Long distance commuting into Australian regions:

Its determinants and impacts on wellbeing in the region and social capital's capacity to mediate those impacts

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This research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council (NHMRC) *National Statement on Ethics Conduct in Human Research*, 2007. The proposed research study received human research ethics approval from the JCU Human Research Ethics Committee:

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I certify that the above material describes my work completed during my registration as Doctor of Philosophy candidate at James Cook University. I also acknowledge that copyright of published works resides with the copyright holder(s).

In addition, I hereby declare that the thesis incorporates material that is a result of joint research, as follows: Nicholas, C., & Welters, R. (2016). Exploring determinants of the extent of long distance commuting in Australia: account for space. *Australian Geographer, 47*(1), 103-120.

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Abstract

Overall, this thesis examined whether spatial dependence is a cause of the ambiguity in the literature about the impacts of inbound LDC on resident wellbeing in communities in Australia. This thesis provides two arguments for the relevance of spatial dependence; one operates at the regional level and the second at the community level. The first argument is that spatial dependence at the regional level influences the scale (and hence impact) of LDC, which may explain the unobserved variance in the LDC impact literature. The second argument is that spatial dependence between communities, which influences socio-economic and sociological characteristics of a community, causes the unobserved variance.

The overarching aim of this thesis was to consider the determinants and impacts on resident's wellbeing of long distance commuting into Australian regions and social capital's capacity to mediate those impacts. Three questions drove this research:

1. What circumstances in and outside a region affect the extent of LDC in that region?
2. Does social capital mediate the impacts of inbound LDC on resident wellbeing in the host region?
3. What (if any) dimensions of social capital are effective in mediating the impacts of LDC on resident wellbeing in a host region?

The first stage used spatial panel modelling, 516 Local Government Areas (LGAs) across Australia over two census periods (2006 and 2011) to explore drivers of LDC. I found that local labour market characteristics had minimal influence on recruitment strategies of companies that typically use LDC. Housing affordability does not impact on the decision of non-resident workers to either migrate into a region or adopt LDC into that region. However, local service provision and the availability of rental accommodation reduces the uptake of LDC. In addition, higher turnover of the resident population erodes social capital in host regions, which reduces the attractiveness of the local area and leads to increased use of LDC. Spatial dependence was detected in the dependent variable and the error term. This infers that the scale of LDC in a given region is influenced by the regional circumstances in neighbouring regions that were not captured within the model.

The second stage used a case study approach, 150 residents from Kalgoorlie-Boulder (an Australian resource town) were surveyed about perceived levels of wellbeing, social capital and LDC impacts. This study purposes that circumstances within the host community could be a contributing factor to the unobserved variance in LDC impact models. These circumstances involve social capital and its use to mediate the impacts of LDC. Differing level of social capital may change the perceived impacts of LDC. Mediation analysis found that social capital did not mediate the established negative relationship between LDC impacts and wellbeing. Social capital therefore does not explain the difficulty to generalise LDC impacts outside of host communities.

In the third stage, also using a case study approach in Kalgoorlie-Boulder, Australia, I explored the potential of social capital as a mediator between LDC impacts and resident wellbeing. I concluded that whilst bonding and bridging social capital were important to wellbeing, they were not effective mediators of LDC impacts. Linking social capital was the least effective, providing no benefit to either subjective wellbeing or mediation of LDC impacts. Structural limitations (such as 12-hour shifts) may prevent connections between residents and LDC workers, limiting available bridging capital. I recommend further research into whether 8-hour shifts would improve social integration of these two groups. Furthermore, linking social capital may have been ineffective because the community members lack a connection with LDC decision makers. These decisions are made in company headquarters which are usually located in capital cities or overseas; not in the host region.

Overall, awareness of spatial dependence was an important consideration at the regional level but not at the community level. There was no evidence that a host region's local labour market is a driver of LDC, limiting local job opportunities. Kalgoorlie-Boulder residents indicated the presence of a hollow economy, suggesting the town is being treated as a resource bank.

This thesis contributes to both academic and wider society through methodological and policy recommendations. The policy goal of this thesis is to improve the wellbeing of individuals living in regional/remote Australia. LDC is widely acknowledged to reduce life satisfaction, commonly through community fractionalisation and the hollow economy. Policy recommendations aimed at addressing these, include: (1) reduce the

scale of LDC within a host region (reduce the hollow economy); (2) reduce community fractionalisation in the presence of LDC and (3) empower residents within the host region to influence decisions around LDC. Methodologically this thesis (1) provides an alternative method to operationalise LDC empirically, (2) highlights the importance of space in LDC/mining research, (3) separates LDC and mining impacts and finally (4) measures social capital at a (remote) community level and its role as a mediator of LDC impacts on wellbeing.

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CHAPTER OUTLINE

1.1 Thesis introduction

This thesis will discuss the impact of long distance commuting (LDC) on the wellbeing of residents of Australian regions, which host LDC workers. Whilst LDC occurs in regional Australia it does not occur in a vacuum and is just one of many issues impacting regional wellbeing. Australian regional communities are generally classified as geographically remote with a small population, enduring harsh weather, with tight labour markets, depending on a single industry and culturally distinct from metropolitan areas (Huskey, 2006; Lovell & Critchley, 2010; Tonts, Plummer, & Lawrie, 2012). Although the population within regional Australia is scattered, there has been a general trend of relative population decline (Ryser & Halseth, 2010). According to ABS census data, Australia's population grew by eight percent from 2006 to 2011, however, the majority of that growth (96%) was in cities with population spillovers into neighbouring areas. Often out of range of the 'sea-change' and 'tree-change' migrants, regional communities are generally regarded as lacking the symbolic resources for attracting permanent residents, thus are not considered 'vibrant communities' (McManus et al., 2012). Regional Australia's struggle to build and sustain regional communities is consistent with a 'new rural economy' (Ryser & Halseth, 2010). The 'new rural economy' describes economic, social and environmental change within regional communities as traditional commodity industries evolve within an increasing globalised economy (Sullivan, Ryser, & Halseth, 2014).

Generalised claims about regional communities, McManus et al. (2012, p1) concluded, are "*fraught with danger*". Regional communities have a diversity of characteristics, continuously evolving with consideration of their local resources (Holmes, 2006). In general, Australia's agricultural industry remains important for regional communities, however, extractive industries dominate some regions, whilst others rely on tourism and services (McManus et al., 2012). There is, however, uneven economic development across different industries in Australia. Corden (2012) divided the Australian economy into a non-tradable sector (indicated by domestic demand and supply) and tradable sector (export-import industries). He further divided the tradable sector into booming and lagging industries. Booming industries are the extraction industries, whilst lagging industries are manufacturing, farming and tourism. Regions that depend on the latter

group of industries fall behind regions reliant on the former, which gives rise to the two-speed economy.

Australia, like Canada and the USA, has an extensive rural geography (large distances between communities) (Ryser & Halseth, 2010). Communities within an extensive rural geography are geographically isolated and are subject to harsh climates (Lovell & Critchley, 2010). It is within this content that I study the impact of LDC on resident wellbeing; more precisely, residents from regions that host LDC workers in regional Australia.

1.2 The rise of LDC

LDC refers to labour movements of workers who work and live in different regions. This umbrella term encompasses all forms of distance labour including Fly-in Fly-out, Drive-in Drive-out, and Bus-in Bus-out. The distinguishing feature of this labour movement is the inability of the non-resident labour force to return home after their workday, usually due to distance (Carrington & Pereira, 2011). Instead, these workers reside in the region of work – also known as the 'host region' – and only return to their usual place of residence – also known as the 'home region' – for days off. Typically, a worker would complete this cycle in block rotations by having a set number of days for work and for recreation (for example: 7 days on, 7 days off).

Since its genesis in the 1940s, when LDC workers serviced offshore oil rigs (Houghton, 1993), LDC has become a worldwide phenomenon. In particular, LDC is now used to support resource exploitation in the remote areas of Australia (Tonts et al., 2012), Russia (Spies, 2006), North America (Bowes-Lyon, Richards, & McGee, 2009; Storey, 2010), South America (Aroca & Atienza, 2011), and Northern Europe (Ejdemo & Soderholm, 2011; Ohman & Lindgren, 2003). This is because mineral deposits require a substantial workforce to extract. Whilst this workforce could be sourced from within the region located near mineral deposits, these regions typically exhibit tight labour markets (Measham & Fleming, 2014; Morris, 2012; Tonts & Plummer, 2012). Consequently, the region generally imports the required labour, either through in-migration or through LDC. LDC is an important element of natural resource exploitation (Spies, 2006) as migration

to some of these remote regions is not attractive to the workforce (Nicholas & Welters, 2016).

1.2.1 Australia's mining industry and the adoption of long distance commuting

The Australian mining industry has been an important driving force of regional growth since the early 19th century (Measham, Haslam Mckenzie, Moffat, & Franks, 2013). Despite the mining industry's transition from investment to production in the early 2010s, it still contributed 8.3 percent of Australia's Gross Domestic Product (GDP) in 2013-2014 (Department of Industry, 2014). Prior to the adoption of LDC within Australia, mining companies would construct 'mining towns' to provide permanent housing for their workforce over the duration of the mine's life. Numerous towns such as Karratha, Newman and Paraburdoo in Western Australia, Australia, were built for this reason (Morris, 2012). Mining companies administered these towns and were also responsible for maintenance and development of these 'closed towns'. In the 1970s, Australian mining companies transitioned away from building 'mining towns' with a permanent workforce towards building work camps near already established towns staffed by a temporary workforce (Storey, 2010). SCRA and Windsor (2013) also observed this transition in Canada in a similar time period.

Australia's mining industry is the largest adopter of LDC with KPMG (2013b) estimating that mining employed 21 percent of all LDC workers. McKenzie (2010) suggests that the extent of the use of LDC in mining depends on the lifecycle of the mine; that is, whether the mine is in its construction or operational phase. During the construction of a mine, LDC workers are predominantly construction workers, hired in large numbers for a relatively short duration. Once construction is completed, LDC is adopted to recruit the operational workforce. Operational workers are a comparatively small workforce that works during the operational life of the mine. Whilst operational workers are mining employees, construction workers are attributed to the construction industry (McIntosh, 2012). The true contribution of the mining industry to LDC may therefore be larger (mining plus construction); however, it is not the only industry using such practices. Hussain, Maple, Hunter, Mapedzahama, and Reddy (2014) and Perkins (2012) highlight a surge of LDC within the health care industry.

The emergence of LDC in Australia, particularly in the mining industry, has been of interest to researchers. One can categorise hypothesised causes of LDC into two groups; the decision-making process of the worker and the behaviour of the mining company. The decision-making process of the worker includes the characteristics of the both the host and home regions, the workers personal circumstances and working environment. Regional characteristics refer to the economic and geographical features of a host and home region such as mineral remoteness (Morris, 2012; SCRA & Windsor, 2013), tightness of labour markets (McKenzie, 2010; Measham & Fleming, 2014; Storey, 2010), and residential attractiveness. A workers personal circumstances include their family situation (Petrova & Marinova 2013), ambitions and career stage for both the worker and their partner (i.e. work life balance) (URS 2012). The working environment includes the situation at both the camp and traditional operations (e.g. roster) (Lovell & Critchley 2010), career opportunities and accommodations (URS 2012). These characteristics collectively influence the appeal for in-migration (Aroca & Atienza, 2011).

Mining company behaviour, on the other hand, refers to willingness to recruit locally. Changing economic incentives that favour temporary workforces over permanent mining towns influence this willingness. Storey (2010) referred to the introduction of the Fringe Benefit Tax in 1985, which discouraged permanent construction in new mining sites. Mining companies which provided low-cost onsite accommodation and subsidized services, were now charged the company rate of 39 percent. This tax, however, only applied to permanent residents within the mining town; workers who transited from other areas were exempt (Houghton, 1993). Thus, there was a tax incentive for hiring non-permanent workers.

Reliance on LDC in regional areas of Australia to supplement tight labour markets continues to be controversial. Mining companies favour LDC, because it increases worker mobility and reduces costs, whilst regions hosting these workers criticise the practice, viewing it as disruptive and damaging to the region's identity. SCRA and Windsor (2013) highlighted the public debate occurring in regards to LDC. The majority of submissions provided by industry were positive towards the practice whilst members of the region (local government and individuals) were negative. This controversy has attracted attention from researchers to investigate the impacts of mining and associated

LDC on host regions (McDonald, Mayes, & Pini, 2012; Measham & Fleming, 2014; Storey, 2010; Tonts et al., 2012).

1.3 Impacts of mining/long distance commuting on a host region

Within the Australian context (which is the focus of this thesis), mining and LDC are commonly associated with each other. This extends to the perception that mining impacts and LDC impacts are mutually inclusive (Carrington, Hogg, McIntosh, & Scott, 2012). Research into the matter has not abetted the situation, since the majority of LDC impact research is based around mining host regions or the affected communities within the host region. Therefore, the literature describes existing socio-economic and sociological impacts as joint mining/LDC impacts. To contextualise the established mining/LDC impact literature, I present these impacts below with the help of a scenario of a large mining company setting up near a rural community.

1.3.1 Socio-economic impacts of mining/long distance commuting on a host region

When a company (e.g. mining) establishes within a region (now referred to as a 'host region') it has to make decisions on sourcing factors of production. These take the form of locally or non-locally sourced labour and capital. The use of different combinations of these factors of production presents its own unique risks and opportunities for the host region, as shown in Figure 1-1. Although the focus of this thesis is on labour impacts (in particular, non-local labour), I will also discuss capital impacts to provide an all-encompassing summary of mining/LDC impacts on host regions.

