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Addressing Structural Inequality of Employment Redistribution Policy Targets

Abstract

Global trends of increased urbanisation have resulted in rising spatial inequality across cities, and land use challenges in providing adequate infrastructure, housing and employment for efficient, sustainable and productive urban systems. One policy response worldwide has been to use sub-regional quantity-driven job-housing targets, such as self-sufficiency, self-containment and jobs housing ratios, to redistribute jobs away from city central business districts into outer areas. To set these, city or state governments predict employment rises in often unclear and simplistic ways with no provision for job location differentials in type and residential access to opportunity. Despite the documented lack of success of such targets in addressing spatial inequality across a city, there is limited research into alternative tools. We address this gap by exploring a ratio to distinguish between strategic and population-driven jobs. Drawing on a case study of Greater Perth, Western Australia, we demonstrate rising spatial inequality despite over 60 years of land use policy measures to decentralise employment and equalise job provision across the city. Using Australian Bureau of Statistics (ABS) data, we classify and characterise 474 occupations into either strategic or population-driven jobs for the specific Greater Perth context. Our discussion highlights the importance of differentiating between job types, rather than targeting absolute growth, in order to implement more location-sensitive employment redistribution. Our findings highlight that disaggregated sub-regional job ratios may be a more appropriate land use planning tool to address spatial inequality than previous job-housing ratios.

Introduction

For most of human history people have lived in relatively rural settings, but the last few centuries have seen a dramatic population rise in cities (Ritchie and Roser, 2018). By the 20th Century, more than 50 percent of the world population were in urban areas as opposed to rural peripheries. For example, 77 percent of Australia's population lived in cities in 1950. This increased to 86 percent by 2018 and is predicted to hit 91 percent by 2050. Whilst Australia is one of the most urbanised in the world, the trend is global. City and regional planning strategic frameworks aim to accommodate this growth by: 1) providing adequate infrastructure, housing and employment to ensure cities and their hinterlands remain efficient and productive (Albrechts, 2015; Boddy and Hickman, 2013; Galland, 2012; McEldowney et al., 2005), and 2) addressing spatial inequality in socio-economic outcomes and in infrastructure and amenity access between and within cities. Despite this, the limited success of these policies and frameworks after implementation may, in reality, exacerbate spatial inequality (cf. Martinus, 2018; Martinus and Biermann, 2018).

For example, one popular policy response has been sub-regional job-housing targets to create new job opportunities in, or redistribute work from city centres to, outer suburban peripheries, largely in the form of self-sufficiency, self-containment and jobs housing ratios (Cervero, 1995; Martinus and Biermann, 2018; Zhou et al., 2017). To achieve these targets (often set by state or national governments), employment increases are predicted in ways that are frequently unsubstantiated, unclear and simplistic. In Australia, local government is held accountable for the delivery of such targets with ill-equipped land use planning structures and development processes which can increase spatial inequality between a city's core and suburbs (cf. Martinus and Biermann, 2018). This is largely because, firstly, core areas are privileged over the outer suburban fringe in attracting employment, infrastructure, amenities and skilled labour; and, secondly, because not all jobs are equal in terms of inputs and outputs of production, including remuneration, economic contribution and location choices (cf. Benner and Karner, 2016; Bhalla, 2007; Schleith et al., 2016; Zhou et al., 2017). Despite a growing evidence of the ineffectiveness of such policy, there is limited research into employment redistribution land use targets to facilitate greater spatial equality across a city.

This paper aims to address this gap by exploring an alternative means to target the spatial redistribution of employment through a ratio of disaggregated strategic to population-driven job types. It does so by first reviewing literature underpinning the rationale and effectiveness of contemporary land use planning targets in addressing issues of inequality. It then outlines a case study of Greater Perth, Western Australia (WA), which has seen rising spatial inequality despite over 60 years of policy measures to spatially decentralise employment and distribute jobs. Using Australian Bureau of Statistics (ABS) population census (complete enumeration of the Australian national population) data, we classify 474 occupations into either strategic or population-driven jobs for the specific Greater Perth economy taking into consideration various socio-economic factors. This is used to create a ratio of strategic to population-driven jobs. Our findings demonstrate that a differentiated comparative (rather than broad absolute) ratio is a better approach to setting location-sensitive employment redistribution targets. We provide evidence of the need to better understand how disaggregated job ratios may more effectively address metropolitan land use spatial inequality than previous job-housing ratios.

Shifts in the strategic planning of cities

The strategic regional planning approach emerging during the 20th Century has been largely due to a desire to create more sustainable and productive workable places for people and business, with overarching goals to reduce socio-economic spatial disadvantage and disparities (Galland, 2012; Watson, 2009). Whilst the idea is noble, many scholars argue it has been operationalised through the post-war global neoliberal agenda focused on city growth. A trend intensifying since the 1980s, under ever-increasing pressures of globalization, is the need for cities and places to be competitive spaces attracting talent and industry (Albrechts, 2015; Boddy and Hickman, 2013; Galland, 2012; McEldowney et al., 2005). Galland (2012) commented that in the Danish context this meant 'regional planning [had] shifted away from being a sociospatial and welfarist state project towards being a domain characterised by growth-oriented strategies that [stood] for neoliberal political agendas' (p.536). Albrechts (2015) stated that governments were being 'lured to adopt a more entrepreneurial style of planning in order to enhance city and regional

competitiveness' (p.510). While Watson (2009) contended that 'current urban planning systems' are problematic in that 'they serve to promote social and spatial exclusion, are anti-poor, and are doing little to secure environmental sustainability' (p.151). And whilst she was speaking specifically on strategic planning in the Global South, urban planning has not resolved issues of spatial inequality in the Global North much better. Indeed, Albrechts (2015) asserted that strategic planning emerges from a normative agenda which co-produces 'certain ideals and principles, and these norms articulate certain values (justice, equity, accountability)' (p.515). Swyngedouw et al. (2002) stated that processes of co-production generated a 'sociospatial restructuring' in cities and regions which shape spatial disadvantage, disparity and decisions on who is included and excluded in the life and powerbase of the city. They and others (e.g. Boddy and Hickman, 2013) have argued that urban planning projects transect at government spatial scale (local, regional, national to the global) through urban schemes and strategies to sculpt the socio-economic environment.

It is interesting to examine then the tools or methods used by authorities to develop cities and regions. As highlighted by Swyngedouw et al. (2002), doing so can illuminate how strategic planning itself replicates processes of spatial disadvantage. As illustrated by Godet (2000), the term 'strategy' is widely misused or misunderstood as it 'stimulate[s] the imagination, reduce[s] collective biases, and promote[s] appropriation' (p.3). Further, the tools used to deliver particular outcomes are often not effective as they draw on standardised and simplified assumptions of extremely complex models (cf. Albrechts, 2015). It is not surprising then that the need to plan for spatial economic growth has led to questions on whether there is over-use of planning by authorities, such as via *target setting* to ensure the spatial equality of jobs and housing (cf. Bunker, 2015) or in how *land-use zoning* may protect the property rights of certain parts of society and create zones of exclusivity (Watson, 2009).

