a significant location for manufacturing, but there are also important clusters of firms along the M1 and N1 corridors to Tshwane, in the north-west in Strydompark and Kya Sands, as well as in more traditional areas for manufacturing such as Village Deep/Areoton and Wynberg around Alexandra. The incidence of manufacturing firms recorded in the former township areas, such as Soweto, and more so Orange Farm further to the south, is particularly low, save for a very small clustering near Lenasia.

There are notable departures from the dominant arrangement of manufacturing firms located in industrial zones. A number of firms are recorded in more dispersed locations, particularly in the north. The most likely explanation for this is head offices separate from sites of production, but the data also reveal some activities coded as manufacturing occurring in decentralised suburban locations, notably publishing.

The dominant pattern of manufacturing location contrasts sharply with the FIRE sector shown in Plate 30. Of the 2,748 Johannesburg-based firms, there is some aggregation in the CBD with some of the major banks still headquartered there, but most FIRE-sector firms concentrate in a series of nodes in the north (Rosebank, Sandton, Randburg, etc.).
Fourways, etc.) and along major highways (especially the M1 and N1) and arterials. There are some overlaps in the location of firms in the FIRE sector with manufacturing firms in the north, especially along the N1/M1 around Midrand, and in certain nodes such as Kyalami and Kya Sands. This is likely attributable to new land-use mixes, business service activities closely related to manufacturing – such as renting of machinery, packaging and consulting engineering – as well as to new economic patterns such as the outsourcing of labour, notably cleaners and security guards, from manufacturing firms to labour brokers whose activities are recorded as business services (Tregenna 2010). Beyond this, a broader pattern of dispersal in the northern part of the city is evident, with many firms distributed into suburban areas. Again, it is clear that there are few finance and business service activities in former townships.

Plate 31 maps the location of the wholesale and retail trade, and catering and accommodation businesses which, with 5 525 recorded’ is easily the largest sector by firm numbers in AfriGIS’s Johannesburg dataset. As with the FIRE sector, wholesale and retail trade activities clump in a number of defined nodes. The largest concentration by far is in the inner city. Beyond that there is significant clustering in areas commonly understood to be regional shopping destinations such as Rosebank and Sandton and, more interestingly, in areas zoned industrial. It would be an error to think that trade activities in this sector equate to consumer shopping. There is considerable wholesale, specialised retail and ‘retail not in store’ activity in areas like Kya Sands, Kyalami, Midrand and Modderfontein. Indicatively, Wynberg and Wynberg Extension have 101 wholesale and retail trade firms. Fifty-three of them are in categories such as ‘wholesale trade on a fee or contract basis’, and wholesale trade in ‘foodstuffs’, ‘pharmaceuticals’, ‘office machinery’ and ‘construction materials’. A further 18 firms are in the field of ‘maintenance and repair of motor vehicles’.

Perhaps the most notable feature of the wholesale and retail trade sector is that it is strongly aligned along key arterials, a pattern much more evident than for other sectors, although it is also somewhat noticeable for finance and business services. Jan Smuts Avenue to Randburg, Ontdekkers Road stretching west to Krugersdorp, Beyers Naude past Cresta, and Rivonia Road to Sunninghill, all stand out. According to the AfriGIS data, the south of Johannesburg has a slightly greater number of wholesale and retail trade companies than is visible for other sectors, but it is still only a fraction of that found in the north. There is only a scattering of firms in Soweto and a small clustering in Lenasia.

Plate 32 is a map of construction firms, which AfriGIS put at 1 358 in 2010. To some extent construction firms also cluster in industrial nodes such as Kya Sands, Lazer Park, Strydompark and Wynberg. But in general the pattern is of far greater spread, with two unique features in comparison to the other sectors. First, there is a very low concentration of construction firms in Johannesburg’s core north-south economic spine from Parktown, through Rosebank, Illovo, Sandton, Rivonia to Sunninghill, in contrast to the FIRE sector, for example. Instead, construction firms seem to disperse further north and west into newer suburbs. This may partly reflect the dramatic expansion within the construction
sector itself over the last decade, with newly established companies likely to be located in newer parts of the city where rentals are less onerous than in core nodes. It may also testify to construction following the spatial trends in the market of new middle-class home building, understandably since many of the companies listed in AfriGIS are in the fields of house construction, electrical contracting, plumbing, painting and decorating, and other building installation (e.g. air conditioning) and completion (e.g. tiling). A second unique signature of construction firms is that they do not seem to locate along mobility corridors. As with the main sectors, AfriGIS records virtually no construction firms in the southern parts of the city.

Spatial distribution of industrial and commercial buildings

The spatial analysis of economic activity allowed by the AfriGIS firm-level data is useful in describing some patterns, but it is not a perfect reflection of Johannesburg’s economy in space and, more importantly, it affords only a static view. Another perspective is provided by data on the physical space utilised for economic activity. Economic changes manifest in the built environment through the mechanism of the property market, which means that the construction of offices, shops and factory spaces can be taken as a measure of the general strength of the local economy, and where this strength or weakness is focused geographically.