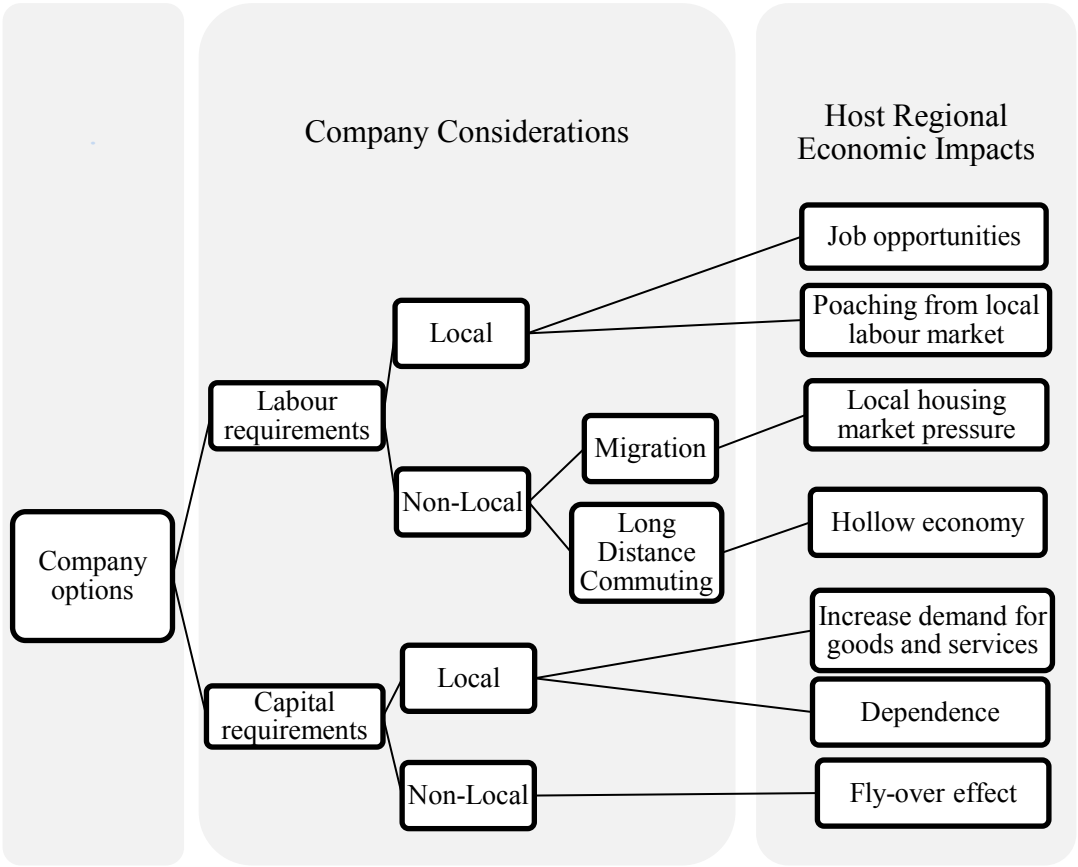

Figure 1-1: The risks and opportunities to host regions associated with the establishment of a company requiring factors of production

1.3.1.1 Labour impacts on host regions

Establishment of a large-scale mine within a host region can bring benefits and disruptions to the local labour market. With respect to benefits, wages provided by the resource industry are substantially higher than the Australian average (SCRA & Windsor, 2013). In addition, the variety of jobs available in rural areas can be limited. Mining operations in these regions provide opportunities for introducing new skills and life experiences. On the other hand, however, the establishment of mining can create more pressure on local businesses. Esteves, Barclay, Brereton, and Samson (2012) describe how high wages provided by mining companies further tighten the local labour market. The mining industry attracts the limited pool of workers in host regions with higher wages, leaving local businesses with employee shortages. In addition, when local employees undertake employment in the mining sector, local business owners lose skilled and experienced workers, which forces them to retrain new staff.

Despite efforts to include local labour, employment of non-local workers is sometimes inevitable. In particular, when large-scale mining establishes itself within remote regions, shortages in the local labour market become problematic. That is, a tight labour market restricts the desire of mining companies to recruit locally. In fact, labour market tightness could be an important contributing factor to the adoption of LDC (Measham & Fleming, 2014; Morris, 2012; Tonts & Plummer, 2012). To try to mitigate the negative effects of a tight local labour market, resource operators can move workers to the region or employ LDC.

Traditionally, mining workers would relocate to the host region before LDC was financially viable. In such instances, labourers would reside in the host region for the duration of their contract. This large inflow of well-paid workers would create inflationary pressures on the local housing market due to increased demand for housing. In some remote mining regions the cost of living can rival that of cities (Lawrie, Tonts, & Plummer, 2011). This can compromise the flow of local investment because higher housing prices provide incentives for local residents to invest outside the region in preparation for departure (Head & Lloyd-Ellis, 2012). It is the in-migration of labour to service the mining industry that causes inflation in house prices. Mining companies, therefore, commonly use housing pressure as an argument to adopt LDC (Lawrie et al., 2011; Windle & Rolfe, 2013). If mining labourers were to reside in purpose built camps instead of local housing, housing inflation caused by the mine would be minimised.

Finally, McKenzie (2010), found that regions with a high prevalence of LDC workers suffered from the 'hollow economy syndrome'. This occurs when workers do not spend their wages and salaries from economic activity in the host region within that region. Mining companies provide all the necessities for the workers so there is no need to make local purchases. McKenzie (2010) uses the Pilbara mining region in Western Australia, Australia as an example; the LDC workers spend little of their pay in the host region with the exception of alcohol.

1.3.1.2 Capital impacts on host regions

With the establishment of mining within a region, there is a need to supply the mine (and associated workforce) with everyday necessities such as food and materials. Non-local

suppliers have the advantage of being able to handle the scale of supplies needed for mining operations. Typically, a mining company has numerous mines across different regions and the use of several non-local suppliers to cater for all of their mines provides benefits of scale. In doing so, the host region can suffer from the 'fly-over effect', when businesses outside the host region receive the economic benefits from supplying the mine instead of local businesses (Basson & Basson, 2012). Local suppliers have raised many complaints about the failure of resource companies to provide an avenue to enable local businesses to supply basic services (Esteves et al., 2012). One major complaint from local businesses in host regions is the co-location of goods and services provided within work camps. If these services are already available within the region, local suppliers argue they can and should supply the basic services (SCRA & Windsor, 2013).

The literature suggests that the best strategy to combat this 'fly-over effect' is through local procurement by incorporating procurement policies and guidelines (Esteves et al., 2012). McKenzie (2010) highlights that there are currently few such policies in place, and raised concerns about the capacity of those regions to supply mining developments. Esteves et al. (2012) share this sentiment, who state that the extent to which local suppliers can benefit from supplying goods and services depends on their capacity. If local suppliers do not have the capacity needed, then local procurement will not be effective at reducing the fly-over effect (McKenzie, 2010). This concept, however, it not just a scale issue. Local businesses may not have the experience or even interest in providing the necessary goods and services. Esteves et al. (2012), however, cautioned about the perceived benefits of local supply, because this would reduce economic diversification of the region by concentrating economic growth in one industry. Having a single industry economy, particularly the resource industry, makes a region vulnerable to boom and bust cycles (McDonald et al., 2012). Tonts and Plummer (2012) agreed that resource dependence is indeed an issue, but questions how host regions could diversify their economies given their remoteness and size.

Regardless of the mining company's decision to source locally or not, there are disruptions to the local economy. That is, infrastructure within these regions is under pressure from the increased economic activity. SCRA and Windsor (2013) highlight that the lack of compensation from resource companies is a prominent concern from local governments in host regions. In regions of rapid growth, the local infrastructure is unable

to provide adequate services (Tonts & Plummer, 2012). Regional services such as water, road and sewerage, as well as airport and telecommunication infrastructure can all become congested, where the associated service provision costs burden the host regions (Edmiston, 2007). The ad-hoc manner of infrastructure investments by resource companies compounds the issues.

Investment from mining companies in these regions is minimal with administration for recruitment and management often based outside the region (McKenzie, 2010). As it stands, there is little monetary compensation from resource companies to assist these host regions (Edmiston, 2007), because these companies do not provide real on-going maintenance support. Contributions from resource companies tend to be 'showcase' projects like pools or recreational facilities. Whilst regions may enjoy these 'showcase' projects, residents are concerned that industry favours short-term economic benefits over long-term regional wellbeing (Carrington et al., 2012).

1.3.2 Sociological Impacts of Mining/Long Distance Commuting on host regions

Whilst the socio-economic impacts of mining/LDC can be described within the context of labour and capital, another important consideration is mining/LDC impacts on the residents themselves. During the North American mining boom in the 1970s and 1980s, researchers described sociological disruptions in existing mining towns caused from an influx of mining workers. (Tonts & Plummer, 2012). These towns experienced social dysfunction, detachment and reductions in social networks, which resulted in fractionalisation (SCRA & Windsor, 2013) and increased mental health issues (Lovell & Critchley, 2010).

LDC workers are different demographically than local residents, with the majority being males aged between 25 and 40 years old (Petkova, Lockie, Rolfe, & Ivanova, 2009). These workers are temporary, resulting in the need for residents to continuously establish new networks to maintain connections with this demographic cohort. This can create emotional fatigue and end in residents avoiding LDC workers (Lovell & Critchley, 2010). This avoidance creates the perception of 'us versus them' which is prominent in host regions (SCRA & Windsor, 2013). Degrading of social networks within the region (particularly between residents and LDC workers) reduces trust and social inclusion, potentially leading to fractionalisation (Smith, Moore, Anderson, & Siderelis, 2012),

increased crime rates and social disorder (Carrington et al., 2012). This assumes that there was sufficient social capital between residents and LDC workers that can be degraded. This is not always the case, if no social capital is present, fractionalisation between the residents and LDC workers may be more immediate.

Whilst resident wellbeing is an issue within the wider population, there is little known about specific populations (Hamilton, Watson, & McDonald, 2013) such as those in the remote regions which, according to Lovell and Critchley (2010), wellbeing research largely ignores. The isolation, harsh climate and environmental factors they described are important risk factors for deteriorating individual wellbeing. Lovell and Critchley (2010) and Poortinga (2012) highlight that limited access to education, health and childcare services are major causes of stress in rural areas. In conjunction with the mining impacts discussed in the previous sections, they amplify the wellbeing risks.

The concept of wellbeing has no agreed definition, but is indistinguishable from (and interchangeable with) quality of life and life satisfaction (McCrea, Walton, & Leonard, 2014). Evaluating the most 'correct' definition of wellbeing is out of the scope of this thesis, therefore one will be adopted. This thesis defines wellbeing as *"... a function of the actual conditions of that life and what an individual or community makes of those conditions*" (Michalos & Robinson, 2012, p 23). This definition is appropriate because it includes opinions and perceptions of an individual's circumstances. I investigate these perceptions in Chapters 5 and 6 in regards to wellbeing changes caused by perceived LDC impacts. The measurement of wellbeing needs to consider spatial interactions, wellbeing measures at different scales (i.e. individual, community, national), and influences by different factors (Armitage, Bene, Charles, Johnson, & Allison, 2012) such as climate, economic linkages and government policy. It is important to distinguish between different scales of wellbeing measures. Community wellbeing focuses on the community as a whole whilst subjective wellbeing focuses on the individuals within the community. To clarify, this thesis will focus on subjective resident wellbeing, as opposed to community wellbeing.

1.4 Research direction of the thesis

Australia – an adopter of LDC practices – is a geographically sparse country. On the one side there are pockets of heavily populated areas (centred around capital cities on the southeast and southwest coast), which generally act as the 'home region' for LDC workers. Then, on the other side, there are remote regions with small populations that generally serve as the 'host region' for LDC workers. To date, however, no LDC research has sought to understand how the scale of LDC practices (which influences the impacts of LDC on resident wellbeing) in a host region depends on characteristics in that region. Thus, research needs to explore what factors drive the scale of LDC practices at a macro-level, where the region is the unit of analysis.

Furthermore, communities in regions exposed to the aforementioned socio-economic and sociological impacts of LDC practices do not experience similar impacts. That is, researchers have found that host communities react differently, which makes extrapolation of LDC impacts on host communities difficult (Lawrie et al., 2011; McDonald et al., 2012; Tonts et al., 2012). Consequently, there is a need for a better understanding of how inbound LDC affects Australian communities, which—for reasons I will discuss in Chapter 2 – occurs at the micro-community level.

1.4.1 A spatial measure of LDC

Most of the hypothesised causes of the scale of LDC are without empirical testing, that is, determinants that gave rise to LDC have only been explored on a national scale, with little regard for regional differences. The issue with this approach – as illustrated above – is that the scale of LDC (and subsequent LDC impacts) is likely to differ according to the unique characteristics of a place. Tonts et al. (2012, p.291) suggest that

> *"in the present context of 'vague' and 'ambiguous' theoretical perspectives on the determinants of socio-economic performance in Australian mining towns, a purely 'theory driven' approach to model specification and testing is not feasible".*

It is my belief that greater understanding concerning all aspects of LDC practices (both scale and impacts) will reduce this vagueness and ambiguity. In particular, researchers

who have tried to understand what causes different LDC impacts on host communities may have overlooked (or failed to control for) spatial features of the host region, of which the host community is a part. This thesis explores two spatial dependent features of host regions; **(1)** the scale of LDC in a host region. This scale is a function of regional characteristics (i.e. local labour market conditions and regional residential attractiveness) (see Chapter 4). In addition, it may also be a function of regional characteristics in neighbouring regions. For example, favourable housing prices in a neighbouring region to the work site may persuade workers to relocate and undertake long distance commuting, rather than remaining in their hometown. The exodus of local workers from the host region, then to commute back into the region for work purposes, influences the scale of LDC. Therefore, extra-regional characteristics are also investigated as a determinant of the scale of LDC in a host region (Nicholas & Welters, 2016). **(2)** Social capital's ability to mediate LDC impacts (see Chapter 5 and 6). Increased exposure to LDC impacts can reduce resident wellbeing (Chapman, Plummer, & Tonts, 2015). As a result, psychological stress levels increase, quality of life reduces and mental health concerns may arise. Availability of social capital can, however, mediate the impacts of LDC on resident wellbeing (Walton, McCrea, & Leonard, 2014). Social capital is the benefits associated with the establishment of social networks between individuals. The density and composition of social capital can vary between communities within a region, and therefore, social capital's ability to mediate LDC impacts. Failure to measure social capital at the community level adequately, may obfuscate the relation between LDC impacts and resident wellbeing.

1.4.2 Research question and research aims

Overall, this thesis examines whether spatial dependence is a cause of the ambiguity in predicting LDC impacts on communities in Australia. Drawing on the need for a macro and micro level analysis, the overarching research question is:

What are the determinants and impacts on resident wellbeing of long distance commuting into Australian regions and social capital's capacity to mediate those impacts?

To answer the overarching research question, I investigate the following three research aims within the Australian context:

- *What circumstances in a region affect the scale of LDC into that region, and do circumstances in neighbouring regions matter as well?*
- *Does social capital mediate the impacts of inbound LDC on resident wellbeing in a host region?*
- *What – if any – dimensions of social capital are effective in mediating the impacts of LDC on resident wellbeing in a host region?*

1.5 Organisation of the Thesis

Following this introductory chapter, the next chapter (Chapter 2) discusses the concepts 'space' and 'spatial dependence' and why they are important considerations when discussing LDC impacts. Chapter 3 operationalises the concepts of 'space' and 'spatial dependence' from an Australian perspective. Chapters 4, 5 and 6 report the research findings. Chapter 4 investigates the regional and extra regional circumstances that drive LDC practices in a host region. Chapter 5 investigates a host community's ability to mediate losses in wellbeing caused by LDC impacts using social capital. Chapter 6 explores the dimensions of social capital that may help residents to mediate LDC impacts on wellbeing within a host community. Finally, Chapter 7 draws the thesis together by summarising the findings and drawing conclusions, considering the limitations, providing policy recommendations, and identifying future research opportunities. Figure 1-2 displays the chapter outline for the thesis.