Job-housing targets and spatial inequality

The practice of setting city job-housing growth targets illustrates how contemporary strategic land use planning has co-produced spatial inequality, despite an explicit objective to alleviate it (cf. Forster, 2006;

Martinus and Biermann, 2018; Zhou et al., 2017). The three most common urban planning targets - jobs-housing balance, self-sufficiency and self-containment, define some ratio of residents to jobs within a specified region, with commuting distance assumed to decrease when number of working residents and job numbers are roughly equal. Employment self-sufficiency (ESS) measures the inflow of labour to a region, being the proportion of local jobs filled by local residents. Higher ESS means less commuters travelling to the region for work. Employment self-containment (ESC) describes the outflow of labour, being the proportion of local residents employed locally. A higher ESC means less residents are leaving for work outside the region. And, jobs-housing balance (JHB) is the simple ratio of local jobs to local working residents (cf. Biermann and Martinus, 2020).

But the implementation of these targets as policy tools assumes that people live in the same region as they work, which cannot be evenly applied across a city and may be truer in some areas than others as job and housing types are not equally distributed. For example, comparing the differences between self-containment results across various industry of employment and occupation types in Greater Perth, WA, Martinus and Biermann (2018) found that the large deviations suggested some industry or occupation types were more contained than others. The results highlight that the use of representative ESC targets 'might reinforce rather than relieve the inequitable distribution of employment, as high ESC targets may lead to increases in industries and occupations which are inherently less mobile given their low skill or wage base' (p.44). While in a Shenzhen, China, JHB study of housing prices, job type and location using cellphone data, Zhou et al. (2018) observed that employment self-containment was more likely in secondary sector compared to tertiary sector workers.

Further, Benner and Karner (2016) noted more low-wage jobs in the outer suburban fringes compared to more high-wage jobs in the various urban cores of the San Francisco Bay Area. In a study of India, Bhalla (2007) found greater socio-economic disadvantage in rural peripheries than urban centres. She argued that efforts to increase employment growth to address this were inadequate given the prevailing attitude of strategic planners that any employment growth (i.e. in low productivity employment) was better than none, and that more inclusive growth strategies should account for the type of employment being generated. In

this way, an assumption of *ceteris parabus* in the distribution of employment-type in current job-housing targets introduces a spatial bias to the model which undermines its capacity to decrease commuting or vehicle miles travelled. Comparing trip data against variables of ESS, ESC and JHB in Perth, Australia, Kelobonye et al. (2019) observed that 'policies solely relying on these measures may not be effective in reducing commuting times' (p.1488). While Blumenberg and King (2021) found lower wage workers in California were more likely to live where housing was more affordable, but that these same areas had less access to jobs leading to an increase in commuting time, vehicle miles of travel and lower ESC rates.

There are four key factors which appear to influence the spatial imbalance between the core urban area (with most jobs, infrastructure, amenities and socio-economic advantage) and the urban fringe (with most housing and socio-economic disadvantage). First, the geography associated with industry and therefore, labour markets, is territorially (re)produced (Peck, 1989). Moreover, targets to increase the number of workers residing and working in the same region imply some level of geographic job-skill matching. This may lead to lower skill and knowledge needs in some areas than other, as not all industry of employment types are distributed evenly across a city (cf. Guirao et al., 2017) with some employment types more prone to clustering than others (cf. Sigler et al., 2018). It is well-known that clustering occurs in industries relying on a high degree of knowledge or specialised input, such as research and development in high-tech industries, as well as those relying on interpersonal connections, such as advanced business or professional services (Asheim and Coenen, 2005; Ballard et al., 2016; Maskell, 2001). However, other employment types are less likely to cluster and are more evenly distributed across a city, such as various types of retail and recreation. As different employment types have different base wage rates, skill needs, and knowledge levels, some have argued that workers in higher-skilled occupations may commute longer distances than those in low-skilled occupations (Zhou et al., 2018; Bill et al., 2007). These scholars contend that targets to redistribute employment more evenly across a city should distinguish between occupation types.

Second, there are temporal variations associated with the establishment of different employment types. While certain jobs may 'follow people' as a natural outcome of population growth, others may be the result of place maturity having well-established amenity, infrastructure, etc. (Hoogstra et al., 2017). Jobs which

158 follow people may be a mix of skilled (doctors, police, trades people) and unskilled (shop assistants,
159 laborers, waiters). Other jobs may emerge over time due to industry specialisation around infrastructure
160 (e.g. a marine research complex at a port, or bio-medical zones near a hospital or university) or the creation
161 of specialised urban enclaves (e.g. of artists, entertainment districts). For Garreau's (1992) edge cities, this
162 growth occurred in three phases – first the people, then the marketplace jobs to service the people, and lastly
163 the wealth-creating jobs. Martinus and Biermann (2018) referred to these latter job types as strategic
164 compared to the former which are population-driven.

165 Third, and related to the first two factors, is that targets to redistribute employment opportunities throughout
166 a city (i.e., ESS, ESC and JHB ratios) do not disaggregate by job type (Martinus and Biermann, 2018).
167 Given the spatial unevenness of industry and employment opportunities, job productivity and skill needs
168 will also vary. This is problematic as government attitudes that any employment growth (i.e. in low-
169 productivity or low-skill jobs) is better than no growth may contribute to spatial socio-economic inequality
170 (cf. Bhalla, 2007), such as is the case with spatial mismatch where minority groups do not live in areas
171 where their jobs are (Hu, 2015; Reeves, 2020). These outcomes raise questions around the underlying aim
172 of job redistribution targets - to promote spatial evenness in job numbers, or to improve access to job
173 opportunities in socio-economically less advantaged areas? If the aim is the latter, then targets should
174 distinguish between job types with a focus on increasing employment diversity and opportunities. If the
175 aim is the former, then continuing with current ratios of ESS, ESC and JHB can equalise job *numbers*
176 spatially, but may increase spatial inequality in terms of job opportunities (Martinus and Biermann, 2018).

177 Fourth, household and work decisions are increasingly based on a complex set of socio-demographic and
178 behavioral factors – not just work and travel considerations. For example, education, income differentials,
179 occupation and employment opportunities (Bill et al. 2007; Li et al., 2012; Suárez et al., 2016; Yigitcanlar
180 et al., 2007). These decisions are further complicated as families grow smaller, have both parents working,
181 and/or other factors come into play such as school runs, further education, second jobs or shift work
182 (Forster, 2006; Mulder, 2007; Sang et al., 2011). There are also complexities with shifts towards the gig
183 and sharing economies, workforce casualisation and flexible working hours and locations. As such, whilst

planning attempts to provide greater spatial equality in job provision, how to achieve this is unclear under current targets and measures. The remainder of this paper examines job distribution under contemporary planning targets in a case study of Greater Perth, WA, before exploring a disaggregated job ratio approach aimed at improving access to job opportunities in outer metropolitan or structurally disadvantaged areas.