Property development

Johannesburg has seen considerable property growth since the early 2000s. Table 6.1 shows building plans completed for office and banking, shopping, and industrial and warehouse space in the city over the period 2001–2012. Over this decade, 674 office buildings were built, making up some 2.5 million m$^2$. This compares with 233 shopping spaces contributing 806 000 m$^2$ and 567 industrial or warehouse buildings at a total of 1.2 million m$^2$.

The data mirror some of the trends seen in the GVA data, for example the performance of wholesale and retail trade. As with the GVA trends, it is also notable that growth in manufacturing capacity remained reasonably robust throughout. In all three categories the number, square meterage and value of buildings completed peaked in 2007, 2008 and 2009, with enormous construction values being recorded especially in the years just before the global recession began to be felt locally. All three then fell off sharply. Shopping space construction halted dramatically earlier than the others, perhaps reflecting the slowdown in spending that started in early 2008 with high inflation and interest rates as well as stricter credit regulations. Some level of recovery was, however, evident by 2012.

Data from the South African Property Owners Association provide both a legacy perspective on where office accommodation has historically concentrated in key nodes in the city, as well as a picture of change (see Table 5.1 in Chapter 5). The CBD remains the single most important centre, with 1 622 593 m$^2$ in total rentable area in 2011. The
next largest node, Sandton, has 1,468,991 m$^2$. This is followed by Midrand, Bryanston, Braamfontein, Randburg and Woodmead, all with over 350,000 m$^2$. The new node Greenstone, at 55,875 m$^2$, is last placed on the list of 22 nodes tracked by the city. While the CBD is the largest node it is undergoing significant changes. Between 2007 and 2011 it lost 63,859 m$^2$ in total rentable area and in 2009 carried a vacancy rate of 18 per cent. Meanwhile Sandton gained 255,863 m$^2$ and has a vacancy rate of just 9 per cent. Municipal data based on applications for rezoning and building plans largely corroborate these trends. As Ahmad and Pienaar (Chapter 5) show, market demand over the 2006–2010 period was focused on areas of already consolidated development and around key arterials, both in the north of the city.

### Distribution of industrial and commercial buildings

An alternative source of information on the spatial distribution of property for economic purposes is GTI’s ‘land-use per building’ dataset. GTI has used satellite imagery to develop a digital dataset marking each building with a dot, which is then assigned a land-use code. This enables a view of where all industrial and commercial buildings are in Johannesburg. Plate 33 maps industrial land use per building in 2010, broken into three categories: heavy industries, light industries and warehousing/distribution, and fuel depots. In many

<table>
<thead>
<tr>
<th>Year</th>
<th>Office and banking space</th>
<th>Shopping space</th>
<th>Industrial and warehouse space</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of buildings</td>
<td>Total m$^2$</td>
<td>Total value R’000</td>
</tr>
<tr>
<td>2001</td>
<td>70</td>
<td>283,271</td>
<td>468,762</td>
</tr>
<tr>
<td>2002</td>
<td>116</td>
<td>322,339</td>
<td>525,412</td>
</tr>
<tr>
<td>2003</td>
<td>87</td>
<td>237,845</td>
<td>499,895</td>
</tr>
<tr>
<td>2004</td>
<td>63</td>
<td>180,129</td>
<td>352,076</td>
</tr>
<tr>
<td>2005</td>
<td>60</td>
<td>223,701</td>
<td>595,662</td>
</tr>
<tr>
<td>2006</td>
<td>39</td>
<td>120,780</td>
<td>414,315</td>
</tr>
<tr>
<td>2007</td>
<td>43</td>
<td>175,742</td>
<td>632,606</td>
</tr>
<tr>
<td>2008</td>
<td>57</td>
<td>353,067</td>
<td>1,873,747</td>
</tr>
<tr>
<td>2009</td>
<td>30</td>
<td>304,463</td>
<td>1,651,696</td>
</tr>
<tr>
<td>2010</td>
<td>20</td>
<td>112,941</td>
<td>621,533</td>
</tr>
<tr>
<td>2011</td>
<td>47</td>
<td>71,420</td>
<td>405,790</td>
</tr>
<tr>
<td>2012</td>
<td>42</td>
<td>105,198</td>
<td>695,025</td>
</tr>
</tbody>
</table>

### Table 6.1: Office, retail and industrial building plans completed in Johannesburg, 2001–2012

Source: Stats SA (2001–2012)
respects it mirrors the AfriGIS map on manufacturing (Plate 29). Consider, for example, how both maps show industry on the eastern side of the N1 around Midrand, whereas the western side is discerned to be office buildings associated with the FIRE and wholesale and retail trade sectors (Plates 30 and 31). However, there are also a number of distinct differences from the AfriGIS maps. There is a large aggregation of industrial buildings around City Deep, along Heidelberg Road, and east towards Rosherville and Heriotdale where Johannesburg meets Ekurhuleni. AfriGIS correctly identifies some of this built form as associated with wholesale and retail trade, as well as transport, storage and communications, both related to the large inland port and container distribution functions of the area. However, this does not seem to account for all the industrial buildings, and AfriGIS shows virtually no manufacturing in this area. The City of Johannesburg’s own nodal study determines that there is a heavy industry component in City Deep, with metal and machinery fabrication at its core (CoJ 2009). It is very likely that these older sites of production, with industrial stock dating back to the 1920s, do not have office functions associated with them and in turn the area does not appropriately appear in the AfriGIS data as a manufacturing hub.