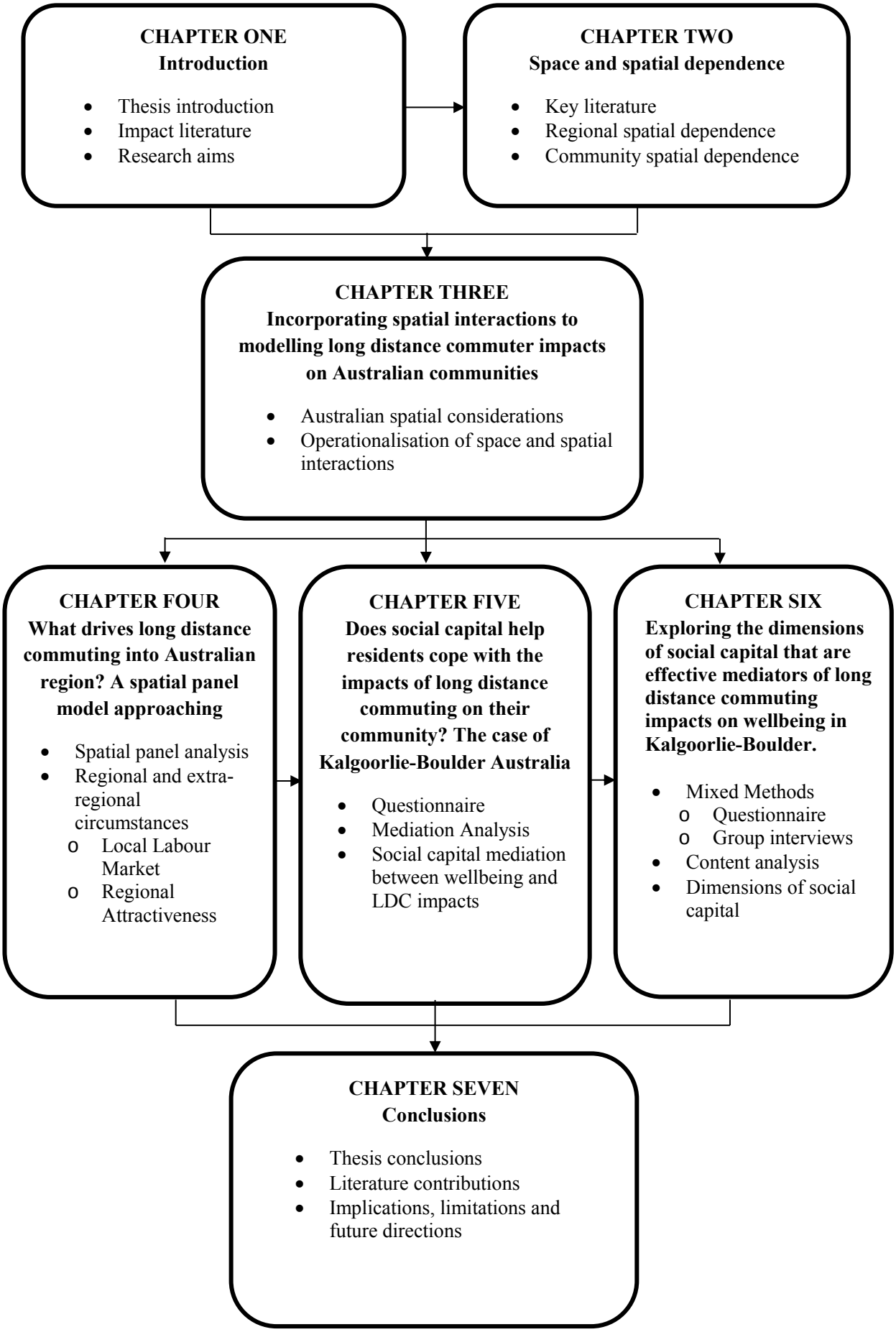

Figure 1-2: Chapter outline of the research thesis

Chapter 2 Space and spatial dependence

CHAPTER OUTLINE

2.1 Introduction

The rise of spatial analysis over the past decades has been attributed to a transition from looking at an individual in isolation to considering the interactions between individuals. All actions (and their causal effects) are a result of and influenced by their location in space and its surroundings (Logan, 2012). As Tobler (1970, p236) states "everything is related, but near things are more related than distant things". Spatial dependence is the relationship between the variations in a variable's value and the coinciding locations. In other words, similar things are clustered together. Spatial dependence can manifest from a variety of sources including; the interactions between individuals in a neighbourhood, then the interactions between neighbourhoods. These relate to the notion of 'embeddedness' of a given neighbourhood in the greater region (Logan, 2012). Spatial dependence could also arise through the mismatch between the artificial boundary of a neighbourhood (used for analysis) and the 'real' boundary of a neighbourhood. An example would be two (or more) administrative regions that are highly connected (i.e. cities), which would be better understood as a single region.

To consider 'space' and 'spatial dependence', there needs to be an understanding of the geographic unit of analysis – or scale. Discussions about LDC in this thesis are addressed from two different scale perspectives, both the region- and community – level. The definition of a region is dependent on its application. In general, however, researchers classify a region under one of three categories; formal, functional or vernacular. Formal regions (also known as uniform) are established by homogenous population characteristics (Brown & Holmes, 1971), for example, administrative and political boundaries. Functional (or nodal) regions focus on clustered economic activity. In this context, functional regions maximise within regional interactions and minimise between regional interactions (Klapka, Halas, Tonev, & Bednar, 2013). For example, cities are functional regions; this is due to the high connectedness within a city (via the transportation networks) and relatively low connectedness outside of the city limits. Vernacular (perceptual) regions represent the cultural identity of the population residing there. In contrast to the other regional demarcations, vernacular regions do not always have definitive boundaries, and may experience changes in the current population's attitudes and ideals (Zelinsky, 1980). One example is the difference in attitudes and behaviours between city and remote populations of the same country. Chapter 3 will

discuss how functional regions would be the ideal definition for this thesis; however, due to data limitations I used formal regions, specifically the administrative boundaries labelled local government areas (LGA).

Communities offer another geographical classification system, where units (communities) are commonly viewed as separate entities. More specifically, a community is generally seen as a small piece of a region (Bowes-Lyon et al., 2009). Similar to the concept of regions, the definition of a community changes depending on the context. Not all communities within a region are the same, communities with most of the regional activity are known as regional centres or service hubs (Misan & Rudnik, 2015). Traditionally a community consists of two components; geographically boundaries (Roseland, 2012) and a common identity (James, Nadarajah, Haive, & Stead, 2012). With the growing popularity of virtual platforms, the geographically bounded component expands to a broader sense of place to include virtual communities. MacQueen et al. (2012) listed four core elements of a community; (1) sense of place, (2) common attitudes and ideas, (3) social cohesion, and (4) social interactions.

Tonts et al. (2012) argued that the unique characteristics within each community prevent extrapolation of LDC impacts outside of the area of study. When explaining why LDC impacts differ between host communities (in one host region or across different host regions), this thesis theorises that the concepts of 'space' and 'spatial dependence' are important considerations. Chapter 1 summarised that the impacts of mining / long distance commuting (LDC) practices on host communities can be diverse and will depend on the community's socio-economic and sociological characteristics. This thesis suggests that the location of a community (i.e. place) is an integral part of that community's characteristics. I argue that the unobserved variance caused by 'place' in LDC impact models may contribute to the different results shown in the LDC impact literature (Chapter 1). I provide two arguments for the relevance of space. One argument operates at the level of the region (of which the community is a part); the second argument operates at the level of the community itself.

The first argument (Section 2.2) is that spatial dependence at the regional level influences the scale and hence impact of LDC practices in a region (and subsequently in the region's communities). This may explain the unobserved variance in the LDC impact literature,

which largely ignores spatial dependence. Spatial dependence at the regional level, I argue, predominantly depends on geographical distances. The second argument (Section 2.3) is that spatial dependence between communities within a region, which influences the socio-economic and sociological characteristics of a community, causes unobserved variance. Spatial dependence at the community level, I argue, depends predominantly on social distance. This thesis uses measurements of social capital as a proxy of social distance at the community level, where I hypothesise that social capital mediates the impacts of LDC on resident wellbeing.

2.2 Spatial Dependence at the regional level

Spatial dependence at a regional level is primarily a function of geographical distance. The geographical distance between regions will influence the scale of their interactions, and subsequently, the spatial spill overs (i.e. the LDC impacts) it produces (Niebuhr, Granato, Haas, & Hamann, 2012). Reductions in geographical distance will typically increase spatial interactions between two regions, as they decrease the cost of movement without necessarily affecting the benefit (Chakraborty et al., 2013), causing increased spatial dependence. To illustrate how spatial interactions lead to spatial dependence, I will use a hypothetical example of housing prices within three regions. Regions 1 and 2 are in close proximity whilst Region 3 is further away. Assume each region operates in autarky, i.e. no spatial interaction. Each region has different house prices dependent on their regional characteristics (visually represented in Figure 2-1).

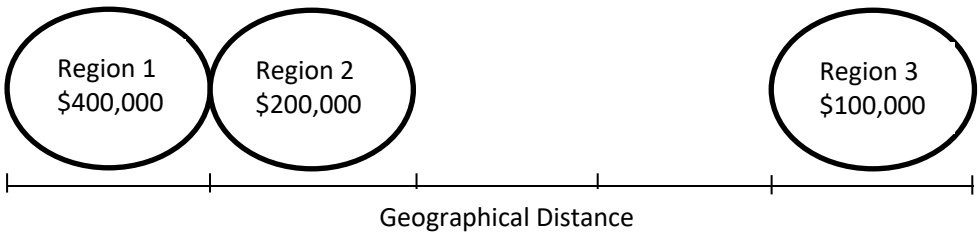

Figure 2-1: Location of regions and house prices at autarky

Post-autarky regions may spatially interact, resulting in house price equalisation in Regions 1 and 2 (Figure 2-2). That is, residents of Region 1 move to Region 2 taking advantage of the cheaper house prices. This places downward pressure on Region 1's house prices and upward pressure on Region 2's house prices until there is house price equalisation (or convergence if regional differences exist that matter to house prices).

Whilst house prices in regions 1 and 2 have converged as a result of spatial interaction, house prices in region 3 have not. Region 3 is geographically distant which, according to Tobler's (1970) Law, experiences less spatial interaction with Region 1 and 2, thus house prices in Region 3 will not change. That is, residents of Regions 1 or 2 will not move to Region 3 to exploit the lower house prices, because Region 3 is too far away from Region 1 or 2 where they perhaps work.

In the above example, spatial interaction between Region 1 and 2 has led to convergence/equalisation of house prices in the two neighbouring regions, which is an example of (house price) correlation across space. Spatial correlation therefore leads to spatial dependence, i.e. house prices are not randomly distributed across regions, but house prices in one region (spatially) depend on house prices in neighbouring regions.

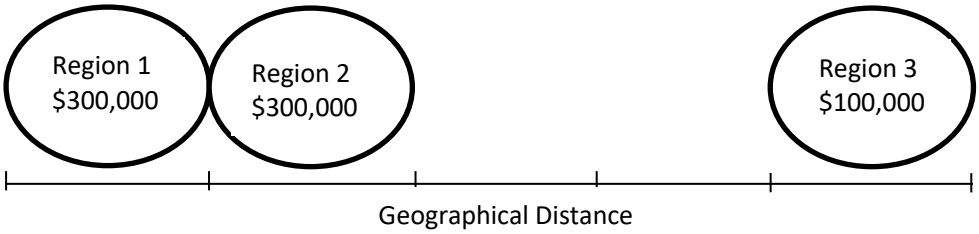

Figure 2-2: Location of regions and house prices post autarky

Researchers, who wish to investigate the determinants of house prices at the regional level need to take into account spatial dependence. For example, ordinary least square (OLS) regressions assume that the observations of the dependent variable (house prices in a region) are independent of each other, which is not the case if regional house prices are spatially dependent. Consequently, the research must apply spatial econometrics techniques to control for the spatial dependence (if present in their model). Glaeser, Liaibson, and Sacerdote (2002) demonstrate the concepts of spatial interaction and dependence using an individual's social network. Social networks within closer geographical proximity require less effort to maintain, thus individuals will favour close

networks over distant ones. Spatial dependence, if present and not addressed in statistical modelling, may lead to inaccurate conclusions (refer to Section 3.4 for more details).

The incorporation of LDC provides new challenges for spatial econometrics. Patterns are a common phenomenon caused by interactions over space between the destination and origin (Bhattacharjee & Holly, 2010), depending on locational characteristics (Allen and Arkolakis (2013). The reliance on LDC (a) amplifies spatial dependence (between host and home regions) and, because the home and host region are far apart, (b) potentially obscures the applicability of Tobler's law, that is, increases in geographic distance between two regions decrease spatial interaction and hence spatial dependence. This is a problem for spatial econometric modelling, which – more or less – assumes the applicability of Tobler's Law.

2.3 Spatial considerations at the community level

At the community level, social distance is the dominant source of spatial dependence. Hodgetts & Stolte (2014, p1776) define social distance as "*the extent to which people experience a sense of familiarity (nearness and intimacy) or unfamiliarity (farness and difference) between themselves and people belonging to different social, ethnic, occupational, and religious groups from their own.*" Consequently, social distance may hinder interaction between residents of a community and residents of other communities within the same region. As a result, social distance will reduce the scale of spatial dependence between communities (Mitchell & Flanagan, 2014); this results from peer effects, neighbourhood effects and network effects (Glaeser, Scheinkman, and Sacerdote (2003). Neighbourhoods at the community level need not be socially uniform, even though geographic distances are small (Hellerstein, Kutzbach, & Neumark, 2014). An example used by Topa (2001) describes how spatial patterns in unemployment (i.e. spatial dependence) can be influenced by the spatial distribution of an individual's social network. There is a positive feedback loop where employed members of a social network are likely to pass information about available jobs to unemployed members. Depending on the industry, individuals' social networks create 25 percent to 85 percent of employment opportunities (Ioannides & Loury, 2004). If the job was within this individual's social network, it reduces social distance.

Spatial dependence caused by low social distance indicates that residents have broader social networks spanning outside their community to other communities within the region. Access to this extensive social network may help residents cope with the impacts of LDC on their wellbeing. Not including social distance (or failure to control for the spatial dependence it may cause) in an analysis that attempts to explain LDC impacts on resident wellbeing in host communities may bias the findings.

2.3.1 Social capital

Similar to the idea that physical attributes can make a location unique, the same thing can be said for social networks (Logan 2012). "Place makes a difference to the outcome of social processes" (Mohan & Mohan 2002, p196). Social distance closely relates to 'social capital'. Social capital is the relationship between an individual's or community's (depending on the scale) social networks and the associated benefits. Fractionalised communities have high social distance, which results in a lack of information and skill sharing that would otherwise benefit the community. Glaeser et al. (2002) explain that reductions in social distance build trust, loyalty, altruism and cooperation between individuals. These characteristics are concepts in social capital, which researchers generally define as levels of trust, reciprocity and civic participation (Petrova & Marinova, 2013; Poortinga, 2012; Ryser & Halseth, 2010; Smith et al., 2012). Mohan and Mohan's (2002) seminal work discussed the intersection between social capital and place. Of relevance here were the connections with geographical based theories such as the 'localities debates in the 1980's, structuration theory and actor-network theory. In summary, networks between actors can alter a location's social capital stock (for better or for worse). More importantly, this is a fluid process dependent on the outcome of interactions between actors. Therefore, reductions in social distance will improve an individual's/ community's social capital through the improved flow of information and skills.