Planning for employment redistribution in Greater Perth, WA

The more equal provision of jobs across Australian cities is a key policy concern for governments at both the state and local level, given the increasing spatial inequality privileging certain areas over others in attracting better employment, infrastructure, amenities and skilled labour. High property prices and rents in privileged areas attract high-income and/or high-educated and more advantaged workers compared to elsewhere, creating a distinct geography of spatial inequality. These dynamics of Australian cities mean a spatial match between lower income jobs and less advantaged residents (in more peripheral suburban areas), but one that is very different to the *spatial mismatch* noted in American cities (cf. Hu, 2015; Reeves, 2020) where disadvantaged groups living in inner city areas are remote from lower income job opportunities located in more suburban areas. The planning of Australian cities since the 1950s has tried to address this through land use policies and measures to decentralise employment. In Greater Perth, WA, employment redistribution has been the aim in successive plans of the 1955 *Stephenson Hepburn Plan*, 1970 *Corridor Plan*, 1990 *Metroplan*, 2004 *Network City Plan* and *Directions 2031 and Beyond* (Curtis and Olaru, 2007; Department of Planning (DOP) and Western Australian Planning Commission (WAPC), 2010). Each has reflected the planning ideologies of their eras, accommodating population rises by providing land for employment close to residential areas with increasingly better public transport linkages (Martinus and Biermann, 2018).

The most recent plan, *Perth and Peel@3.5 Million* (Department of Planning, Lands and Heritage (DPLH) and WAPC, 2018a; hereinafter called *P&P@3.5*), similarly aims to provide 'greater employment opportunities close to where people live … reduc[ing] the need for long and costly commutes and increas[ing] the economic sustainability of individual sub-regions' (DPLH and WAPC, 2018a, p.44). It sets

employment self-sufficiency ratios (hereafter called *P&P@3.5* ESS) to achieve this, as well as for the: (1) 'creation of employment opportunities that match the skill sets of [the sub-region's] labour force'; (2) 'integration of land use and movement networks, particularly public and active transport links to employment nodes…particularly around emerging activity centres'; and, (3) 'strengthening accessibility to transport infrastructure and facilities in neighbouring sub-regions to enhance competitiveness and attract industrial development' (DPLH and WAPC, 2018b, p.24). As such, P&P@3.5 aims to promote both job growth and access to job opportunities across Greater Perth in a way which minimises the need for travel between home and work. This is of particular importance in terms of the urban form of Greater Perth with development extending linearly for almost 150km north-south, following the coastline (see Figure 1). With the highest concentration of jobs located in the CBD and surrounds and very low residential densities, the average commute distance people travelled from their place of usual residence was just over 15 km (ABS, 2016), with an average daily commute time in 2017 of 59 minutes (Wilkins et al, 2019). Commuting trips are made predominantly by private vehicle (84%), 13% by public transport and 3% active travel (Loader, 2016). Public transport is provided in the form of a heavy rail network with a newer north-south line and older east-west heritage line, served by well-patronised park-and-ride facilities and less utilised feeder buses.

In accordance with previous plans, the *P&P@3.5* ESS ratios for each of Greater Perth's four sub-regions are calculated using the proportional balance of jobs to housing without accounting for regional commuting flows (unlike related ESS and ESC ratios). These sub-regions (Central, North-West, North-East, and South Metropolitan Peel) are shown in Figure 1. The difference between the actual and target *P&P@3.5* ESS for each sub-region allows authorities to know how many additional residents or jobs are needed in each sub-region to generate better employment balance across the entire metropolitan area (Martinus and Biermann, 2018).

Figure 1: Location of the four metropolitan sub-regions of Greater Perth, and constituent Local Government Areas (LGAs)

Since the early 1990's, State-defined ESS targets have been used to gauge the success of outer metropolitan areas to increase employment, though the difference between actual and target ratios have remained largely similar. For example, planned in 1977 for a total of around 330,000 residents at build-out (inclusive of 145,000 workers), Greater Perth's North-West sub-region (PNWS) reached 109,000 residents by 1992 forcing build-out revisions to 420,000 persons (including 210,000 workers). In 1992, ESS targets were introduced to redress spatial imbalances between the Central Sub-region and outer fringe sub-regions - with the PNWS target pegged at 60% by 2021. The PNWS target has changed little since then, currently at 59.5% by 2050 (DPLH and WAPC, 2018a). Nevertheless, the actual rate is only around 49% and the lowest of all sub-regions. *P&P@3.5* ESS actual and targets are given in Table 1, implying an additional 143,560 jobs are required in PNWS by 2050. This is equivalent to 3,681 new jobs each year, which is more than the earlier 2010 *Direction 2031* target of around 3,000 new jobs annually (see DOP and WAPC, 2010, p.81).

In contrast, the Central sub-region is already at its 2050 target of around 140%, with only 52% more jobs needed to maintain this.

Table 1: Job increase needed to achieve 2050 target and P&P@3.5 ESS actual and target ratios, by sub-region

Greater Perth sub-region	2011 jobs	Number of jobs needed by 2050	Total increase in jobs	Total percent change	Actual ESS (2011)	2050 Target ESS	Total change
Central	546,120	831,960	285,840	52%	140%	140%	0%
North-West	80,570	224,130	143,560	178.2%	49%	60%	11%
North-East	82,380	192,950	110,570	134%	80%	86%	6%
South Metropolitan Peel	143,970	437,730	293,750	204%	59%	74%	15%

Source: Adapted from DPLH and WAPC (2018a)

The lower actual PNWS ESS (49%) compared to its 2050 target (60%) underestimates how many PNWS 167,179 residents (15% of all Greater Perth residents) work in PNWS (69,000) versus leave to work in other sub-regions (98,000). The numbers working and residing across all the sub-regions in 2016 is shown in Table 2. Of the around 90,000 employed in PNWS (about 8% of the total workforce), only around 70,000 (77%) are PNWS residents and almost 21,000 are from other sub-regions. Of commuters to PNWS, 13,541 are residents of the Central and almost 5,000 of the North-East sub-regions. The Central sub-region employs around 45% of the total Greater Perth working residents with 58% (303,671 persons) also residing there. Table 2 highlights the large proportion of the labourforce working outside their own sub-region, whose movements are not considered in the *P&P@3.5* ESS target. The underestimation of commuter flows is an issue in the context of outer suburban growth, as it leads to under-investment in transport infrastructure or other amenities. The following section presents a disaggregated job type ratio to achieve greater equality in employment provision.

Table 2: Numbers of persons living and working in Greater Perth sub-regions, ABS journey-to-work

Sub-region (based on LGA 2016 Boundaries)	Place of residence					
	Regional West Australia	North-East	Central	North-West	South Metropolitan Peel	**Total Workers in sub-region**
Place of work						
Regional West Australia	213,961	4,952	9,194	5,983	12,740	**246,830 (21%)**
North-East	1,550	41,714	17,019	10,211	7,825	**78,319 (7%)**
Central	4,052	45,666	303,671	68,930	98,644	**520,963 (45%)**
North-West	723	4,981	13,541	68,915	1,713	**89,873 (8%)**
South Metropolitan Peel	1,367	4,826	21,858	2,900	128,114	**159,065 (14%)**
Other*	10,704	5,377	13,858	10,240	13,854	**54,033 (5%)**
Total residents in sub-region	**232,357 (20%)**	**107,516 (9%)**	**379,141 (33%)**	**167,179 (15%)**	**262,890 (23%)**	**1,149,083 (100%)**

* includes Migratory - Offshore - Shipping (WA) and No Fixed Address (WA).
Source: Adapted from ABS (2016)

Methodology

This research explored an employment redistribution ratio based on disaggregated job types as opposed to the aggregated approach of current job-housing targets. To do this, jobs were classified as either strategic or population-driven within the specific employment context of Greater Perth, WA. Strategic job types were defined as associated with key industries of global competitive advantage driving the Greater Perth economy, being largely the materials and energy (and supporting) sectors. For example, a rise in global (rather than local) demand for WA minerals increases the need for engineers and geologists. Population-driven jobs were defined as increasing proportionately to local (rather than global) population growth, such as teachers and police.