The same is true of the area in and around Modderfontein, from the new developments in Greenstone Hill through to Midrand. AfriGIS understandably marks the massive AECI chemicals and explosives complex in Modderfontein with only a few dots: T&C Chemicals, Chemrad Services, Kemin Industries, Excalibur Engineering and so on. But this does not do justice to the scale of manufacturing works that has historically existed in the area. These buildings, especially the heavy industry component, show up clearly in the GTI map.

GTI’s mapping of existing commercial buildings (Plate 34) distinguishes shopping centres, office/business parks, and other commercial buildings such as shops, banks and conference centres. It shows a wide distribution of these ‘other’ buildings, and some dispersal of shopping centres, compared to the concentration of office complexes and shopping centres in the north, focused on nodes linked to the N1 and M1 and, to a lesser extent, major arterials close to them. Concentrations are particularly evident in the further northern and north-western areas. While this is broadly consistent with the AfriGIS data, it also presents a stark difference in two crucial respects. First, according to GTI there is much more widespread commercial activity in the south of the city, and more generally in former townships such as Soweto, Orange Farm and Ivory Park and in informal settlements such as Diepsloot. This suggests that there may in fact be much more economy in these areas than is visible from the AfriGIS data, simply because AfriGIS can only reflect formal businesses with credit records. Second, the GTI map shows commerce more strongly concentrated in key nodes and along major corridors, some radiating out from these centres, than do the AfriGIS maps of sectors such as finance and business services (Plate 30) and wholesale and retail trade (Plate 31). This suggests that GTI, because it is a plotting of buildings rather than firms, underestimates how much business activity has been decentralised into the suburbs and is now run from normal residential dwellings.
Industrial change

As noted, AfriGIS data unfortunately do not permit a longitudinal view of the changes in spatial location of actual businesses, and in turn the sectors they represent. However, GTI’s land use per building data can be organised to show where industrial and commercial buildings were located in 2010 in comparison to 2001, providing a remarkable depiction of change over almost a decade.

Table 6.2 summarises the GTI data on land use per building change for both industrial and commercial properties. Between 2001 and 2010 there was a 15.2 per cent increase in industrial buildings in Johannesburg with 2 445 new buildings built over the period. This means that 17 per cent of the buildings present in 2010 were ‘new’. However, it also needs to be noted that there were 517 industrial buildings visible in the 2001 dataset (4 per cent of the total) that were no longer there in 2010. Care is needed in interpreting what this means. It is unlikely, for example, that a manufacturing company going out of business would spend additional money physically demolishing its production plant assets. So the disappearance of buildings in the GTI dataset does not automatically imply the loss of firms. Rather, it may reflect a significant change in land use in an area, or the replacement of an older building by a new one, a positive sign of reinvestment.

The overall change in industrial buildings obscures some of the nuances in the GTI categories. Indicatively, there were only 28 new heavy industry buildings built between 2001 and 2010, a 6 per cent increase over the 2001 total of 488. In the same period 12 (3 per cent of the 2001 total) disappeared. By contrast, 2 401 new light industrial and warehouse spaces were built and 505 disappeared, with a net positive change of 16 per cent. This confirms Statistics South Africa and Quantec data that manufacturing activity in itself has not collapsed, even while manufacturing continues to lose ground to other sectors in relative terms, but that the more important backstory is a displacement from heavy to light industry.

<table>
<thead>
<tr>
<th>Change indicator</th>
<th>Industrial</th>
<th>Commercial</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001 total buildings</td>
<td>12 652</td>
<td>16 467</td>
</tr>
<tr>
<td>2010 total buildings</td>
<td>14 580</td>
<td>19 929</td>
</tr>
<tr>
<td>New buildings between 2001 and 2010</td>
<td>2 445</td>
<td>3 927</td>
</tr>
<tr>
<td>Buildings present in 2001, but no longer there in 2010</td>
<td>517</td>
<td>465</td>
</tr>
<tr>
<td>Net increase in buildings: absolute change</td>
<td>1 928</td>
<td>3 462</td>
</tr>
<tr>
<td>Net increase in buildings: percentage change</td>
<td>15.2</td>
<td>21.0</td>
</tr>
<tr>
<td>% of 2010 buildings that were built between 2001 and 2010</td>
<td>16.8</td>
<td>19.7</td>
</tr>
<tr>
<td>% of 2001 buildings that disappeared between 2001 and 2010</td>
<td>4.1</td>
<td>2.8</td>
</tr>
</tbody>
</table>