The modern concept of social capital can be traced back to Jane Jacobs, Pierre Bourdieu and Jean-Claude Passeron (Woolcock, 1998). Pierre Bourdieu provided the first analytical definition of social capital;

> "*the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition*" (Portes 1998, p3).

He argued that social and cultural capital needs consideration alongside economic capital within the economic discipline (d'Hombres, Rocco, Suhrcke, & McKee, 2010). Coleman (1990), building off Pierre Bourdieu's work, was credited for being the first to empirically test the purely theoretical concept using educational attainment (d'Hombres et al., 2010). Interestingly, he considered the creation of social capital to be a by-product of the development of a society that had positive spill overs to other members of that society (Tacon, 2013).

However, there are criticisms within the literature that the concept of social capital is not original, rather redressing of other fields in the social sciences. Portes (1998) elaborates stating that involvement in groups resulting in positive outcomes is an established idea in social science. Community development has always been focused on improving social connections and improving social capacity (Sharp, Agnitsch, Ryan, & Flora, 2002). Existing research areas such as networks and trust overlap considerably with social capital, thus drawing criticism for its existence (Tittenbrun, 2013).

Another issue involves the implementation of social capital research. There is a lack of understanding and clarity in current research about the government's role in facilitating the growth of social capital (Kawachi, Subramanian, & Kim, 2008). This has caused many to blame the community for all its problems. Kawachi et al. (2008) have suggested that external forces at the regional level shape social capital. They highlight a positive correlation between income equality and social cohesion. High inequality may erode social cohesion (thus social capital) by creating a divide between the 'haves' and 'have nots' (Ryser & Halseth, 2010). Unfortunately, there is no master plan for facilitating the growth of social capital. In fact, Kawachi et al. (2008) go further in describing that social capital also differs depending on the scale of the unit of analysis. Social capital at the individual level is reflective of someone's personality, whilst at the community level it represents informal social controls (e.g. social norms and expected behaviour).

To improve the applicability of social capital for empirical analysis, Poortinga (2012) distinguishes three types of social capital; bonding, bridging and linking. Bonding refers to strong close networks such as family and close friends whilst bridging refers to networks that are weaker but provide connections outside an individual's social group. Linking capital, on the other hand, refers to vertical networks between people with different levels of power. There is consensus amongst social capital researchers about the importance in using this distinction to operationalise social capital (Besser, 2013; Kawachi et al., 2008; Poortinga, 2012).

Within the context of this thesis, I will not utilise social capital in isolation but within a broader framework of LDC impacts. Specifically, I will use social capital as an explanatory tool for discerning why residents in regions react differently when exposed to similar stimuli (i.e. the extent of LDC practices). Therefore, I need to develop a set of criteria within the three levels of social capital (bonding capital between friends and family, bridging capital between groups with different ideologies and linking capital between individuals of differing authority) to provide testable hypotheses (Chapter 5). Bonding social capital provides residents impacted by LDC an outlet to express their dissatisfaction. Bridging social capital can provide a united voice that can influence LDC decisions. Due to the nature of LDC, linking social capital provides access to the ultimate decision-makers in regards to the scale of LDC. Company headquarters located elsewhere (either overseas or in capital cities) make LDC decisions; therefore, a host community needs substantial linking social capital to influence LDC decisions.

2.4 Spatial level of analysis

Inclusion of only 'place' variables such as remoteness in an analysis that explores the impacts of LDC on host regions may be insufficient. Instead, spatial analysis that incorporates relationships between spatial variables (spatial dependence) may provide a more detailed understanding. Not all circumstances, however, require the analysis of a spatial component (Nicholas & Welters, 2016). I categorise the literature studying mining/LDC impacts on resource regions into four groups (see Table 2-1). Identifying the mining/LDC impacts on a region over time or differences between regions at a single point in time (Categories 1 and 2) does not require spatial assumptions; however, if researchers want to identify and explain why differences across time and/or space exist

(Categories 3 and 4), some methodological problems arise if the researcher neglects space.

Table 2-1: Articles exploring the impact of mining/LDC on resource communities

Time/ space / **Research question**	Across time	Across space
Identify only	**Category 1** (KPMG, 2013a, 2013b; Lawrie et al., 2011); (Measham & Fleming, 2014)	**Category 2** (United Research Services, 2012); (Storey, 2010); (Carrington et al., 2012); (McDonald et al., 2012); (Cheshire, 2010); (Kilpatrick, Johns, Vitartas, & Homisan, 2011)
Identify and explain	**Category 3** (Smith, Krannich, & Hunter, 2001); (Perdue & Pavela, 2012)	**Category 4** (Randall & Ironside, 1996); (Hajkowicz, Heyenga, & Moffat, 2011); (Tonts et al., 2012)

In Category 3, researchers examine LDC / mining impacts on a region over time and provide explanations for the impacts identified. These investigations assume that influences external to the region remain consistent through the length of the study. This assumption seems tentative considering the premise of studies in this category – investigating differences within the region of study over time. For example, Smith et al. (2001) conducted community surveys over 13 years and used a one-way analysis of variance to explain what happened to resource towns in western states in America after their booms. They concluded that the mechanisms behind the recovery of these towns post-boom were inconsistent. I argue that assumptions made by Smith et al. (2001) may have contributed to their inconclusive result. That is, over the 13-year period of the study, they assumed all the neighbouring regions (and interactions between these regions) remained the same.

A study by Perdue and Pavela (2012) employed a similar design to explain whether certain socio-economic impacts depended on methods of mining extraction in West

Virginia, United States. Similar to Smith et al. (2001), they investigated a number of communities over the same length of time. Perdue and Pavela (2012), however, did not assume constant neighbouring region effects, and therefore, tested for spatial effects (which they confirmed). As a result, they amended their methods by using a fixed effects regression with robust estimates, which allowed them to conclude that there was no difference in impacts associated with different methods of extraction.

Category 4 as shown in Table 2-1 entails studies that investigated different regions at a single moment in time. Whilst similar to Category 2, this category further attempted to explain why LDC / mining impacts differ between regions. By not testing for spatial effects, researchers assume that the distributions of variable unit counts are spread evenly across the research area. Hajkowicz et al. (2011) explored the correlation between the share of mining GDP in total regional GDP and indicators of quality of life for 76 Australian regions. They assumed, for example, that regional GDP and mining GDP do not spatially cluster. If the assumption is untrue, then one expects their results are biased. Tonts et al. (2012) attempted to account for spatial effects by using geographic independent variables when investigating resource dependence and socio-economic wellbeing in 33 mining towns in Australia. They confirmed that locational factors and unique regional characteristics associated with confounding influences altered the performance of mining towns.

Mining/LDC literature in category 3 of Table 2-1 assumed that spatial influences distribute evenly across time, whilst category 4 assumed an even distribution across space. However, Nicholas and Welters (2016) demonstrated that spatial influence of LDC is not evenly distributed across space. This implies that LDC research could have a positive bias due to clustering of spatial influences or a negative bias due to dispersion. Studies in category 4 either have under- or overestimated the explanatory power of their independent variables. Without testing for the existence of spatial dependence, this potential bias remains undetected and could result in incorrect policy recommendations.

An important consideration when incorporating space and spatial dependence within economic modelling is the scale of the unit of analysis. Spatial regressions only permit the use of one scale, although as discussed earlier, I will be investigating spatial dependence at both the regional and community level. The use of smaller units of analysis

(i.e. community level) will reduce the unobserved spatial dependence. There are, however, two issues that prevent a spatial regression of the scale of LDC and a spatial regression of the impacts of LDC on resident wellbeing at the community level; inability to measure LDC and more general data unavailability at the community level, respectively.

The operationalisation of LDC in a spatial regression prevents the use of a community level unit of analysis. Derived in Chapter 3, I distinguish LDC from daily commuting by calculating the number of regions between a person's place of work and place of residence, whilst accounting for remoteness. Use of demarcations at the community level blurs this distinction, because both long distance and daily commuters travel between and across many communities. One approach to overcome this problem is to increase the geographic size of the unit of analysis (i.e. from a community to a region). The drawback of this approach is that it will not directly capture the unobserved variance that may arise at the community level because of social distance. I argue that social distance is of limited relevance in explaining the scale of LDC in a region. In Chapter 4, I run a spatial autocorrelation panel model with fixed effects. This model controls for spatial dependence within the error term (where spatial dependence caused by social distance would be located).

Social distance is relevant, however, in explaining the impacts of LDC on resident wellbeing in the host community, which would justify an Australia wide spatial regression analysis at the community level. Unfortunately, collection of data at this scale and of the necessary scope to encompass all possible spatial dependence as a result of social distance is unfeasible for the scope of this thesis. Instead, I decided to focus on one host community, for which I collected all relevant data to explore the mediation role of social capital between LDC impacts and resident wellbeing.

Chapter 3 Incorporating spatial dependence to model long distance commuter impacts on Australian communities

CHAPTER OUTLINE

This chapter outlines the operationalisation procedure for incorporating spatial dependence at the regional level (Chapter 4) and the community level (Chapter 5). Section 3.1 outlines spatial considerations associated with Australian LDC modelling. Taking these spatial considerations into account, the concept of 'region' is defined in Section 3.2, followed by an LDC worker in Section 3.3. Section 3.4 describes the modelling procedure undertaken (spatial panel modelling) in Chapter 4. Section 3.5 utilizing the same definitions incorporates social capital as a proxy of social distance. Section 3.6 describes the operationalization of social capital as a proxy of community level spatial dependence used in Chapter 5 (mediation analysis) and Chapter 6 (content analysis).

3.1 Australian spatial considerations

Australia's spatial characteristics might constitute one reason for the adoption of long distance commuting. The country's population clusters along three coastal areas; East, South East and South West (refer to Figure 3-1). Outside these populated areas, according to ABS 2015 data, 6.37million km^2 or 83 percent of the remaining land area has a population density of less than 0.5 people per km^2. Thus, there are large geographical distances between populated coastal regions and rural regions. For Australia's mining companies operating within these sparsely populated rural regions where mineral deposits are located (refer to Figure 3-2), recruitment of workers can be challenging. Whilst there has always been a relative abundance of qualified labour within coastal regions, large geographical distances in the past required labour migration to purpose-built mining towns. Improved technologies, particularly in the fields of communication and transport, have now made LDC cost effective (Storey, 2001). Whilst mining is the dominant adopter of LDC, subsequent cost reductions in transportation have contributed to the uptake of LDC by other industries within regional communities especially health where Fly-in Fly-out health professionals provide relief to overwhelmed rural healthcare workers (Onnis, 2016) and construction.

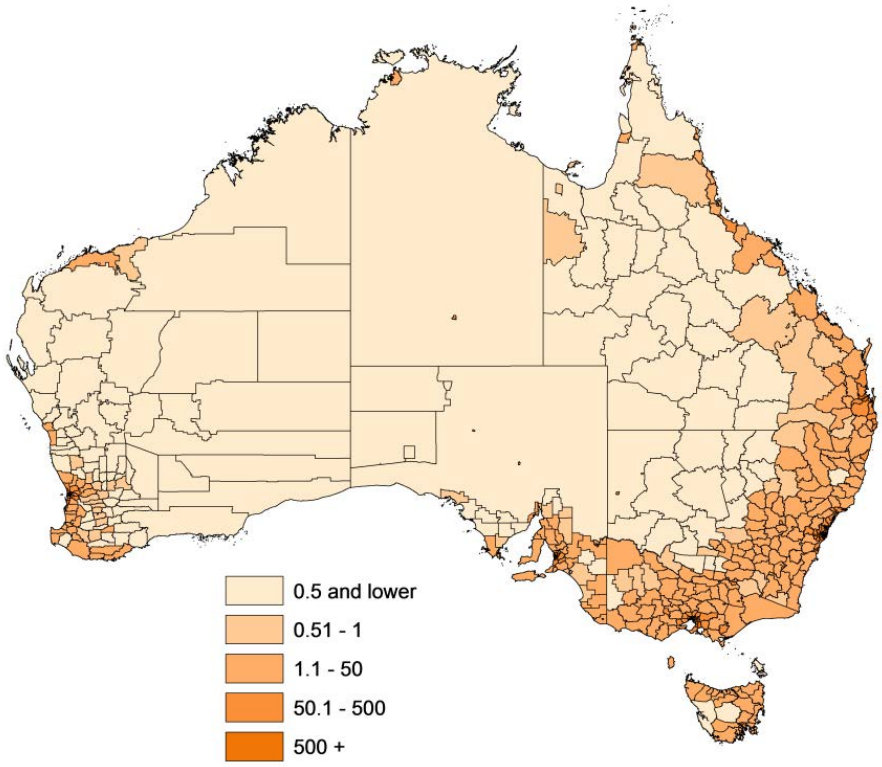

Figure 3-1: Population density (persons per square kilometre) 2015 ABS data.

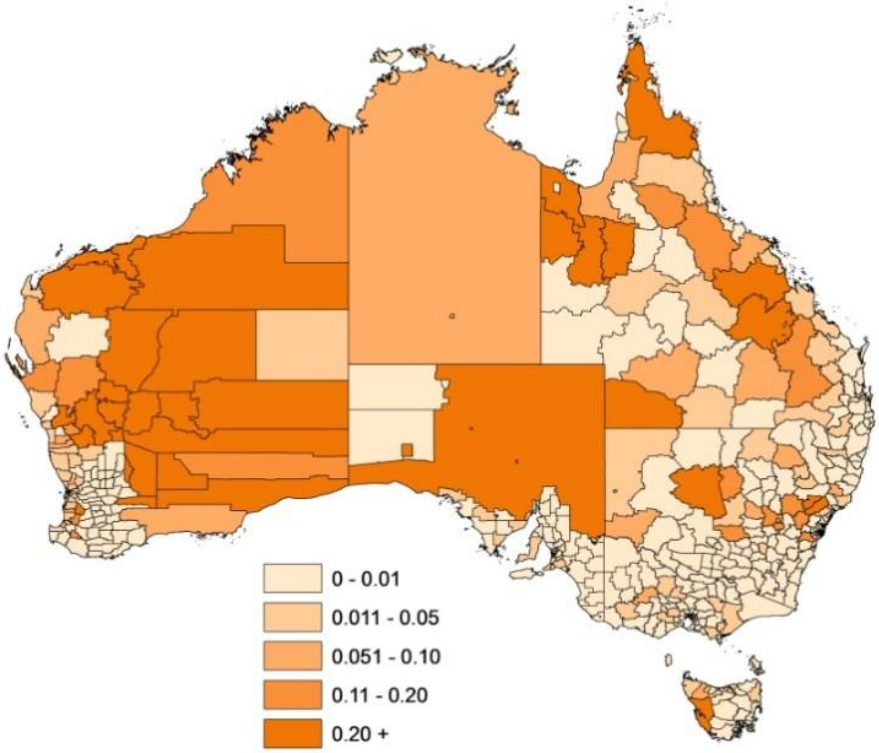

Figure 3-2: Mining workforce distribution (proportion of regional workforce) 2011 ABS census data.