Based on this rationale and using occupation of employment data at the 4-digit level from the Australian Bureau of Statistics (ABS) Census of Population and Housing, we classified 474 occupations into either *strategic* or *population-driven* jobs by first compiling occupation profiles at the 4-digit level. Each profile consisted of a series of sub-category ‘means’ across socio-economic categories as per Table 4, such as income range, gender type, languages spoken at home, etc, where a mean was defined as the sub-category with the largest number of workers. A table of all socio-economic factors and 4-digit occupations (see table

7) compared sub-category means across 3-digit, 2-digit and 1-digit level occupations (see table 3 for example). The 4-digit level was identified as the most appropriate for assessing if an occupation was a strategic or population-driven job at different spatial levels (see table 4).

Table 3: Example of 1- to 4-digit level Manager occupations (ABS, 2016)

1-digit	2-digit Managers	3-digit Specialist Managers	4-digit Education, Health and Welfare Services Managers
Managers	Chief Executives, General Managers and Legislators Farmers and Farm Managers Specialist Managers Hospitality, Retail and Service Managers	Advertising, Public Relations and Sales Managers Business Administration Managers Construction, Distribution and Production Managers Education, Health and Welfare Services Managers ICT Managers Miscellaneous Specialist Managers	Child Care Centre Managers Health and Welfare Services Managers School Principals Other Education Managers

Table 4: Underlying rationale for inclusion of specific socioeconomic factors

Category	Rationale for inclusion
*Frequency of different age ranges (Only working age of 15-65 years included)	Indicator of worker average age in specific occupations. Different age ranges may be proportionally higher in different occupation types. Younger workers (15-25) may have more operative casual jobs, those in their 30s and 40s having more stable full-time jobs technical or operative, and older workers may occupy more senior positions.
Worker gender	Indicator of occupations with higher female or male proportion. Women may accept jobs closer to home due to family duties, even if it is for less pay. Whereas, men may be able to travel further. Gender differences in occupations may also indicate differences in career opportunities, including promotions and advancements.
Number and skill level of languages spoken at home	Indicator of number of languages spoken and level of proficiency. More languages spoken at home may indicate higher proportions of migrant labour.
*Level of education	Indicator of average level of education within different occupations. Higher education may indicate higher income, though this is not the case for the mining sector where technicians have very high incomes.
Sector (private or public)	Indicator of job stability and security, with public sector jobs tending to be more stable.
*Hours worked each week	Indicator of average hours worked within specific occupation. With some jobs such as lawyers having long work weeks, whereas others such as store sales staff may work part-time or casual hours.
Labour status	Indicator of work stability or precarity, given certain occupations have higher full-time employment, others higher part-time or casual (e.g. wait staff).
*Employment status	Indicator of occupations which have more employees (e.g. government workers) or business owners (e.g. farmers).
*Income range	Indicator of average occupational income, given workers may be more willing to travel further for higher income or higher skilled jobs than low paid ones (i.e. wait or sales staff).
*Distance to work	Indicator of average commuting distance, with workers more willing to commuter longer for higher paid or specialised occupations.

*Indicates the final set of categories used to classify occupations as either strategic or population-driven

Each sub-category mean was compared at three ABS spatial scales across both the 2011 and 2016 census periods (ABS, 2011, 2016) by *Place of Usual Residence* and *Place of Work* (as per ABS Census collection locations) to ensure rigorousness of results and consistency in how jobs were classified. These spatial scales were: the entire Perth Metropolitan Region (PMR), Statistical Area Level 2 (SA2), and the Local

Government Area (LGA) of the City of Wanneroo (CoW) being located on the northern outer fringe of the PMR (see Figure 1) and having a high number of residents to jobs and commuters. There was little difference between many categories between the spatial units across the two periods, except for income, work hours, education, distance to work, age, employment status and sector. As such, these were the final categories used to profile occupations and classify whether jobs were strategic or population-driven.

Jobs that were difficult to classify were individually decided via the researchers' own understanding of Greater Perth as a materials and energy hub (References withdrawn until after review) and by answering four guiding questions based on the above literature review of the key factors influence spatial imbalance:

1. Was the job more likely to cluster with other jobs or to be distributed across the wider region?
2. Did the job rely on a high degree of knowledge or specialised inputs and interpersonal connections?
3. Did the job involve industry specialisation around infrastructure (e.g. a marine research complex at a port, or bio-medical zones near a hospital or university) or the creation of specialised urban enclaves (e.g. of artists, entertainment districts)?
4. Did the job service people and businesses or was it wealth-creating?

For example, the occupation of *Legislators* appeared strategic vis-à-vis its sub-category means profile but was changed to population-driven by the researchers as an increased need for these workers was deemed a function of population. Similarly, *Caravanpark and Camping Ground Managers* was first categorised as population-driven, but later as strategic being associated with more people visiting from outside a region (and not population increases). That is, more of workers could be in a low populous area strategically driven by tourism. Other categories of *Social and Welfare Professionals*, and *Legal Professionals* remained as population-driven jobs after considering how they related specifically to the Greater Perth economy.

The final 4-digit level category classifications were compared with the 1-digit, 2-digit and 3-digit groupings, table 5 shows these allocations across strategic and population-driven job types. In most cases, the 2-digit level occupation was sufficient - though the 3-digit level was occasionally needed to further disaggregate jobs. Once all 4-digit occupations were allocated into the two employment types, a strategic-to-population-driven ratio was calculated by summing all workers in each type. The final analysis was

carried out at three levels: 1) the entire PMR; 2) PMR inner, middle and outer regions; and, 3) the outer LGA of CoW (see Figure 2 and 3). It was assumed that the balance of strategic and population-driven jobs for the entire PMR would represent an 'average' job type balance (being an average of all areas across the city) which could be used to set targets for Greater Perth sub-regions. The following sections discuss the findings for PMR and CoW, as well as gives occupational sub-category profiles across job types.