**Table 6.2:** Change in industrial and commercial buildings, 2001–2010

Source: GTI (2013a, b)
Even more important, however, is where manufacturing has grown and shrunk. Plate 35 shows where the numbers of industrial buildings have increased between 2001 and 2010, with the 2001 buildings marked in brown and new buildings in green. It is clear that there is some new growth in every industrial district, but it is uneven. Twenty-seven per cent of the growth (658 new buildings) occurred along the historical east-west mining and manufacturing belt that cuts across the middle of the city; 60 per cent (1 455 buildings) was seen north of this line; and only 14 per cent (332 buildings) occurred in the south. By far the greatest increase was in Kya Sands in the north, followed by the new Longmeadow Business Estate near Greenstone, Laser Park on the western side of the city, and Frankenwold on the N3.

Plate 36 maps the disappearance of manufacturing buildings, with the 2010 situation shown in yellow, and buildings that have vanished between 2001 and 2010 in red. This suggests that the historical east-west manufacturing belt has seen the greatest reduction in buildings. There has also been considerable reduction in Wynberg, adjacent to Alexandra, and in Modderfontein, but this was moderated by some growth in buildings in the same or immediately adjacent area. Wynberg is especially interesting, since the data suggest a node that is both in decline but also has some aspects of renewal. A more detailed inspection reveals, for example, that a number of old industrial buildings have been demolished along Pretoria Main Road to make way for the new Pan Africa Shopping Centre, as well as buildings for stationery and car parts manufacturing, general engineering services and wholesale trade.

The overall picture of growth and decline is stark. Manufacturing expansion has mainly occurred in the far north-west and north-east of the city, without accompanying development in the south. By contrast, manufacturing development along the central east-west manufacturing belt – which would have been within easier reach of Soweto, the east-rand townships of Katlehong, Thokoza and Vosloosrus, and even the inner city itself with its burgeoning population – has had far less energy. On this evidence, manufacturing would have become less geographically accessible to those residents most likely to be looking for work in this sector between 2001 and 2010.

Commercial change

Table 6.2 indicates that 3 927 new commercial buildings were built between 2001 and 2010. On the face of it this is considerably more than for new industrial buildings, but the percentage increase this represents over 2001 commercial buildings was 23.8 per cent, compared to a 19.4 per cent growth in industrial buildings. This again suggests that the ongoing tertiarisation of the Johannesburg economy does not equate to deindustrialisation. On the other hand, 2.8 per cent (465) of the commercial buildings present in 2001 disappeared between 2001 and 2010, noticeably less than industrial.

Strong net growth was seen in shopping malls and centres (a 43.4 per cent net gain) and office parks (a 41.4 per cent net increase). Although the growth in other commercial buildings (shops, banks, etc.) was less impressive in proportional terms (18.4 per cent), this category saw the largest absolute growth with 3 226 new buildings. Intriguingly, the
largest percentage increase was seen in informal trading structures, up from 157 in 2001 to 515 in 2010 (a 228 per cent increase).

Plates 37 and 38 display the growth and disappearance of commercial buildings spatially. Plate 37, showing new buildings in green, indicates that to a large extent new commercial development is occurring in areas that were already reflected as commercial by 2001. But that said, new growth has been quite extensive across the city, including in areas such as Diepsloot and Orange Farm. Growth in the north and centre of the city has been strongly linear, along corridors such as Ontdekkers and Hendrik Potgieter to the west, Rosebank to Sandton and along Jan Smuts to Randburg, as well as along William Nichol Drive and Rivonia Road. A number of growth nodes also stand out, particularly around Midrand, Fourways, in Clearwater north of Roodepoort, and to a lesser extent around Rosebank and Sandton. The Bryanston East/Epsom Downs office node displays as the strongest centre of attraction for new development. There has been limited new growth in the CBD, in areas south of the CBD and in Soweto.11

Although not shown separately, the mapping suggests that growth of shopping centres and office parks has been relatively concentrated spatially, while other forms of commercial activity have developed on a more widespread basis. Although a few shopping centres have been established in places such as Soweto and Lenasia in the south, and to a degree along the east-west corridor, particularly the Chinese shopping centres (see Chapter 29), the predominant focus for growth has been in the north, particularly in nodes along the N1 and M1, and along arterials in the north-west. Growth of office complexes has been even more concentrated and focused on the north and north-west. For the most part, this growth builds on and intensifies pre-existing patterns of office and shopping centre location already there by 2001, but there are also new places of growth, such as Modderfontein along the M3.

Plate 38 marks in red where the city has seen commercial buildings disappear between 2001 and 2010, against the pre-existing situation in yellow. The map indicates a widespread pattern across the city, including in areas of growth. The greatest decline seems to have occurred in the CBD and immediately to the east and west of it, and around Roodepoort in particular. Some areas of ‘decline’ are also areas of growth, suggesting that redevelopment is occurring in these locations. Again, however, it is striking that there are a number of points of decline in Soweto without much corresponding growth, suggesting a further absolute loss of economic opportunity even while it loses relative advantage to the fast-growing northern nodes and arterials.