Researchers argue that thin and tight labour markets are an important consideration for industries, such as mining, that require large workforces in the decision to adopt LDC practices (Measham & Fleming, 2014; Morris, 2012; Tonts & Plummer, 2012). However, McIntosh (2012) and Perkins (2012) found that local labour market conditions had no relationship with the size of the regional LDC workforce for the Australian mining and health care industries respectably, suggesting the adoption of LDC practices is not influenced by host community labour conditions. Nicholas and Welters' (2016) investigation of the entire labour market of Australia supported this conclusion, with their findings indicating that local labour market characteristics had no relationship with the size of the local LDC workforce. SCRA & Windsor (2013) has suggested that the scale differences between available local labour and necessary labour, effectively render local labour considerations mute (although locals are recruited). The use of LDC practices, however, is not the only solution for a thin labour market; employees could also migrate to the regional area. The decision of an LDC worker to migrate may depend on the attractiveness of that region relative to the attractiveness to live in metropolitan areas (Nicholas & Welters, 2016), which is partially determined by the opportunities available (i.e. spouse employment and available services) (SCRA & Windsor, 2013). Regardless, any analysis into the drivers of LDC requires an appropriate definition of a region, which is the topic of the following section.

3.2 Defining a region

'Regions' are aggregated areas of land which are grouped based on similar economic, social and geographic characteristics (Garnett & Lewis, 2007). Within the context of this thesis, I used a combination of characteristics to define the regions. To address the first thesis aim, the definition of regions had to consider: (1) total coverage of Australia, (2) ability to distinguish remoteness and (3) data availability at the regional level. Subsequently, population-based and place-based demarcations (both commonly employed in the literature) represented two potential methodological options.

Organisations interested in mapping population distributions (e.g. government) have developed population-based demarcations. Within the Australian context, Statistical Local Area(s) (SLA) and Local Government Area(s) (LGA) divide the landscape. In 2011, however, land demarcations changed away from LGA and SLA, in favour of

Statistical Area(s) (SA) (Pink, 2011): SA1 (600 – 800 people), SA2 (3,000 – 25,000), SA3 (30,000 - 130,000), SA4 (100,000 – 500,000). Government data collections – such as the Census (collected every 5 years) – use population-based demarcations extensively. The benefit of such demarcations is the coverage, encompassing Australia in its entirety with no regional overlap. Several researchers have merged both LGA and SLA demarcations to form different ways of grouping regions for analytical purposes. For example, Carrington et al. (2012), KPMG (2013a) and United Research Services (2012) clustered neighbouring SLAs that had mining activity, to construct mining regions. This allowed comparisons between different mining regions. Whereas, Measham and Fleming (2014) and Hajkowicz et al. (2011) primarily used LGAs to achieve a similar clustering method. Mitchell, Bill, and Watts (2007) created their own population-based demarcation called Functional Economic Regions (FERs), which used economic behaviour as a criterion to define regions, in an attempt to minimise intra-regional dispersion of economic activities that are present in LGA and SLA demarcations.

Place-based demarcations, on the other hand, are boundaries around places of interest such as a city, town or mining site. This type of demarcation is useful for investigating specific sites whilst removing potential spatial influences surrounding the site (which would otherwise affect population-based demarcations). Storey (2010) and Tonts et al. (2012) used the location of mining sites scattered across their study area. In doing so, the authors achieved a direct comparison between these mining sites. In addition, KPMG (2013b) was able to categorise (and subsequently compare) selected areas of Australia such as capital cities, regional cities and provincial cities.

To perform similar studies with similar scopes, using place-based demarcations would require individual sampling of each geographical location. For larger sized studies – necessary to answer the first research question – this task would not be feasible. Furthermore, place-based demarcations are not continuous across a geographical area, rather they are discrete places. Any analysis to explore spatial dependence would be impossible due to the inability to generate a weight matrix.

Consequently, I used a population-based demarcation to gain an understanding of Australian LDC, which encompasses the entirety of the country, which is important for estimating nationwide LDC counts. Of the population-based demarcations, I selected

LGAs as opposed to FERs and SAs. I did not select FERs due to the following reasons; FERs based on 2011 Census data were not available during data collection (the latest FERs available are based on 2006 census data) and LGA demarcations produce more regions within remotes areas. With the focus on LDC practices – which occur primarily in remote areas – it is appropriate to use the demarcation with the highest remote sensitivity. I did not select SAs, because SA demarcations did not exist in 2006 and one cannot create them retrospectively. Consequently, LGAs were the only demarcation allowing causality testing due to their availability in both 2006 and 2011. Figure 3.3 displays the LGA demarcation employed in this research.

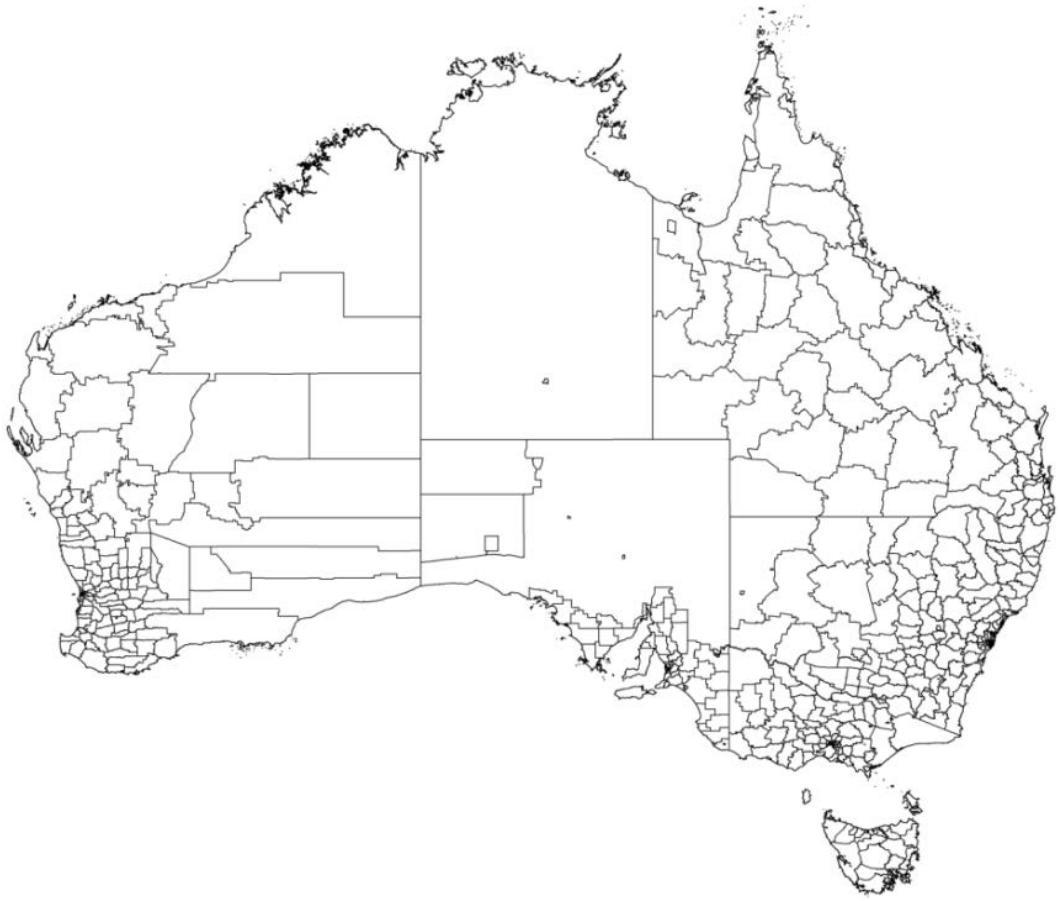

Figure 3-3: Australia's 2011 local government area (LGA) demarcations.

Note: Some regions were modified (see Chapter 4 for further explanation).

3.3 Calculating the scale of LDC

Currently, there is no 'best practice' for estimating the proportion of LDC in Australia's (and subsequently in a region's) workforce. Prior research has attempted to understand

LDC practices by surveying LDC workers directly or through applying sample restrictions to ABS data. For example, Blackman, Welters, Murphy, Eagle, Pearce, Pryce, Lynch & Low (2014) administered a survey method for which they interviewed FIFO workers (major component of LDC) in their place of residence. Similarly, United Research Services (2012) conducted survey work with FIFO workers but from within their place of work. Whilst these methods performed well when applied to place-based regions, such an approach would be financially constricting for a national study. KPMG (2013b) employed a slightly different approach, which utilised population-based regions with ABS data. In their work, the definition of a LDC worker was a person whose usual place of residence is different from their place of work. ABS Census data contain information on both place of residence and place of work for every individual; thus, an appropriate option for a study of national scale. One issue, however, is that because no questions in the Census could identify LDC workers directly this data set requires sampling restrictions (Nicholas & Welters, 2016). KPMG (2013b) addressed this issue by enforcing a 100km minimum distance cut off between home and work regions. Skilton (2015) questioned this parameter by arguing that long distance daily commuters would still be included; instead, he proposed a – still arbitrary – 400km cut off.

Using similar methods to KPMG (2013b), I measured the scale of LDC in Australia (defined as the proportion of LDC workers in the total regional workforce) using population-based demarcations. In addition, to address the concern of Skilton (2015), I used the Accessibility/ Remoteness Index of Australia (ARIA+), which among others uses road distances between towns, to gauge a region's level of remoteness[1], to remove daily commuters. This method is superior to distance only measures, because it uses road distance rather than fly over distance (refer to Figure 3-4).

[1] The Australian Department of Health provided it free online at: https://www.adelaide.edu.au/apmrc/research/projects/category/aria.html).

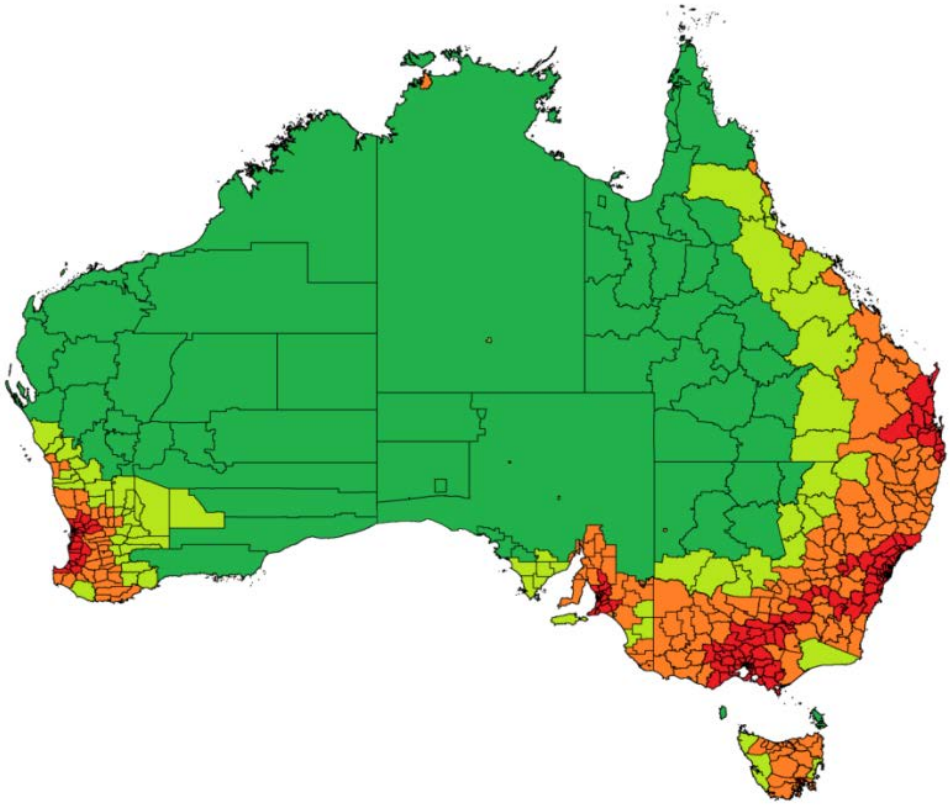

Figure 3-4: Remoteness index 2011 LGA; cities: red, regional centres: orange, rural areas: light green, remote areas: green.

Regional remoteness dictated by the ARIA+ Index informed data sampling rules that were intended to remove daily commuters from the LDC estimate. Firstly, city regions cluster into seven areas across Australia. These areas are (distinguished by darker shades): Darwin (grey), Perth (pink), Adelaide (aqua), Hobart (brown), Melbourne (yellow), Sydney (purple) and Brisbane (blue) (see Figure 3-5). Travel movement within any of these clusters is likely to represent a daily commute, and therefore, is not included in the LDC count. Travel between the seven clusters (e.g. living in Perth and working in Adelaide) is, however, included. Further, I consider workers who travel one or two regions adjacent to/from these seven clusters (displayed as lighter shades around city regions) daily commuters. One exception to this rule is if the adjacent region(s) is a remote area (only relevant for Darwin). Finally, I applied an artificial boundary along the state border to separate the Melbourne cluster in Victoria and the Sydney/Canberra cluster in New South Wales.