Table 5: Strategic and population-driven job classification by 4-digit occupation codes, ABS 2016

OCCP - 1 Digit	OCCP - 2 Digit	Classes and levels included as Strategic jobs	Classes and levels included as Population-driven jobs
Managers	Chief Exec, General Managers	All (2-digit)	None (2-digit)
	Farmers and Farm Managers	All (2-digit)	None (2-digit)
	Specialist Managers	All **except** Education, Health and Welfare Services (3 digit)	Education, Health and Welfare Services (3 digit)
	Hospitality, Retail and Service Managers	Hospitality, Retail and Service; Accommodation and Hospitality; Retail (3 digit); Miscellaneous Hospitality, Retail and Service nfd; Amusement, Fitness and Sports Centre (4-digit)	Call or Contact Centre and Customer Service; Conference and Event Organisers; Transport Services; Other Hospitality, Retail and Service (4-digit)
Professionals	Professionals, nfd	All (2-digit)	None (2-digit)
	Arts and Media Professionals	All (2-digit)	None (2-digit)
	Business, Human Resource and Marketing Professionals	All **except** Librarians (4-digit)	Librarians (4-digit)
	Design, Engineering, Science and Transport Professionals	All (2-digit)	None (2-digit)
	Education Professionals	Tertiary Education Teachers (3-digit); Miscellaneous Education Professionals nfd; Education Advisers and Reviewers (2-digit)	School teachers (3-digit); Private Tutors and Teachers; Teachers of English to Speakers of Other Languages (4-digit)
	Health Professionals	All (2-digit) **except** general practitioners and resident medical officers	General Practitioners and Resident Medical Officers (4-digit)
	ICT Professionals	All (2-digit)	None (2-digit)
	Legal, Social and Welfare Professionals	All legal **except** solicitors; Psychologists; Social Professionals; Legal, Social and Welfare Professionals, nfd (4-digit)	Solicitors; Counsellors; Ministers of Religion (4-digit); Social and Welfare Professionals, nfd; Social Workers; Welfare, Recreation and Community Arts Workers
Technicians and Trades Workers	Technicians and Trades Workers, nfd	All (2-digit)	None (2-digit)
	Engineering, ICT and Science Technicians	All (2-digit)	None (2-digit)
	Automotive and Engineering Trades Workers	All **except** Automotive Electricians and Mechanics (3-digit)	Automotive Electricians and Mechanics (3-digit)
	Construction Trades Workers	None (3-digit)	All (3-digit)
	Electrotechnology and Telecommunications Trades Workers	None (3-digit)	All (3-digit)
	Food Trades Workers	None (3-digit)	All (3-digit)
	Skilled Animal and Horticultural Workers	Skilled Animal and Horticultural Workers, nfd; Animal Attendants and Trainers, and Shearers, nfd; Shearers; Nurserypersons (4-digit)	Animal Attendants and Trainers; Veterinary Nurses; Florists; Gardeners; Green keepers (4-digit)
	Other Technicians and Trades Workers	All **except** Hairdressers (3-digit)	Hairdressers (3-digit)
Community and Personal Service Workers	*N/A*	None (1-digit)	All (1-digit)
Clerical and Admin. Workers	*N/A*	None (1-digit)	All (1-digit)
Sales Workers	*N/A*	None (1-digit)	All (1-digit)
Machinery Operators and Drivers	*N/A*	None (1-digit)	All (1-digit)
Labourers	*N/A*	None (1-digit)	All (1-digit)

Strategic and population-driven job types across PMR and at lower spatial levels

Of the total number of all PMR jobs (830,779) in 2016, 31% were classified as strategic jobs (258,082) and 69% as population-driven (572,697). As described in Table 6, strategic jobs were largely *Specialist Managers* (except *Education, Health and Welfare Service Managers*) (19%) and *Business, Human Resource and Marketing Professionals* (18%), followed by *Health Professionals* (except *General Practitioners and Resident Medical Officers)* (9%) and *Engineering, ICT and Science Technicians* (8%). Whereas population-driven jobs were mostly *Clerical and Administrative Workers* (21%), followed by *Community and Personal Service Workers* (17%), *Sales Workers* (14%) and *Labourers* (12%).

In contrast, the outer metropolitan LGA of CoW had far fewer jobs (43,225), with only 20% strategic jobs (8,845) and 80% population-driven (34,380). As in PMR, most strategic jobs were *Specialist Managers* (except *Education, Health and Welfare Service Managers*), though slightly higher (at 23%) than PMR due to relatively more *Advertising, Public Relations and Sales Managers*, *Construction Managers* and *Production Managers* (4-digit level). This was followed by *Business, Human Resource and Marketing Professionals* and *Automotive and Engineering Trades Workers* (except *Automotive Electricians and Mechanics*) (both 12%). Population-driven jobs were dominated by *Clerical and Administrative Workers* (16%), *Community and Personal Service Workers* (15%), *Labourers* (15%), and *Sales Workers* (14%).

352 Table 6: Number and proportion of jobs in PMR and Wanneroo: strategic and population-driven,
353 based on 4-digit occupation codes, ABS 2016