Access to employment opportunity

Employment and unemployment

In this part of the chapter we consider data on employment and geographical access to jobs in light of the changing composition and spatial distribution of the Johannesburg economy. Table 6.3 examines employment data in the recessionary years from 2008 to 2013 using
Labour Force Survey first quarter data as the measure for the year. In the first quarter of 2013 Johannesburg had a total of nearly 1.8 million workers, giving the city 41.5 per cent of all employees in Gauteng.\textsuperscript{12} Total employment declined marginally between 2008 and 2012, but increased sharply in 2012/2013 with a 182 783 increase over the year, leaving the city with 10.5 per cent more jobs than in 2008. Wholesale and retail trade, the dominant sector in terms of employment, showed an 18.6 per cent overall growth between 2008 and 2013. Although it shed the largest number of workers (45 588) between 2011 and 2012, it then saw one of the largest increases (45 716) the following year. The biggest gain has been in community, social and personal services, which jumped 47.8 per cent (112 947) over the five years to overtake FIRE as the second largest sector.

<table>
<thead>
<tr>
<th>Sector</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>% of total 2013</th>
<th>% change 2008–2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, forestry and fishing</td>
<td>12 863</td>
<td>6 767</td>
<td>3 040</td>
<td>1 002</td>
<td>1 846</td>
<td>8 259</td>
<td>0.5</td>
<td>35.8</td>
</tr>
<tr>
<td>Mining and quarrying</td>
<td>6 594</td>
<td>10 911</td>
<td>4 308</td>
<td>998</td>
<td>4 824</td>
<td>2 793</td>
<td>0.2</td>
<td>−57.6</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>228 531</td>
<td>227 861</td>
<td>212 054</td>
<td>207 850</td>
<td>184 239</td>
<td>219 668</td>
<td>12.4</td>
<td>−3.9</td>
</tr>
<tr>
<td>Electricity, gas and water supply</td>
<td>12 851</td>
<td>11 243</td>
<td>14 228</td>
<td>11 776</td>
<td>10 377</td>
<td>19 944</td>
<td>1.1</td>
<td>55.2</td>
</tr>
<tr>
<td>Construction</td>
<td>113 542</td>
<td>122 021</td>
<td>119 409</td>
<td>149 625</td>
<td>133 087</td>
<td>133 984</td>
<td>7.6</td>
<td>18.0</td>
</tr>
<tr>
<td>Wholesale and retail trade</td>
<td>381 316</td>
<td>390 304</td>
<td>392 602</td>
<td>452 192</td>
<td>406 604</td>
<td>452 320</td>
<td>25.6</td>
<td>18.6</td>
</tr>
<tr>
<td>Transport, storage and communication</td>
<td>111 956</td>
<td>105 947</td>
<td>124 126</td>
<td>103 120</td>
<td>108 775</td>
<td>113 448</td>
<td>6.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Finance and business services</td>
<td>368 500</td>
<td>375 766</td>
<td>352 871</td>
<td>335 236</td>
<td>347 718</td>
<td>343 485</td>
<td>19.5</td>
<td>−6.8</td>
</tr>
<tr>
<td>Community, social, personal services</td>
<td>236 236</td>
<td>240 233</td>
<td>276 462</td>
<td>258 499</td>
<td>251 074</td>
<td>349 182</td>
<td>19.8</td>
<td>47.8</td>
</tr>
<tr>
<td>Private households</td>
<td>124 695</td>
<td>114 537</td>
<td>143 291</td>
<td>123 597</td>
<td>133 837</td>
<td>122 440</td>
<td>6.9</td>
<td>−1.8</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>1 986</td>
<td>0</td>
<td>612</td>
<td>358</td>
<td>0</td>
<td>0.0</td>
<td>n/a</td>
</tr>
<tr>
<td>Total</td>
<td>1 597 082</td>
<td>1 607 575</td>
<td>1 642 392</td>
<td>1 644 507</td>
<td>1 582 740</td>
<td>1 765 523</td>
<td>100.0</td>
<td>10.5</td>
</tr>
</tbody>
</table>

\textit{TABLE 6.3:} Employment in Johannesburg by main industry sector, 2008–2013

Source: Stats SA (2008–2013)
Remarkably, FIRE has seen an overall decline of −6.8 per cent over the period (shedding 25 015 jobs), although it was one of the few sectors to increase employment between 2011 and 2012. Manufacturing declined steadily between 2008 and 2012, but regained ground in 2012/2013 with 35 429 new jobs.

The sectoral trends are echoed in the occupations data. There were reductions in the numbers of clerks (−6.8 per cent), craft and trade workers (−0.4 per cent) and plant and machine operators (−15.1 per cent) over the period 2008–2013. Meanwhile, shop and market sales workers increased slightly (5.1 per cent), mirroring the small increase in the wholesale and retail trade sector, albeit with a similar steep drop of 43 471 workers in 2011/2012. From a different perspective, high-skilled occupations (senior officials, managers, professionals and technical professionals) have held their ground in the face of the major recession that started in 2008/2009, increasing their share of employment from 29.4 per cent in 2008 to 36.9 per cent in 2013. By contrast, factory and trade workers have seen opportunities diminish, dropping from 21.8 per cent of the workforce to 18.6 per cent over the same period.