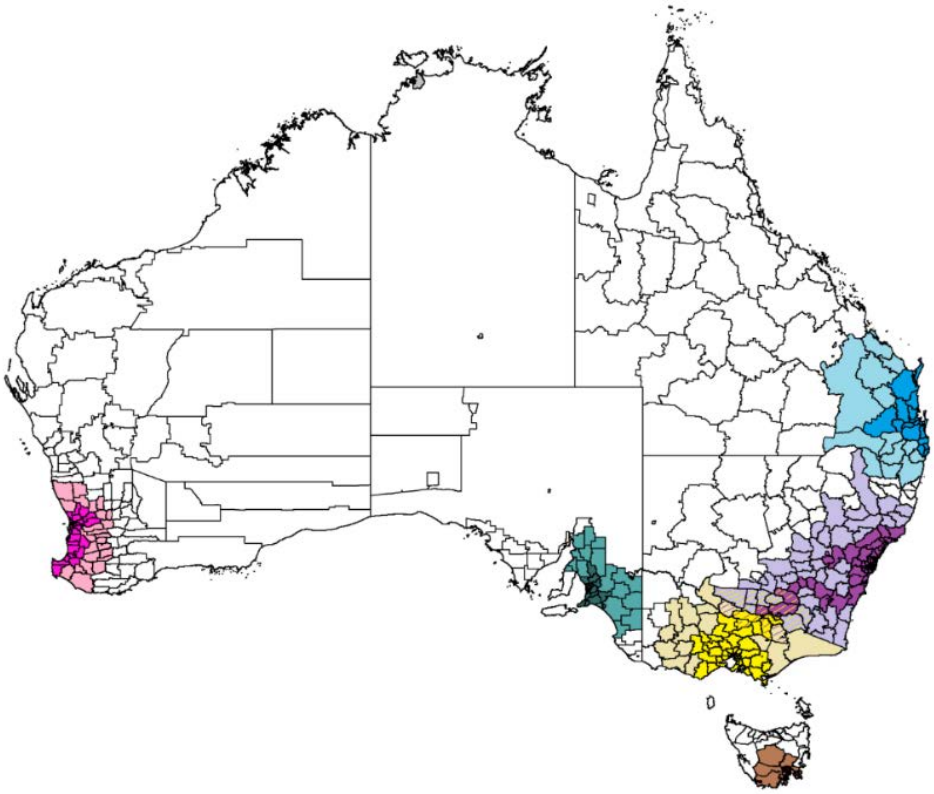

Figure 3-5: Identification of city clusters based on ARIA+ rules and LGA demarcations.

Note. Coloured areas represent different city clusters; LDC count does not include anyone who lives and works within the same colour-shaded cluster. The diagonal stripes within the city clusters indicate the overlap.

Secondly, regions, which are located further away from a city cluster, are more remote and have larger area sizes. Due to the longer travel distances, daily commuters from these larger regions will typically travel only within that same region. Thus, I relaxed data sampling restrictions based on regional remoteness. In this study, people who work in a Regional Centre (orange in Figure 3-4) and live within two adjacent regions – or vice versa – are classified as daily commuters. Furthermore, for Rural Areas (light green in Figure 3-4), I consider workers daily commuters if they live and work in adjacent regions, whereas I consider any commuting done by workers to or from Remote Areas (dark green in Figure 3-4) LDC (i.e. no sampling restrictions).

Finally, spatial matrices do not take into account water. That is, regions appear as adjacent on a spatial matrix albeit physically separated by a body of water. To clarify, commuting

across large bodies of water (i.e. the Bass Strait and Torres Strait) counts as LDC, whilst small bodies (i.e. rivers) do not count as LDC.

3.4 Incorporating spatial dependence in economic modelling

If a covariance matrix has pairs with non-zero covariances this could indicate the presence of a spatial pattern. This pattern, however, needs interpretation which is done by embedding a spatial structure. When embedding a spatial structure there are two considerations that are unique to spatial variance-covariance matrices; (1) the positional relationships between the observations and (2) representation of distance decay (the relevance of this consideration is discussed later in the chapter). The dominant approach for embedding spatial structure in covariance matrices are 'spatial process models (spatial stochastic models) (Anselin 2001). The two main types are the; spatial autoregressive process and the spatial moving average process. The spatial autoregressive process considers a variable at location i to depend on variable(s) at neighbouring i's. The spatial moving average process considers the weighted average of a variable at location i to depend on the weighted average of neighbouring i's (Anselin 2001). This thesis used the spatial autoregressive process because the likely spatial interactions will extend beyond i's neighbours. As opposed to the spatial moving average process that is designed for local spatial interactions.

The development of spatial econometrics enables the investigation of variables across space (Nicholas & Welters, 2016). Known generally as cross-product statistics, there are two types of spatial econometric models; spatial interaction models (e.g. gravity models) and spatial autocorrelation models (Getis, 1990). Spatial interaction models link interactions between regions (e.g. the volume of long distance commuters) to the importance of the regions (e.g. population size or GDP) and the distance between the regions. Spatial autocorrelation models link a dependent variable (e.g. the scale of LDC in a region) to a set of independent variables (e.g. regional determinants of the scale of LDC in a region) controlling for spatial autocorrelation.

The most appropriate modelling technique depends on the research question. Chapter 4 investigates the regional and extra-regional circumstances that give rise to LDC. The focus is on finding correlations between regional characteristics and the scale of the LDC

workforce, controlling for potential spatial autocorrelation (which arises if spatial dependence is present). Therefore, I chose spatial autocorrelation modelling as the preferred technique.

Spatial panel models – a variant of spatial autocorrelation modelling, which use panel data – provide the ability to investigate causality by incorporating both temporal and spatial dependence (Elhorst, 2010). Panel data has the advantage of increasing the possibility of uncovering relationships that would have been lost if the data had been aggregated (Nerlove, Sevestre, & Balestra, 2008). Equation (1) shows the basic pooled linear regression with space specific effects but without spatial dependence:

$$y_{it} = \chi_{it}\beta + \mu_i + \varepsilon_{it} \quad (1)$$

where i is an index for spatial units, t is an index for time, μ represents the fixed or random effect, χ are the independent variables, β is a vector of fixed but unknown parameters and ε is the error term.

If the spatial effects are treated as fixed effects, the researcher introduces dummy variables for each spatial unit and time period (with one left out to avoid perfect multicollinearity). Random effects however, where ε and μ are treated as random variables that are independent of each other, have a zero mean and variances of σ^2_μ and σ^2_ε (Elhorst, 2014).

3.4.1 Random or fixed effects

Appropriate use of random effects as opposed to fixed effects is, however, still unanswered. Literature using panel modelling appears to favour random effects. According to Elhorst (2014), random effects:

- offer a compromise for the all or nothing approach that fixed effects offer. With fixed effects, the spatial effects can only be present or not present regardless of its strength. With random effects, spatial effects are a gradient, which allows differentiation between weak and strong spatial effects;
- allow the avoidance of the loss of degrees of freedom in presence of a large number of spatial units. Random effects lose an additional 2 degrees of freedom

because of the addition of ε and μ as independent variables as compared to fixed effects which adds an additional independent variable and thereby loses a degree of freedom, for each spatial unit added; and

- produce variable coefficients that do not change or change only marginally over time, which the researcher therefore can estimate (as opposed to fixed effects).

Subsequently, the advantages of random effects lead to the conclusion that random effects should be the default option, because the most common use of panel models is to make unconditional inferences about a population. Thus, the use of fixed effects would lead to a large reduction in degrees of freedom especially for large numbers of units (Beenstock & Felsenstein, 2007). Elhorst (2014), however, cautions the default use of random effects by describing three conditions that need to be satisfied before their implementation; **(1)** i (the number of spatial units) should be able to approach infinity, **(2)** observations should represent the population, and **(3)** zero correlation between the random effects.

3.4.2 Spatial panel modelling

The second condition is of particular interest for spatial research because the observations tend to be population based. The majority of spatial research using panel modelling makes use of cross-sectional or space-time data of spatial units. These units are connected throughout the field of study as opposed to random sampling within the study area (Elhorst, 2014). This is due to the use of spatial weight matrices that need to be consistent over space, i.e. have no gaps. Allowing gaps would make the weight matrix impossible to define and the spatial dependence would not be consistent over time periods. This form of research methodology requires sampling the entire population to avoid inconsistencies. If the data are a random sample of the population, then the researcher can specify random effects. However if the sample is the population, then the researcher should use fixed effects (Nerlove et al., 2008). Beenstock and Felsenstein (2007) explained that spatial units represent themselves and are not sampled randomly. The whole point according to Elhorst (2014) is that the spatial units are fixed, not sampled and therefore a conditional inference would be made. Therefore, because I sampled the entire population of Australia in Chapter 4, I chose fixed effects.

3.4.2.1 Spatial dependence

With the inclusion of space-specific effects within the model, the next step was to specify the dependence between these spatial effects. Spatial dependence is present whenever there is a spatial ordering to the correlations observed between spatial units (Anselin, Le Gallo, & Jayet, 2008). By specifying spatial dependence, it is implied that both location and distance, in terms of geography and time, influence the relationship between the dependent and explanatory variables.

To test for the presence of spatial dependence, I used the program ArcMap to run Global Moran I and Local Moran I tests (Chapter 4). The Moran I tests assess whether a variable is correlated across space, taking into account the location of the spatial units that are correlated. The Global Moran I and Local Moran I tests are two-tailed tests which can distinguish between spatial clustering and dispersion in a variable. The Local Moran I test has the additional benefit of being able to produce Moran I results specific to individual spatial units.

The dependent variable (y_{it}) is the scale of LDC in region i – see equation (2a). The inclusion of a spatially lagged dependent variable (y_{jt}) allows for the possibility that the scale of LDC is correlated across space. Further, spatial dependence can take the form of a spatially lagged independent variable (χ_{jt}) or as a spatial autoregressive process in the error term (ϕ_{it}) (Elhorst, 2010). An example of an independent variable is the region's unemployment rate. If the researcher suspects that the unemployment rate is correlated across space, the researcher should include a spatially lagged independent variable. A spatially correlated error term implies that unobserved (spatially correlated) variables influence the dependent variable. The general nesting spatial panel model (GSPM) includes all types of potential spatial dependence:

$$y_{it} = \delta \sum_{j-1}^{N} W_{ij} y_{jt} + \chi_{it}\beta + \sum_{j-1}^{N} W_{ij}\chi_{jt}\,\sigma + \mu_i + \phi_{it} \qquad (2a)$$

$$\phi_{it} = \rho \sum_{j-1}^{N} E_{ij}\phi_{it} + \varepsilon_{it} \qquad (2b)$$

where δ is the spatial autoregressive coefficient and $W_{ij}$is an element of a spatial weight matrix W, σ and β are vectors of unknown parameters, ϕ_{it} represents the spatially autocorrelated error term, *E* reflects the spatial weight matrix for the idiosyncratic error component and ρ is the spatial autocorrelation coefficient. W_{ij}represents the strength of a relationship between two spatial units, where i is the row spatial unit and j is the column spatial unit (Elhorst, 2010).

The spatial weight matrix (W) expresses the spatial dependence amongst spatial units. This matrix is a nonnegative N*N matrix with rows and columns consisting of spatial units used within a study. Typically the weight matrices only consist of 1s and 0s, with W_{ij} = 1 when i and j are neighbours and W_{ij} = 0 when they are not (Anselin et al., 2008). All diagonal elements are set W_{ij} = 0 to prevent a spatial unit being its own neighbour and typically the rows are normalised so each row = 1. According to Elhorst (2014), the four most common types of weight matrices are

- p-order contiguity matrices. First order (p = 1) contiguity matrices treat all regions that share a common border with region *i* as a neighbour of region *i*. Second order (p = 2) contiguity matrices expand the set of first order contiguity neighbours with all regions that share borders with first order neighbours of region *i*;[2]
- inverse distance matrices, which define neighbours based off distance measurements from region *i*, with the optional inclusion of cut-off points;
- n-nearest neighbour matrices, which impose a pre-set number of spatial units that are classified as neighbours (e.g. if n = 3 then the three closest regions to region *i* are classed as neighbours); and
- block weight matrices, which consider all spatial units within a block neighbours to region *i*.

There is, however, uncertainty when assigning the correct weight matrix. Bhattacharjee and Holly (2010) describe the tendency of the literature to view spatial dependence as fixed by arbitrarily assigning a weight matrix. I chose a second-order queen contiguity weight matrix for my analysis in Chapter 4. The decision to use a queen contiguity matrix

[2] A further distinction exists between queen and rook contiguity matrices. Queen contiguity matrices include all neighbouring regions; rook contiguity matrices exclude diagonally neighbouring regions to region *i*.

was based on the unit of analysis used in the model; local government areas (LGAs). These population-based demarcations cluster and follow supply lines, which form asymmetrical regions of various sizes. I specified Queen, because it provided the advantage of accounting for all adjoining neighbours regardless of their boundary shape or size. I selected the second-order (as opposed to a first order) contiguity matrix to accommodate for the fact that a substantial share of the interactions between regions as a result of LDC is interaction between non-contiguous regions (i.e. higher order contiguity). That is, LDC interactions may occur between remote regions on one side of the country and city regions (where LDC workers reside) on the other side of the country. That would even suggest the use of a higher (than two) order contiguity weight matrix. However, as Smith (2009) warned, highly connected weight matrices will produce an underestimate of coefficients. Therefore, I chose second-order contiguity as a compromise. I used the same spatial weight matrix for all the spatial dependence in the data.

The general spatial panel model can be reduced to specifically identify where the spatial effects are within the data. There are three specifications for dealing with spatial dependence. The first is the spatial autoregressive lag panel model (SAR) that posits the spatial dependence in the dependent variable.

$$y_{it} = \delta \sum_{j-1}^{N} W_{ij} y_{jt} + \chi_{it}\beta + \mu_i + \varepsilon_{it} \quad (3)$$

The lagged dependent variable is a constructed variable that consists of an average of neighbouring spatial units, which are weighted using the spatial weight matrix (W) (Anselin et al., 2008).

The second specification is the spatial error panel model (SEM), which postulates that a spatially correlated error term influences the dependent variable.

$$y_{it} = \chi_{it}\beta + \mu_i + \phi_{it} \quad (4a)$$

$$\phi_{it} = \rho \sum_{j-1}^{N} E_{ij}\phi_{it} + \varepsilon_{it} \quad (4b)$$

With the spatial dependence in the error term, the model implies an indirect influence on the dependent variable. Therefore when the researcher knows little about the structure of

the spatial dependence, the spatial error model can be specified (Bhattacharjee & Holly, 2010).

When these two specifications are combined in different combinations, the resulting models are labelled 'higher order models' (Elhorst, 2014). The spatial autocorrelation panel model (SAC) specifies that there is spatial dependence within the dependent variable and spatial correlation within the error term.

$$y_{it} = \delta \sum_{j-1}^{N} W_{ij} y_{jt} + \chi_{it}\beta + \mu_i + \phi_{it} \tag{5a}$$

$$\phi_{it} = \rho \sum_{j-1}^{N} E_{ij} \phi_{it} + \varepsilon_{it} \tag{5b}$$

The third specification is the spatial Durbin panel model (SDM), which specifies that there is spatial dependence within both the dependent and independent variables.

$$y_{it} = \delta \sum_{j-1}^{N} W_{ij} y_{jt} + \chi_{it}\beta + \sum_{j-1}^{N} W_{ij} \chi_{jt}\, \sigma + \mu_i + \varepsilon_{it} \tag{6}$$

Similar to the spatial lag panel model, the SDM creates a spatially lagged dependent variable. In addition, researchers use the same method to create spatially lagged independent variables.

To determine where the spatial dependence is within the model, I ran each variation (GSPM, SAR, SEM, SAC and SDM) and used the Bayesian Information Criterion (BIC) to select the appropriate specification (see Table 3-1). The SAC model with fixed effects had the lowest BIC score. Consequently, I deemed it the most appropriate model and used it in Chapter 4.