		Perth Metropolitan Region			Wanneroo LGA			% difference (Wanneroo-Perth)		
OCCP - 1 Digit	OCCP - 2 Digit	No. strat. jobs (%)	No. pop jobs (%)	Total jobs (%)	No. strat. jobs (%)	No. pop. jobs (%)	No. total jobs (%)	Strat. jobs	Pop. jobs	Total jobs
Managers	Chief Exec, General Managers	12,831 (5%)	0 (0%)	12,831 (2%)	587 (7%)	0 (0%)	587 (1%)	2%	0%	0%
	Farmers and Farm Managers	1,697 (1%)	0 (0%)	1,697 (0%)	384 (4%)	0 (0%)	384 (1%)	4%	0%	1%
	Specialist Managers	48,450 (19%)	5,079 (1%)	53,529 (6%)	2,062 (23%)	295 (1%)	2,357 (5%)	5%	0%	-1%
	Hospitality, Retail and Service Managers	10,195 (4%)	22,510 (4%)	32,705 (4%)	436 (5%)	1,220 (4%)	1,656 (4%)	1%	0%	0%
Professionals	Professionals, nfd	2,991 (1%)	0 (0%)	2,991 (0%)	24 (0%)	0 (0%)	24 (0%)	-1%	0%	0%
	Arts and Media Professionals	4,346 (2%)	0 (0%)	4,346 (1%)	138 (2%)	0 (0%)	138 (0%)	0%	0%	0%
	Business, Human Resource and Marketing Professionals	46,166 (18%)	717 (0%)	46,883 (6%)	1,039 (12%)	18 (0%)	1,057 (2%)	-6%	0%	-3%
	Design, Engineering, Science and Transport Professionals	31,714 (12%)	0 (0%)	31,714 (4%)	707 (8%)	0 (0%)	707 (2%)	-4%	0%	-2%
	Education Professionals	8,323 (3%)	31,237 (5%)	39,560 (5%)	94 (1%)	2,675 (8%)	2,769 (6%)	-2%	2%	2%
	Health Professionals	23,818 (9%)	17,737 (3%)	41,555 (5%)	302 (3%)	569 (2%)	871 (2%)	-6%	-1%	-3%
	ICT Professionals	12,621 (5%)	0 (0%)	12,621 (2%)	183 (2%)	0 (0%)	183 (0%)	-3%	0%	-1%
	Legal, Social and Welfare Professionals	3,851 (1%)	10,331 (2%)	14,182 (2%)	82 (1%)	227 (1%)	309 (1%)	-1%	-1%	-1%
Technicians and Trades Workers	Technicians and Trades Workers, nfd	1,789 (1%)	0 (0%)	1,789 (0%)	103 (1%)	0 (0%)	103 (0%)	0%	0%	0%
	Engineering, ICT and Science Technicians	20,978 (8%)	0 (0%)	20,978 (3%)	752 (9%)	0 (0%)	752 (2%)	0%	0%	-1%
	Automotive and Engineering Trades Workers	18,619 (7%)	7,659 (1%)	26,278 (3%)	1,103 (12%)	673 (2%)	1,776 (4%)	5%	1%	1%
	Construction Trades Workers	0 (0%)	18,885 (3%)	18,885 (2%)	0 (0%)	2,111 (6%)	2,111 (5%)	0%	3%	3%
	Electrotechnology and Telecommunications Trades Workers	0 (0%)	14,825 (3%)	14,825 (2%)	0 (0%)	1,210 (4%)	1,210 (3%)	0%	1%	1%
	Food Trades Workers	0 (0%)	12,774 (2%)	12,774 (2%)	0 (0%)	590 (2%)	590 (1%)	0%	-1%	0%
	Skilled Animal and Horticultural Workers	134 (0%)	7,048 (1%)	7,182 (1%)	32 (0%)	585 (2%)	617 (1%)	0%	0%	1%
	Other Technicians and Trades Workers	9,559 (4%)	4,746 (1%)	14,305 (2%)	817 (9%)	313 (1%)	1,130 (3%)	6%	0%	1%
Community and Personal Service Workers	*N/A*	0 (0%)	94,771 (17%)	94,771 (11%)	0 (0%)	5,048 (15%)	5,048 (12%)	0%	-2%	0%
Clerical and Administrative Workers	*N/A*	0 (0%)	122,119 (21%)	122,119 (15%)	0 (0%)	5,373 (16%)	5,373 (12%)	0%	-6%	-2%
Sales Workers	*N/A*	0 (0%)	82,097 (14%)	82,097 (10%)	0 (0%)	4,894 (14%)	4,894 (11%)	0%	0%	1%
Machinery Operators and Drivers	*N/A*	0 (0%)	49,899 (9%)	49,899 (6%)	0 (0%)	3,332 (10%)	3,332 (8%)	0%	1%	2%
Labourers	*N/A*	0 (0%)	70,263 (12%)	70,263 (8%)	0 (0%)	5,247 (15%)	5,247 (12%)	0%	3%	4%
TOTAL		**258,082** (100%)	**572,697** (100%)	**830,779** (100%)	**8,845** (100%)	**34,380** (100%)	**43,225** (100%)	0%	0%	0%
% of total		31%	69%	100%	20%	80%	100%	-11%	11%	

354 * rounded off to nearest whole number

Overall, CoW was over-represented in population-driven jobs (11%) and under-represented in strategic jobs (-11%) compared to PMR. However, it was over-represented in some strategic job types (*Farmers and Farm Managers* (4%), *Specialist Managers* (5%), *Automotive and Engineering Trades Workers* and *Other Technicians and Trades Workers*) and under-represented in others (*Business, Human Resource and Marketing Professionals* (-6%) together with *Health Professionals* (-6%). And compared to PMR, CoW had relatively more population-driven jobs in *Construction Trades Workers* and *Labourers* (both by more than 3%), but less in *Clerical and Administrative Workers*.

Table 7 outlines the sub-category means for occupational profiles. Population-driven jobs for PER appear associated with more disadvantaged socio-economic groups, having a higher proportion of younger workers, females, lower level qualifications (Year 10+), part-time employment, lower paid incomes and shorter home to work commuting distance. CoW had a more disadvantaged workforce profile, with significantly more population-driven jobs. This signals a need to increase strategic jobs to address the spatial inequality of job access and opportunity for PNWS residents compared to the higher average of this job type found in PMR. There was little difference found in the categories of employment sector (private, public) and travel mode across both strategic and population-driven job types. Figure 2 highlights the significant spatial inequality in strategic and population-driven job distribution, with the most central LGAs of PMR having the majority of total jobs (almost half) and strategic job types. The outer LGAs of PMR had disproportionally more population-driven jobs.

To better understand job type spatial patterns, PMR was divided into three zones of the Inner, Middle and Outer based on the road distance between the Central Business District (CBD) and the centroid of SA2s. Inner SA2s were less than 15km from the CBD, Middle SA2s between 15km and 30km from the CBD, and Outer SA2s greater than 30km from the CBD. Strategic jobs were predominantly in the Inner zone (65%), with substantially less in Middle (24%) and only 11% in Outer. Figure 3 represents these results. As expected, population-driven jobs were found more evenly distributed across PMR with the highest proportion (48%) being in the Inner - followed by 33% and 19% in the Middle and Outer zones respectively.

381 Table 7: Indicative employee characteristics of strategic and population-driven jobs, PMR 2016

		Strategic								Population -driven							
OCCP - 1 Digit	OCCP - 2 Digit	Age	Gender M/F	Degree	Sector	Hrs/week	Labour status	Income annual $K	Travel distance to work	Age	Gender M/F	Degree	Sector	Hrs/ week	Labour status	Income annual $K	Travel distance to work
Managers	Chief Exec, General Managers	40-69	M	Bach.	Priv.	49+	FT	>156	10-30km	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Farmers and Farm Managers	50-69	M	Yr 10+	Priv.	49+	FT	34-65	Nil	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Specialist Managers	40-59	M	Bach.; AC; Yr 10+	Priv.	49+	FT	104-156	10-30km	50-59	F	Bach.	Priv.	35-49	FT	104-156	10-30km
	Hospitality, Retail and Service Managers	20-59	M	Yr 10+	Priv.	35-49+	FT	52-156	10-30km	30-39	F	Yr 10+	Priv.	49+	FT	52-64	10-30km
Professionals	Professionals, nfd	30-39	F	Postgrad	Priv.	35-39	FT	104-156	10-30km	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Arts and Media Professionals	30-39	F	Bach.	Priv.	1-15hrs	PT	6-65k	Nil	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Business, Human Resource and Marketing Professionals	30-39	M/F	Bach.	Priv.	35-40	FT	104-156	10-30km	55-59	F	Bach.	Priv.	30-39	FT	70-91	10-30km
	Design, Engineering, Science and Transport Professionals	30-39	M	Bach.	Priv.	40	FT	52-156+	10-30km	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Education Professionals	40-59	F	Bach.	Priv./ Gov	35-39	FT	104-156+	10-30km	30-49	F	Bach.	Priv./ State	35-40	FT	91-156	10-30km
	Health Professionals	30-59	M/F	Bach.	Priv.	35-49+	FT	156+	2,5-10; 10-30	20-39	F	Bach.	Priv.	35-39	FT	65-156	10-30km
	ICT Professionals	30-39	M	Bach.	Priv.	40	FT	104-156+	10-30km	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Legal, Social and Welfare Professionals	40-59	F	Bach.	Priv.	35-49+	FT	52-156+	2,5-10; 10-30	30-39	F	Bach.	Priv.	35-49	FT	52-65	2.5-10; 10-30
Technicians and Trades Workers	Technicians and Trades Workers, nfd	20-29	M	AC	Priv.	40	FT	52-65	10-30km	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Engineering, ICT and Science Technicians	30-39	M	Bach.; AC	Priv.	35-40	FT	52-156+	10-30km	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Automotive and Engineering Trades Workers	30-49	M	AC	Priv.	35-49+	FT	52-156+	10-30km	30-39	M	AC	Priv.	40-49+	FT	52-156+	10-30km
	Construction Trades Workers	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	20-29	M	AC	Priv.	40	FT	52-65	10-30km
	Electrotechnology and Telecommunications Trades Workers	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	20-29	M	AC	Priv.	40	FT	52-156+	10-30km
	Food Trades Workers	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	20-29	M	AC	Priv.	35-39	FT	52-65	10-30km
	Skilled Animal and Horticultural Workers	30-49	M/F	AC; Yr10+	Priv.	35-40	FT	26-65	2,5-10; 10-30	20-39	M/F	AC; Yr10+	Priv.	1-39hrs	PT / FT	33-65	10-30km
	Other Technicians and Trades Workers	40-49	M	AC; Yr10+	Priv.	35-49+	FT	52-65	2,5-10; 10-30	20-29	F	AC	Priv.	35-39	FT	34-42	10-30km
Community and Personal Service Workers	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	20-39	F	AC; Yr10+	Priv./ Gov	All	PT / FT	<65	2.5-10; 10-30
Clerical and Administrative Workers	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	20-49	F	Yr 10+	Priv.	35-39	FT	52-65	10-30km
Sales Workers	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	20-29	F	Yr 10+	Priv.	1-49+	PT / FT	<65	2.5-10; 10-30
Machinery Operators and Drivers	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	20-59	M	Yr 10+	Priv.	35-49+	FT	52-156+	2.5-10; 10-30
Labourers	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	20-29	M	Yr 10+	Priv.	All	PT / FT	34-156+	10-30km