Unemployment is of course a key issue for all parts of South Africa, including Johannesburg. In the first quarter of 2008 the official unemployment rate in Johannesburg was 23.2 per cent, and on the expanded definition including discouraged work seekers, 25.3 per cent. The participation rate – the proportion of those of working age who were either employed or actively looking for work – was 75.1 per cent. By the first quarter of 2012 unemployment on the strict definition had climbed to 26.6 per cent, and with the discouraged was 29.1 per cent. The city then saw a recovery to 22.4 per cent official unemployment by the first quarter of 2013, with 24.6 per cent on the expanded definition. However, the participation rate had declined to 70.5 per cent, suggesting that many had abandoned hope of finding work.

Spatial distribution of employment

An overriding conclusion from the spatial analysis in the sections above is that economic activity is inequitably distributed and becoming more so. The data show that there is an overwhelming predominance of business in the north of the city and, with few exceptions, manufacturing and commercial buildings are growing faster in the north and disappearing in locations of relative proximity to large poor populations in the south.

In general terms this seems to confirm Naude’s findings on the spatial mismatch of employment in Johannesburg, at least in respect of that part of his analysis that demonstrates that jobs are becoming more distant from those who need them. Of course, we acknowledge analysis that demonstrates that some seemingly marginal locations in Johannesburg are not as peripheral from the emerging centres of development as they might first appear. Sharon Biermann’s (2004) work on Diepsloot is notable here. We also concede Crankshaw and Goetz’s (n.d.) point that the spatial mismatch hypothesis fails to take into account highly versatile networks of information exchange about job opportunities that penetrate deep into even those communities seemingly most isolated from the streams of labour market intelligence. And of course it would be incorrect to discount the day-to-day
entrepreneurship of households and individuals, constituted as adaptable and innovative
economic agents by sheer force of necessity to earn a livelihood, regardless of where they
are located. Richard Grant (2010) is especially useful on this. But overall the data mapping
seems to indicate that the dislocation between people and jobs is still a defining feature
of the Johannesburg space economy, and the pattern is getting worse. This is likely to be
compounding the trends – notably weaker opportunities for those in the lower-skilled
segments of the economy, and declining participation rates – seen in the Labour Force
Surveys between 2008 and 2013.

One more dataset, somewhat different from those already analysed, reinforces this
conclusion in some respects, but also offers important qualifications. The GCRO’s 2011
Quality of Life Survey took GPS co-ordinates for each of 16 729 respondents interviewed
across Gauteng, and asked detailed questions about their trip-making activities, including
where they went to work and looked for work.

Plate 39 plots the movement lines of respondents from the Orange Farm/Stretford area
in the far south of Johannesburg, tracing where they were either working or looking for
work. The map is representative of a similar analysis done for Alexandra and Diepsloot,
with the three areas taken as a sample of poorer neighbourhoods across the city. The
map, and the background data for the sample areas it represents, reveals three things.
First, both work seekers and workers in these areas make long trips to find or get to work.
There is some percentage of local work and work seeking in the three communities, but
generally respondents have to commute some distance outside their home areas to reach
employment. Second, in general the primary destination for both employment and job
hunting is the inner city of Johannesburg. Indicatively, while a small proportion of Orange
Farm respondents look for or have found work in the industrial areas of the Vaal Triangle,
and therefore travel south to work, by far the majority goes north to the inner city. However,
there are important qualifications and nuances to this. There are differences between where
respondents go to work and where they look for work. For example, in the case of Alexandra,
35 per cent go to work in the CBD or Braamfontein, in near-inner suburbs like Berea,
and in industrial areas such as Cleveland and Denver. By contrast, over 60 per cent of the
unemployed look for work in those areas. Seventeen per cent said they worked in Alexandra
itself or the immediately adjacent industrial area of Wynberg, but no one looked for work
in these areas. Nine per cent worked in Sandton and proximate suburbs like Morningside,
and a roughly equivalent 10 per cent looked for work there. In sum, a far greater proportion
of respondents saw prospects of finding work in central Johannesburg than actually worked
there, taking the view that while Sandton offered some opportunities, there were none to
be had locally. Third, while the CBD remained the key attractor for two of the three areas
we considered in detail, this was not the case for Diepsloot. Here, just 7 per cent had work
in central Johannesburg, while 33 per cent sought work there. The vast majority of those
working and those looking for work did so in the fast-growing commercial and industrial
nodes of the north, including Fourways, Bryanston, Meadowhurst, Rivonia and Lanseria.
In Alexandra, newer nodes and industrial areas attracted a smaller, but not insignificant,
proportion of workers and work seekers. For example, 8 per cent have employment in Greenstone and the Frankenwald and Linbro Park industrial estates.