Table 3-1: BIC for spatial panel models (fixed and random effects)

	Random	Fixed	**Fixed**

		(spatial only)	**(spatial and time)**
GSPM	365.546		
SAC		-1054.811	**-1106.177**
SDM	992.858	-599.943	
SAR	2397.26	-424.160	-495.666
SEM	372.349	-1026.04	-1103.836

3.5 Incorporating social capital as a proxy of social distance

Advances in spatial econometric modelling (see Chapter 2) allow for investigations into the determinants of the scale of LDC at the regional level. Analysis of LDC impacts on resident wellbeing, however, lacks fine-tuned social distance data at the regional level, which is also not readily available at the community level. Consequently, the research approach needed to consider primary data collection at the community level. Due to the confines of doctoral research, I decided that one community, used as a case study, could demonstrate a proof of concept of the mediating role of social capital (a proxy of within regional social distance) between LDC impacts and resident wellbeing.

3.5.1 Criteria for regional selection

To select the community of study, I applied a four-criterion regional-removal process. The first criterion was that the population of the largest community within that region needed to dominate the region's total population, i.e. the community is approximately equal to the region. This way I can ensure that LDC is present in the community (the scale of LDC in the community roughly equals the scale of LDC in the region). I aggregated SA2s to represent a community's boundaries. Secondly, LDC needed to be present within the region/community of study. LDC counts derived in Chapter 5 facilitated the removal of all regions with no LDC. Thirdly, I removed all regions classified as 'cities' using the ARIA + remoteness index. This prevents large cities from being the unit of analysis. Finally, I removed all regions, in which the largest community of the LGA had a population of 5,500 people or less. Chapman et al. (2015) argued that only communities larger than this could support higher-order economic and services structures. Higher-order structures – specifically social capital – were of interest in the current research. Appendix A lists the stage of removal from analysis for each region.

Overall, 12 regions/communities remained which met all four of the above criteria. By order of LDC size (smallest to largest), these regions/communities were: Launceston, Townsville, Port Augusta, Devonport, Geraldton-Greenough, Broken Hill, Whyalla, Port Lincoln, Burnie, Alice Springs, Kalgoorlie-Boulder and Mount Isa. 'Kalgoorlie-Boulder' and 'Mount Isa' had the highest LDC scale (and potential LDC impacts) therefore, both represented potential case study options. I selected Kalgoorlie-Boulder as opposed to Mount Isa (albeit a smaller LDC count) due to its larger and more centralised population. The anticipation was that this would allow for a greater sampling size.

3.5.2 Kalgoorlie-Boulder region

The Kalgoorlie-Boulder region is located approximately 600km east of Perth, the state capital, with an area of over 95,000km^2 (Figure 3-6). On the ARIA+ remoteness scale, Kalgoorlie-Boulder is a very remote region (score of 1). The 2011 Census indicated that the mining industry was the largest employer at 17 percent of the workforce. Whilst mining is the largest employer, the region has diversity with numerous other industries (e.g. Healthcare, Education, Manufacturing, Construction, Accommodation, Retail and Public Admin and Safety), which collectively contribute half of the workforce. The dominant feature of this region is a large open pit gold mine, 3.5km long, 1.5km wide, 600m deep, called the Fimiston Open Pit but colloquially known as the 'super pit'. Whilst this mine does not conduct FIFO (a major component of LDC), the numerous smaller mines in the surrounding area do.

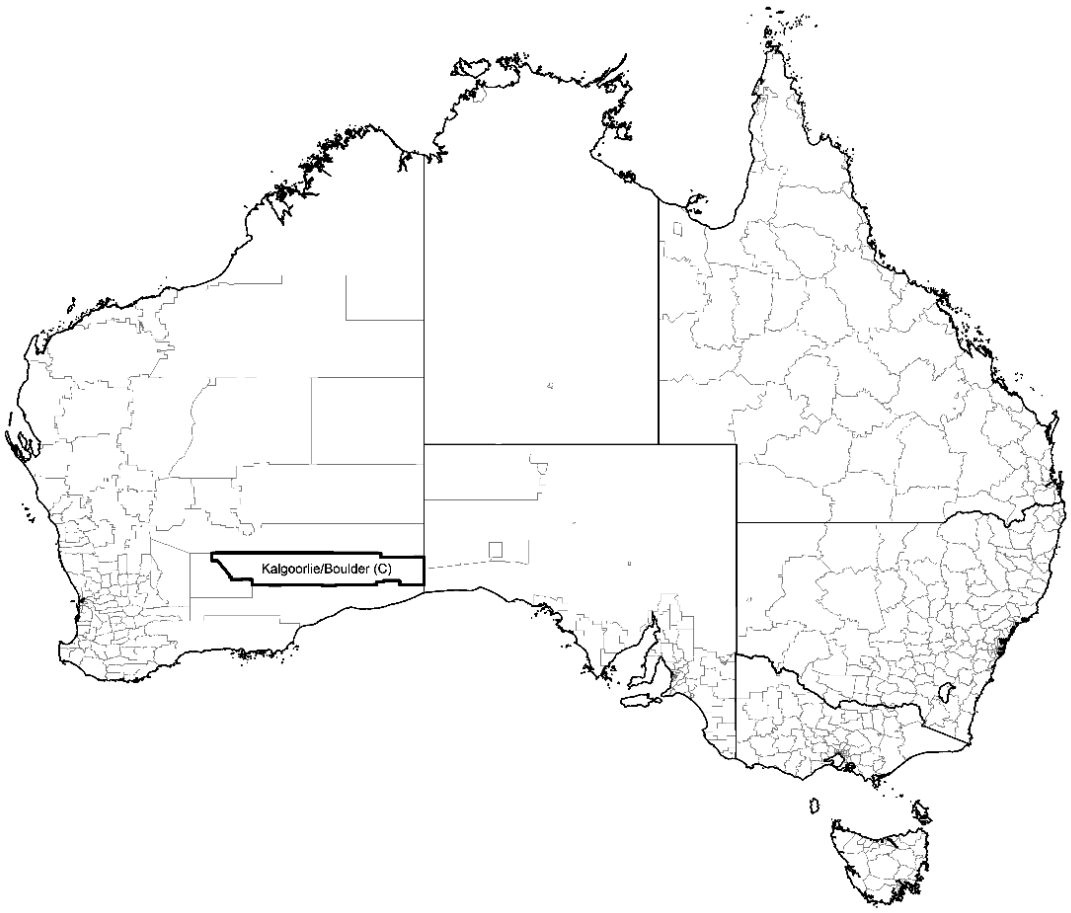

Figure 3-6: Location of Kalgoorlie-Boulder local government area (LGA) in Australia

Six percent of the regional workforce in Kalgoorlie-Boulder used LDC practices, compared to the nationwide median of 0.1 percent[3]. Figure 3-7 plots the predicted scale of LDC for each LGA (emanating from the spatial panel model in Chapter 4) and the calculated scale of LDC using the methodology explained in Section 3.3 (using 2011 Australian Bureau of Statistics (ABS) census data). The calculated scale of the LDC workforce was – more or less – equal to the predicted scale of LDC (derived using the Chapter 5 model) in the Kalgoorlie-Boulder region (when taking into account regional variables). Consequently, in terms of the scale of LDC, Kalgoorlie-Boulder is not a 'special case', which enhances the generalisability of my findings.

[3] I used methods described in Chapter 4 to derive national and regional LDC counts.

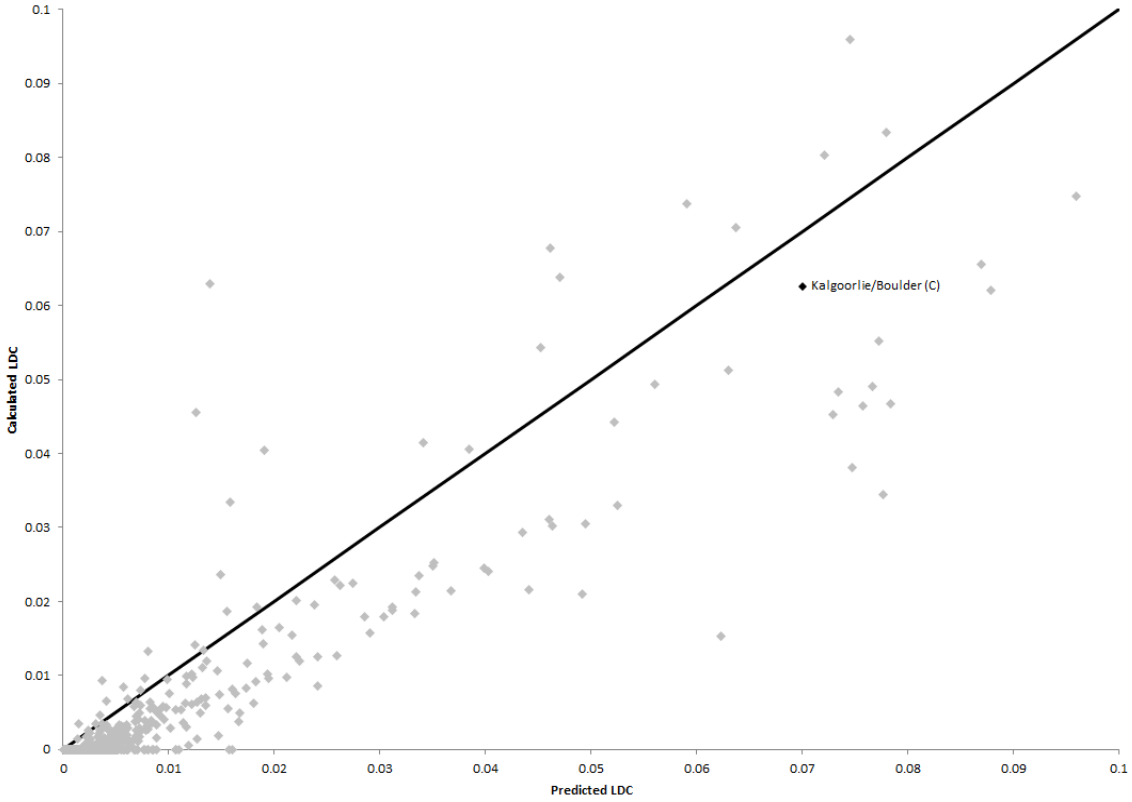

Figure 3-7: Calculated versus predicted LDC

Note: Figure only shows regions with an LDC scale between 0 and 10 percent.

Several industries employed LDC practices in the Kalgoorlie-Boulder region. Mining was the dominant employer of inbound LDC, representing 55 percent; construction was the next highest at 13 percent; followed by retail (6 percent) and healthcare (5 percent). The majority of inbound LDC workers in the Kalgoorlie-Boulder region lived in southwestern Western Australia (see Figure 3-8). Fifty three percent lived in neighbouring regions (i.e. Coolgardie, Yilgarn, Leonora, Esperance, Ravensthorpe and Lake Grace) whereas Perth was home to 45 percent. The remaining two percent inhabited New South Wales.

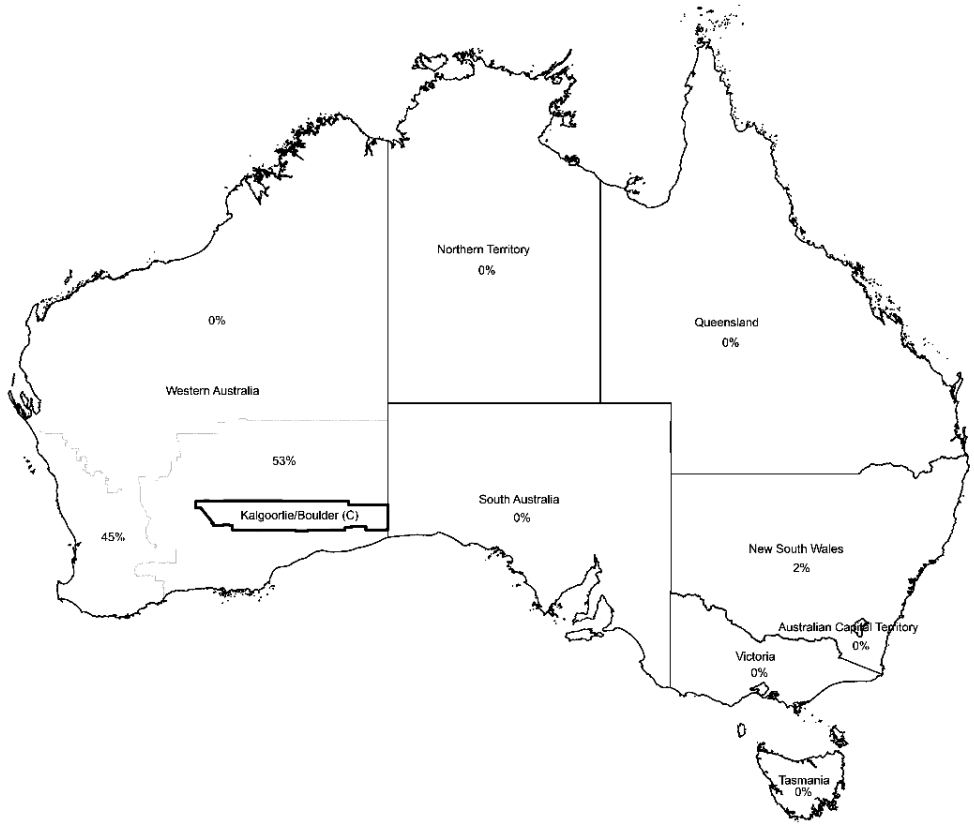

Figure 3-8: Distribution of inbound LDC workforce into Kalgoorlie-Boulder region

3.5.3 Descriptive overview of the Kalgoorlie-Boulder community

The city of Kalgoorlie-Boulder (from here on the Kalgoorlie-Boulder community) is the main service town to the Kalgoorlie-Boulder region[4], and with a population of 30,840 in 2011, it constitutes 96 percent of the Kalgoorlie-Boulder regional population. As Table 3-2 demonstrates, this community is representative of the Kalgoorlie-Boulder region. When compared to the rest of Australia, however, the Kalgoorlie-Boulder community exhibits some notable differences. Kalgoorlie-Boulder residents appear to represent a transient population, who are younger and earn higher incomes compared to the national average. These differences are characteristic of a mining workforce, with miners representing a large proportion of those people residing in the Kalgoorlie-Boulder community (21 percent) compared to the two percent national average. SCRA and Windsor (2013) stated that mining companies prefer to hire younger workers from outside

[4] The Kalgoorlie/Boulder community constitutes the SA2s; Kalgoorlie – North, Kalgoorlie, Kalgoorlie Airport, Boulder, and Trafalgar (WA). SA2 demarcations constitute populations of 3,000 to 10,000. In the remote regions of Australia (where there are vast distances between communities), communities appear as a cluster of small SA2 regions surrounded by a single larger region.

the region even if skilled older workers already reside there. Chapters 5 and 6 – which explores Kalgoorlie-Boulder residents' perceptions of LDC and their usage of social capital – provide a more detailed demographic profile of a sub-set of the Kalgoorlie-Boulder population.