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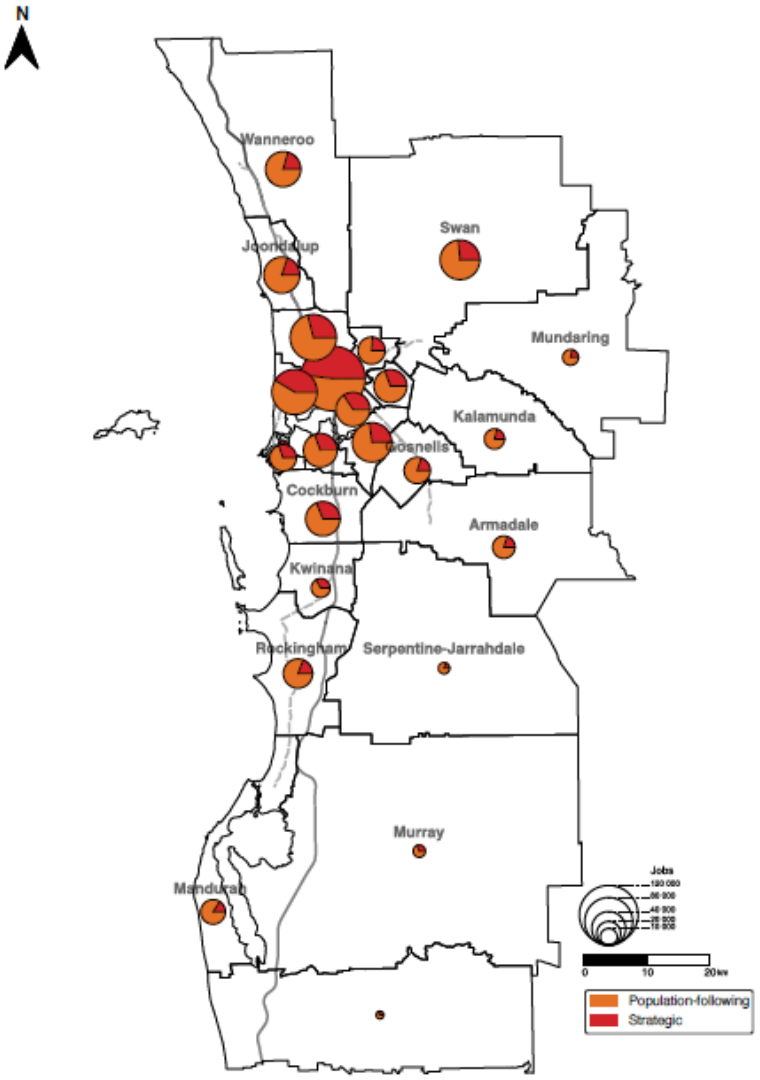
383 *Abbreviations: ndf = not defined; AC = Advanced Certificate; Bach = Bachelor; Postgrad = Postgraduate studies; FT = Fulltime; PT = Part time; km = kilometers; Gov = government; Priv. = private

As a ratio, strategic jobs were over-represented in the Inner (+11%) but under-represented in the Middle (-6%) and Outer (-5%) zones. Population-driven jobs were under-represented in the Inner (-5%) but over-represented in the Middle (+3%) and Outer (+2%) zones. These findings reflect the greater number of strategic jobs in the Inner zone, almost double the number of population-driven jobs in the Middle and more than double that of the Outer zone.

Figure 2: Number of strategic and population-driven jobs per LGA in Greater Perth

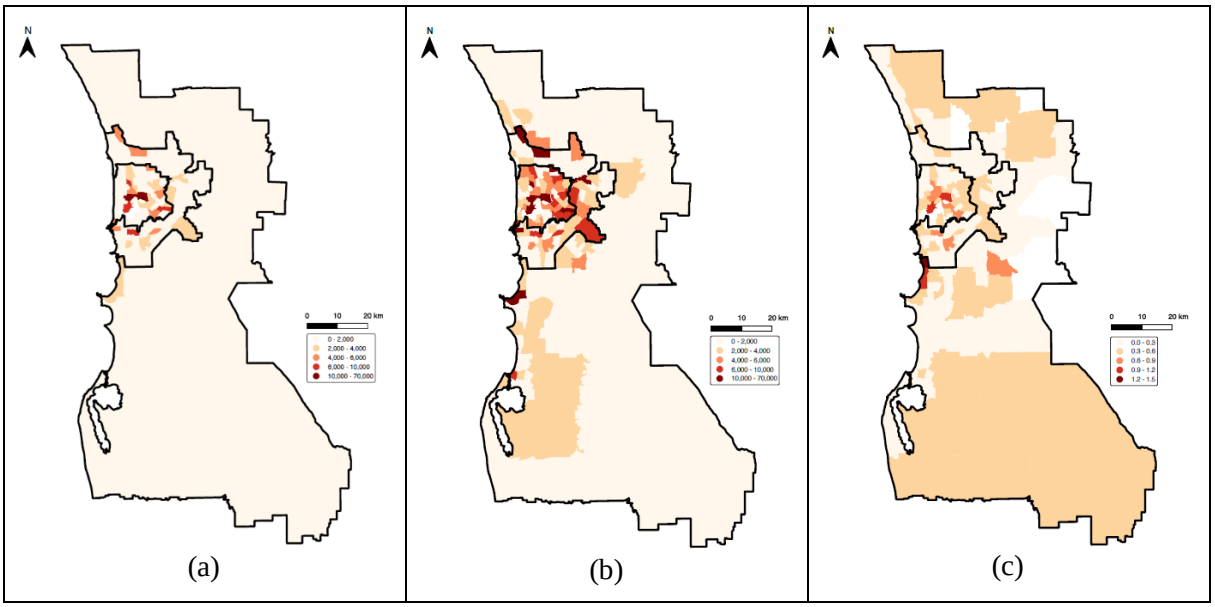


Source: Adapted from ABS (2016)