Last, while residents of poorer areas generally face long trips to work or to find work, a preliminary analysis of changing travel times shows a complex picture. Average travel times from the 2011 Quality of Life Survey were compared with times for the same areas a decade ago, using data from a transport survey conducted in 2002.14

In 2002, respondents in Orange Farm/Stretford took 75 minutes on average to get to work. A decade later, in 2011, this was 66 minutes, still well over an hour, but a reduction nevertheless. Those looking for work took on average 52 minutes. A comparative mapping suggests that this was not because respondents in the area had found work closer to home; in the previous study, too, most work trips also went north to the core areas of Johannesburg, although with a much wider spread across the band of the city’s central east-west industrial belt. The most likely explanation is the better transport connections made over the last decade, with minibus taxis in particular having extended their reach into such areas.

For Diepsloot, the average time to work in 2002 was 72 minutes. By 2011 this had reduced remarkably to 40 minutes, and time to look for work was no more than 35 minutes. Better transport connections no doubt played a role here too, but the larger part of the explanation is likely to have been the improved proximity of work locations with the burgeoning of economic activity in nodes and arterials in the north of Johannesburg. Alexandra presents a mixed picture. In 2002, the average travel time to work was 48 minutes – far better than either Diepsloot or Orange Farm. By 2011 this had reduced only slightly to 45 minutes, and those looking for work took on average 38 minutes. This meant that workers from Alexandra now take longer to get to work than those in supposedly peripheral Diepsloot, suggesting that even while employment opportunities have opened up in new nodes such as nearby Greenstone and Longmeadow, overall access has not improved as much as in other places, possibly because of the deterioration in Wynberg.

Conclusion

This chapter has painted a picture of Johannesburg’s changing space economy, and pointed in particular to shifts over the last decade. It has shown that Johannesburg’s space economy needs to be understood in the context of the broader Gauteng city-region, where economic activity in the CBD and in the northern areas of Johannesburg is coupled with development in adjacent Ekurhuleni and in the southern parts of Tshwane. New economic centralities are emerging coupled with existing patterns of growth in these areas.

Within Johannesburg itself, the study confirms the continued economic significance of the CBD, but also shows the growing importance of a spray of nodes in the north, as well as a number of key corridors and arterials along which firms in certain sectors, notably wholesale and retail trade and finance and business services, are concentrated. There are also many firms – especially in the tertiary sectors – distributed into suburban locations, thus nodal growth is coupled with significant dispersed development. The overwhelming
evidence is that former townships, and the south of Johannesburg more generally, remain areas where formal economic activities are very limited, although GTI data do suggest that there are buildings in these poorer parts of the city housing less established businesses. Nevertheless, the north-south divide appears to be expanding: while the last decade has seen a growth of shopping centres in townships, particularly in Soweto, it is dwarfed by much more rapid development in the north. Further, there is little office development occurring in the south.

The chapter has also shown that there has been a spatial shift associated with the move from heavy to light industry. New industrial spaces and areas of manufacturing expansion are concentrated in the north, and there has been a level of decline of manufacturing employment closer to the south. The AfriGIS data usefully highlight that manufacturing nodes also contain significant aggregations of wholesale and retail trade and transport, storage and communication, but a mapping of GTI suggests that there are also some tracts of industrial land where head-office functions do not collocate.

The Quality of Life Survey data enable a revealing plotting of where employment and work aspirations are focused, relative to where people live. They indicate that workers and work seekers in poorer areas indeed face long trips to centres of employment, but that the more detailed patterns are very complex. While Diepsloot seems to have benefited from the shift in centres of economic gravity to the north, Alexandra has had mixed fortunes, with the decline in adjacent older manufacturing areas only partly offset by the growth of new commercial and industrial nodes arrayed along the key M3 corridor. In general, work seeking orientates towards the Johannesburg CBD. This is understandable for poorer settlements in the south, but seems disproportionate for areas in the north where the relative concentration of actual employment has shifted to other locations.

We believe that this analysis has filled in the currently available Johannesburg space economy picture with important new details. But at the same time it opens up new lines for further enquiry where even more specifics are needed. The nature of agglomeration in certain industrial areas, the functioning of mixed nodes, the fortunes of particular arterials, the deterioration or regeneration of some industrial estates while others nearby see dramatic expansion, and changing lines of work commuting in response to patterns of growth and decline, all deserve further research on the basis of the data we have analysed and mapped.

Acknowledgements
Thanks are due to Daniel Kibirige, Jennifer Paul and Chris Wray for considerable support with the mapping and spatial data analysis.

Notes
1 Statistics South Africa releases quarterly GDP data for the country, and every November produces provincial breakdowns for the preceding year – its so called GDP-Regional (GDP-R) data. However, it does not break this down to municipal level. Statistics South Africa does break its labour market data down to municipal but not sub-municipal level.
While the Census provides employment figures at sub-municipal level, these reflect the residence of those employed, not places of work.

2 Both Global Insight and Quantec model forward old Statistics South Africa information on the geographic spread of businesses, calibrating this with various official datasets and reconciling to the official GDP-R data released annually.

3 Global Insight disaggregates its data into magisterial districts, while Quantec divides the data up by the ‘main places’ designated in the national statistical geography. However, these data are unsatisfying for two reasons. First, the main places in Johannesburg are very awkwardly demarcated. The economically most significant main place is ‘Johannesburg’, which in 2010 contributed 41.5 per cent of the city’s total GVA in constant 2005 prices. It covers the Johannesburg CBD, as one might expect, but also extends all the way to Sandton and Randburg in the north, making it impossible to distinguish important nodes such as Rosebank and Illovo. Even more strangely, it extends far south, including all the southern suburbs as far as Alberton, and then south-west, improbably encompassing Lenasia and Eldorado Park and stretching all the way to Orange Farm. Other main places such as Roodepoort and what seems to be a residual category – the ‘City of Johannesburg Metro’ – split spatially into six large but separate compartments, all on the edge of the metropolitan area, are just as oddly formed. This configuration makes it difficult to reach meaningful conclusions about the overall shape of the Johannesburg economy. Second, regardless of these demarcations, the data seem to render some implausible results. Most noticeable is that Soweto, the main place boundaries of which fairly accurately match the actual township, is estimated to have contributed R29 billion to the local economy in 2010, 13.2 per cent of the total, and to have grown at 3.1 per cent per annum over 1995–2010. Meadowlands, delineated as a separate main place, contributed a further 1.9 per cent and grew at 3.4 per cent annually. By contrast, Quantec estimates that Sandton made up only 8.5 per cent of the local economy, and grew more slowly than Soweto at 3.04 per cent per annum between 1995 and 2010. This seems unlikely given how commercial development has exploded in Sandton over the last two decades (see Chapter 18).

4 This Platform has involved the development of a ‘geoframe’ which divides the whole country into a grid of some 25 000 roughly equivalent-sized blocks. Data which are usually collected at a higher level are then broken down into the mesozone blocks on the basis of various assumptions (CSIR 2011). This includes data on GVA, which CSIR now obtains from Quantec.

5 Also, because the employment data are modelled from the typical number of jobs generated per unit of GVA in each sector at higher scales, they cannot discern, for example, whether there is less employment generated in areas dominated by heavy industry, likely to be more capital intensive than clusters of light industry, within the overall category of ‘manufacturing’.

6 2 110 home-to-work commuters and 456 work seekers originating in Johannesburg. This number does not include survey respondents who started their to-work or look-for-work journey outside Johannesburg and travelled into the city.

7 The AfriGIS BizCount data need to be treated with some caution. They are based on information Matrix Marketing gets from a credit bureau, which captures businesses applying for credit and models their turnover. This is supplemented with information on industry sector, employment and fleet acquired by phoning each firm. This method is
likely to limit the record to more formal businesses, and may underestimate public-sector activities. An unavoidable result is the recording of turnover and staffing information at firms’ head offices, rather than sites of production or branch operations where output value and jobs are actually generated. Nonetheless, AfriGIS provides a powerful new view of where business numbers, turnover and employment concentrate. The limitation of the GTI data is of course that they provide only a count of building types in particular locations, and do not provide any data on businesses occupying those buildings, let alone their size or employment. The GCRO’s Quality of Life Survey is a sample survey, and although its sample size is large in comparison to other similar surveys, statistical veracity is inevitably constrained at finer geographic scales and the horizon of accuracy is set by respondents’ subjective self-reporting.

8 It has estimated the likely employment associated with each unit of GVA for the different economic sectors using Quantec 2009 data, and on this basis modelled the probable employment per sector for each mesozone across the country.

9 This is roughly consistent with Quantec’s projection that Johannesburg makes up 38.8 per cent of Gauteng GVA. The words ‘firm’ and ‘company’ are used loosely since the data also cover many government and civil society organisations.

10 The maps employ a density analysis, using circles of a radius of 564 m, to arrive at a display – in the form of overlapping circles – of the number of (a) firms and (b) employment per square kilometre. The higher the concentration, the redder the area. Areas with fewer than ten firms per square kilometre are excluded from the map of businesses, and areas with fewer than 100 employees per square kilometre are excluded from the employment map.

11 Interestingly, Diepsloot emerges as an area of relatively healthy growth compared to Soweto, perhaps reflecting the extent of population growth there.

12 These Labour Force Survey (LFS) data were valid at the time of writing. However a major revision of the LFS datasets, recalibrating them with Census 2011 population estimates, was planned for 2014.

13 We do not of course try to replicate the analysis which tests for whether unemployment rates are more attributable to distance from jobs than to, say, skill levels, for white and black parts of the population respectively.


References


GTI (GeoTerraImage) (2013a) Building-based land-use dataset, 2010. Dataset obtained from GTI, http://www.geoterraimage.com


GCRO (Gauteng City-Region Observatory) (2011) Quality of Life Survey 2011. Dataset obtained from GCRO, http://www.gcro.ac.za