At a smaller spatial scale, the only SA2s with strategic to population-driven job ratios greater than 0.9 occurred in the Inner zone (of Perth CBD and the Nedlands/Crawley university and hospital precinct) and in the Outer zone near the highly specialised shipping and heavy industrial coastal area of

Henderson/Kwinana (see Figure 3c). At the LGA level, the results within the three zones was also highly variable. CoW had only 11% of all PMR jobs, was under-represented in strategic jobs by -4% and over-represented in population-driven jobs by 2% (see Figure 3 table). Its strategic to population-driven job ratio of 0.25 was lower than that of the entire Outer zone.

Figure 3: Distribution of *strategic* (a) and *population-driven* (b) jobs and the ratio of strategic to population-driven (c) per Statistical Area (SA2) and for PMR Inner, Middle and Outer zones, compared to Wanneroo



Region	Strategic Jobs		Diff. %Strat. to %Total	Pop.-driven Jobs		Diff. %Pop. to %Total	Total Jobs		Strategic: Pop. jobs
	No.	%		No.	%		No.	%	
Inner	166,916	65%	11%	277,312	48%	-5%	444,228	53%	0.60
Middle	62,470	24%	-6%	187,263	33%	3%	249,733	30%	0.33
Outer	29,108	11%	-5%	107,710	19%	2%	136,818	16%	0.27
Total	**258,494**	**100%**		**572,285**	**100%**		**830,779**	**100%**	0.45
Wanneroo	8,845	7%	-4%	34,380	12%	2%	43,225	11%	0.25

Source: Adapted from ABS (2016)

Concluding discussion

Rising spatial inequality across cities worldwide has presented land use policy and planning challenges regarding the equal access of residents to jobs and employment opportunities. For much of the 20th Century, governments have implemented growth strategies to assist in the strategic land use planning process. A good example being sub-regional job-housing targets, such as self-sufficiency, self-containment and jobs

411 housing ratios, which have aimed to redistribute jobs more fairly across a city by promoting more equal
412 land use distribution of residents to jobs. Despite long term use, these ratios have not curbed spatial
413 inequality - as illustrated by Australian cities - raising questions as to their effectiveness as a planning tool.
414 This is because, firstly, in some countries, like Australia, core urban areas are often better endowed with
415 employment, infrastructure, amenities and skilled labour. Secondly, there are large variations in job
416 productivity and type (cf. Benner and Karner, 2016; Bhalla, 2007; Schleith et al., 2016; Zhou et al., 2017).
417 Despite this, there has been limited examination into alternative planning methods to better redistribute
418 employment across a city.

419 We fill this gap by examining how a disaggregated strategic to population-driven job ratio gives insight
420 into differentiated employment spatial patterns and by doing so, provides a novel means to address uneven
421 spatial access to jobs and job opportunities. Drawing on a case study of Greater Perth, WA, we explore
422 strategic and population-driven jobs at three different spatial levels of the entire urban system, at a smaller
423 statistical area and finally at the local government level. The ratio of the entire urban system provided an
424 average job type balance as it consists of a CBD (which is naturally higher) and its outer metro areas
425 (naturally lower). As such, it may be useful in setting targets to disaggregate strategic and population-driven
426 job types and facilitate more context-relevant employment redistribution.

427 There are two take-away points from our analysis. First, a ratio that holds all jobs equal (irrespective of
428 skill level, educational attainment, experience, etc.) does not account for differences in jobs or the spatiality
429 of industry clustering, and therefore may exacerbate spatial inequality as socio-economically disadvantaged
430 and infrastructure poor outer metropolitan areas tend to attract more population-driven jobs than core urban
431 areas. Indeed, except for some specialised industrial areas, we find more population-driven jobs in the outer
432 and to a lesser extent, middle areas, and that these jobs are associated with a more vulnerable workforce
433 sectors with greater numbers of younger workers, females, lower qualification levels, part-time
434 employment, lower incomes and shorter commutes. In contrast, the inner area had relatively more strategic
435 jobs which were more strongly linked to a medium-aged workforce, higher qualification levels, full-time
436 employment, higher incomes and longer commutes. Such findings align with other scholars who also

observe continued spatial inequality across cities despite employment redistribution targets, such as Forster (2006), Martinus and Biermann (2018) and Zhou et al. (2017). As well as Bhalla (2007) who observed a spatial bias is introduced when any employment growth is used to measure success rather than inclusive job growth strategies accounting for employment type.

Second, a ratio which focuses on strategic job creation and access overcomes the limiting land use policy objective of travel reduction, being an implied aim of current employment self-sufficiency and other jobs-housing targets. Indeed, there are spatial disadvantages related to where job opportunities are located (or not) which need to be addressed through broader measures targeting travel accessibility to employment across the city in conjunction with job redistribution targets. In doing so, planning authorities and government will generate a more efficient and sustainable city irrespective of business or worker location, as these are likely to maximise business profits or worker trade-offs associated with time and economic value spent doing different activities such as travel, leisure and being at home. As Cervero (1996) argued, demand-side (road pricing and parking restrictions) and supply-side (rises in level and quality of transit) may lead to less car travel than land-use targets (jobs-housing related ratios).

A ratio of strategic and population-driven job types may encourage long-term strategic industry development with sub-regional collaborations across the city. Whereas jobs servicing populations will almost naturally follow housing development without much government intervention, strategic jobs are unlikely to be distributed evenly across a city responding to a more complex set of location and business dynamics. Decentralisation planning targets focused on strategic jobs will mean achieving fewer but more diverse job creation outcomes by governments. For outer metropolitan areas, this may mean leveraging competitive and strategic advantages in existing and emerging industries (such as renewables and bio-agriculture). More targeted increases in strategic jobs may help to improve spatial inequalities between core and outer urban areas of a city. Indeed, targeting increases in any and all jobs may lead to complacency in job growth and does not correct the spatial bias of where most strategic jobs tend to locate relative to most population-driven jobs.

Emerging and disruptive trends, technologies and innovations in vehicle and transport service delivery models, information and communications, new types of businesses and work practice, will further impact current mobility and spatial patterns and dynamics across cities. Significant and rapid changes to travel and work practices in response to the COVID-19 pandemic, has demonstrated the influence of unforeseen disruptions to conventional practices, requiring new approaches to manage the consequences and achieve sustainable outcomes. These changing trends make it even more crucial for the development of responsive land use and transport policy mechanisms, informed by appropriate tools, measures and data, to ensure diversified job growth as well as equitable access to job opportunities across cities.

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