Table 3-2: Demographic profiles for Australia (nation), Kalgoorlie-Boulder (region) and Kalgoorlie-Boulder (community) ABS Census 2011

	Kalgoorlie-Boulder Community	Kalgoorlie-Boulder Region	Australia
Proportion of males	52%	52%	49%
Age	31.9	32	37.9
Proportion of high school graduates	37%	36%	48%
Average number of children per family	1.6	1.6	1.5
Average weekly personal income	$1,019	$1,019	$755
Proportion of residents living in same place since last census (2006)	42%	42%	58%
Unemployment Rate	4.3%	4.3%	5.6%
LDC proportion of workforce	4%	6%	0.1%

Note: Calculation of the scale of LDC for the Kalgoorlie-Boulder community was possible due to the 'remote' classification of the Kalgoorlie-Boulder region. This classification counts all workers as LDC that live outside the region. Using this same method but for the community only, an LDC worker is every person who works in the Kalgoorlie-Boulder community but lives outside the Kalgoorlie-Boulder region.

3.6 Operationalisation of social capital proxy

The second and third research aims intend to investigate whether social capital plays a mediating role in the relationship between LDC impacts and resident wellbeing at the community level, and the dimensions of social capital that facilitate or inhibit that

mediating role, respectively. The mediation analysis (Chapter 5) required the following measurements; perceived LDC impacts (independent variable), perceived density of social capital (mediating variable), subjective wellbeing (dependent variable) and a set of control variables. I obtained the required information through online and face-to-face surveys across the Kalgoorlie-Boulder community (see Chapters 5 and 6 for more details). This, therefore, describes a deductive approach where I had an understanding of the potential mediating role of social capital, and sought to prove if this was the case in Kalgoorlie-Boulder. Then, I used follow up group interviews to explore social capital mediation in more detail, specifically what (if any) dimensions of social capital facilitate or inhibit social capital's mediation role (Chapter 6). Due to the fragmented knowledge of social capital in Kalgoorlie-Boulder, however, an inductive approach was appropriate (Elo & Kyngas, 2007). That is, I wanted to explore patterns in the usage of social capital towards LDC impacts.

3.6.1 Mediation analysis

The literature has extensively studied the relationship between two variables, commonly denoted as X and Y, and the conditions in which X causes Y (shown in Equation 1). Mediation describes the addition of a third variable within the causality pathway between X and Y (MacKinnon, Fairchild, & Fritz, 2007). Mediation analysis explores the influence of moderating variables on the relationship between a dependent and independent variable. This type of analysis explores not only *whether* a mediating variable influences the dependent variable(s) but also *how*. Equations 7, 8 and 9 express the simplest and most used form of mediation analysis (MacKinnon et al., 2007) developed by (Baron & Kenny, 1986):

$$Y = \alpha_1 + \beta X + \varepsilon_1 \quad (7)$$

$$Y = \alpha_2 + \beta' X + \delta M + \varepsilon_2 \quad (8)$$

$$M = \alpha_3 + \mu X + \varepsilon_3 \quad (9)$$

where, β is the relationship between the independent and dependent variable, M is the mediating variable, β' is the relationship between the dependent and independent variables in the presence of the mediator, δ is the mediating coefficient on the dependent variable, μ is the relationship between the independent variable and the mediator.

The mediation analysis requires a four-step procedure. The first two steps require statistical significance between the dependent and independent variables (equation 7) and between the mediator and independent variable (equation 9). Then, the third step requires statistical significance of the mediating variable when both the independent variable and mediator are within the same model (equation 8). Finally, the fourth step requires β to be larger than β'; the difference represents the mediation effect. The introduction of the Sobel test improved this mediation analysis, which derived standard errors for the mediating effect (MacKinnon et al., 2007).

There are, however, limitations to this method. In particular, two factors needed addressing in order to facilitate mediation analysis on survey data. Firstly, the mediation effect is assumed to be the difference between (β) and (β'); this difference can change with the inclusion of a variable into the model, regardless of the relationship between the mediator and independent variable, known as cross-model coefficient non-comparability (Kohler, Karlson, & Holm, 2011). Secondly, confidence intervals developed to test the mediating effect (Sobel test) assume normally distributed data. This assumption is often false with survey-collected data due to small samples sizes, the use of Likert scales (ordinal data) (MacKinnon et al., 2007) and multiple choice options (categorical data) (Hayes & Preacher, 2014). In order to overcome these limitations, Chapter 5 implemented a Stata user-written procedure 'KHB' created by Kohler et al. (2011):

$$Y = \alpha_2 + \beta' X + \nabla R + \varepsilon_2 \quad (10)$$

$$R = M - (\alpha_3 + \mu X) + \varepsilon_3 \quad (10a)$$

where R are the residuals from equation 9 (represented in equation 10a), and ∇ is the relationship between the dependent variable and residuals of a linear regression between the mediator and independent variable.

The KHB procedure is the same as the aforementioned 4-step mediation analysis only with modified equations. The main difference is that, the standard procedure incorporates the mediating variable coefficients directly into the main regression (equation 8). The KHB procedure instead incorporates the residuals of the independent and mediating variable regression (equation 10a) into the main regression (equation 10). Potentially

different scales in the model are thus standardised which allows for ordinal logit models and the inclusion of categorical variables. Furthermore, bootstrapping is used to create confidence intervals. Bootstrapping treats the observed data as the 'population' and continuously resamples this with replacement data. The treatment of the observed data as the 'population', means assumptions of normality do not apply (MacKinnon et al., 2007). Kohler et al. (2011) demonstrated that their mediation procedure was superior when dealing with asymmetric data.

3.6.2 Content Analysis

Content analysis describes a procedure for revealing patterns within communication. The researcher groups these patterns into manageable chunks with consideration of the groups' underlying themes and relationships. Using these groups, the ideas of the text can be exposed and highlighted; these ideas can include: psychological state of the author, target audience, culture and historical context (Leximancer, 2011). Methodologically, content analysis can be either quantitatively or qualitatively driven. The difference is that quantitative content analysis is objectivist (focusing on statistical inferences), whilst qualitative content analysis is constructivist (focusing on exploring context) (Oleinik, 2011). This thesis focuses on the perception of residents impacted by LDC; thus, context is very important and justifies the selection of qualitative content analysis.

Thematic coding is an important process for the construction of themes from written/spoken data. The trustworthiness of content analysis depends on the appropriate application of thematic coding specific to the research question. Hsieh and Shannon (2005) highlighted three approaches for qualitative content analysis coding; 'conventional content analysis', 'directed content analysis' and 'summative content analysis'. The key difference between these approaches is the research question. Conventional content analysis is appropriate for exploring phenomenon with limited literature. Coding is defined during data analysis, with subsequent themes entirely data driven. Directed content analysis is appropriate for validating and/or expanding on existing theoretical frameworks. Coding is guided by the literature and completed before data analysis; but can be modified to suit the research question during data analysis. Summative content analysis is appropriate for exploring the usage of words within a given context. The researcher derives keywords either from the literature or from a particular

research interest. This thesis focuses on exploring dimensions of social capital that are effective at mediating LDC impacts. I considered a conventional content analysis most appropriate due to limitations in the literature, however, the literature still guided the questions used in the group interviews (see Chapter 6). It was not necessary to restrict the coding.

3.7 Conclusions

The Australian geography is conducive to the use of LDC due to large distances between populated coastal areas (where the workers are located) and rural areas (where the workers are needed). Rural communities have tight labour markets that are quickly overwhelmed when large workforces are needed for mining. Resulting spatial interactions between the host and home regions create spatial dependence. I incorporated spatial dependence into the economic model via a spatial autocorrelation model (with fixed effects) using a second-order contiguity weight matrix. The weight matrix was populated using population-based region demarcations (Local Government Areas) as spatial units. To estimate the number of LDC workers in Australia, I used a hybrid of KPMG's (2013b) definition and ARIA+ remoteness index supplemented with data collection rules to minimise daily commuters. The economic model allowed analysis of the determinants of LDC at the regional level.

Whilst geographical distance was incorporated, social distance (particularly within a community) was not, due to data limitations. This requires a separate analysis using primary data at the community level. Within the community level, social capital was used as a proxy of social distance. I used case study analysis to demonstrate social capital's potential to mediate LDC impacts. Using a four-criteria removal process, Kalgoorlie-Boulder was selected. Kalgoorlie-Boulder had a greater percentage of inbound LDC (6%) compared to the national average (0.1%), where the local workforce is reliant on the mining industry with 17 percent of the resident workforce directly employed. I operationalised social capital using a mediation analysis to investigate whether social capital mediates resident wellbeing reductions caused by LDC impacts. A follow up analysis using an inductive approach through content analysis explored dimensions of social capital that facilitated or inhibited this mediating role.

Chapter 4 What drives long distance commuting into Australian regions? A spatial panel model approach

This chapter is a modified version of a paper published in the Journal of Rural Studies: Nicholas, C., & Welters, R. (2017). What drives long distance commuting into Australian region? A spatial panel model approach. *Journal of Rural Studies, 49*, 140 - 150.

CHAPTER OUTLINE

4.1 Introduction

This chapter investigates the regional and extra-regional circumstances that drive inbound long distance commuting (LDC). Sections 4.1 and 4.2 contextualises LDC within Australia whilst critiquing LDC literature. Sections 4.3, 4.4 and 4.5 operationalise the procedures and variables required for modelling, this includes working definitions of LDC, spatial units and drivers of LDC. Section 4.6 demonstrates exploratory data analysis, including summary statistics and spatial correlation testing. Section 4.7 presents the results for the drivers of LDC and Section 4.8 discusses the results.

Mining in Australia predominantly occurs in rural/remote regions whose economies depend on a limited number of industries (Kotey, 2015; Tonts, Martinus, & Plummer, 2013). As a result, the opportunities for the mining industry to build local backward and forward industry linkages and hence contribute to the growth and diversification of the local economy are restricted. Instead, the region becomes a resource bank to other regions from which the mining industry sources its input requirements – typically urban regions (MacKinnon, 2013; Rolfe & Kinnear, 2013; Tonts et al., 2013). The adoption of LDC into a region – whether related to mining or otherwise – only reinforces this tendency. LDC workers do not spend (or only disperse limited amounts of) their wages in the host region, which gives rise to the hollow economy syndrome (McKenzie, 2010). Furthermore, LDC might contribute towards fractionalisation of the community (Storey, 2010; Tonts & Plummer, 2012) and social disorder (Carrington et al., 2012).

It is against this backdrop that research exploring the impact of LDC into a region or mining in general on the socio-economic wellbeing of host regions is conducted. This body of research has highlighted as impacts; the displacement of non-mining related industries (Fleming & Measham, 2015a), increased income (Hajkowicz et al., 2011), increased income inequality (Fleming & Measham, 2015b; Reeson, Measham, & Hosking, 2012), increased housing costs (Haslam McKenzie & Rowley, 2013) or more general increased costs of living (Lawrie et al., 2011). In addition, the diversity of the commodity base was found to be a driver of socio-economic outcomes (Tonts et al., 2012).

However, this body of research has recently drawn criticism from two ends. First, Chapman et al. (2015) show that the impact of drivers of socio-economic wellbeing in resource rich regions are highly variable both across time and space. Hence, results from studies that explore the impacts of LDC or mining in a particular region (Chapman et al., 2015; Tonts et al., 2013) or studies that compare impacts across regions, but not simultaneously across time (Fleming & Measham, 2015a; Hajkowicz et al., 2011; Haslam McKenzie & Rowley, 2013; Reeson et al., 2012; Tonts et al., 2012) are difficult to reconcile. Studies that account for both time and space are rare (Fleming & Measham, 2015b). Second, Nicholas and Welters (2016) show the importance of spatial dependence in explaining the extent of LDC in a host region, which is arguably an important driver of impacts on regional socio-economic wellbeing. Spatial dependence occurs if the extent of LDC into a region not only depends on circumstances in the region, but also on circumstances in other regions. They argue that this is likely the case given the relatively undeveloped economic structure of host regions. This implies that mining industries in the region must interact with other regions to source capital input (the resource bank argument) and labour input (the LDC argument). Not controlling for spatial dependence may lead to biased model results, yet none of the above studies controls for spatial dependence – though Fleming and Measham (2015b) and Rolfe & Kinnear (2013) demonstrate the importance of spatial spill over effects.

This study builds on the Chapman et al. (2015) and Nicholas and Welters (2016) studies. That is, Chapman et al. (2015) account for time and space but not spatial dependence, whereas, Nicholas and Welters (2016) control for space and spatial dependence but not time. To address this gap, the current study incorporates all three elements: space, spatial dependence and time. The addition of temporal effects to the Nicholas and Welters (2016) study is not only likely to increase the accuracy of the model, but also to address issues of causality. That is, without controlling for time, only correlation (not causality) between the extent of LDC into a region and regional characteristics can be detected. The analysis presented here establishes both correlation and causation; thus, a much stronger evaluation of the determinants, which influence the extent of LDC in a host region, can be achieved, and, as a result firmer policy implications can be suggested.

To do this, data from the 2006 and 2011 Australian Censuses for 516 regions are utilised. Findings from the study confirm that spatial dependence is present; hence, consideration

of this element does indeed improve the accuracy of the model. Researchers interested in explaining the extent of LDC or the impacts of LDC on the wellbeing of regions should endeavour to incorporate spatial dependence in their analysis next to space and time. Furthermore, local service provision and the availability of rental accommodation rather than the tightness of the labour market or housing affordability reduce the uptake of LDC into a region. Lastly, population transience increases LDC into a region.

4.2 Long distance commuting in rural/remote Australia

Spatial dependence occurs if economic activity in a region uses inputs which are not sourced locally. With respect to labour requirements, this will typically happen in thin labour markets which cannot accommodate substantial additional labour demand, even if significant wage premiums are offered. Thin labour markets are found in rural and remote regions of Australia. Hence, if companies require workers, they must entice them to migrate to the region or commute to the region either on a daily basis or less frequently through LDC. In the case of the mining industry, which typically operates in rural/remote Australia, this was illustrated by SCRA and Windsor (2013, p25), who claim that "*resource companies prefer to engage with local workers where possible; however, this pool is very quickly exhausted particularly in regards to skilled workers*".

Traditionally, mining workers would relocate (i.e. migrate) to the host region at least for the duration of their contract. Subsequent increased demand for housing and other services, combined with miners' significant purchasing power led to inflationary pressures on the local housing market. These pressures have caused concerns around housing affordability (Haslam McKenzie & Rowley, 2013) and cost of living in general (Lawrie et al., 2011). In some regions with extraction companies the cost of living can rival that of cities (McKenzie, 2010). Windle and Rolfe (2013) argue that high prices discourage permanent migration into the region. The reluctance of workers to migrate into a region featuring high living costs serves as the main justification used by mining companies to adopt LDC (Lawrie et al., 2011). High cost of living also encourages local residents to sell their houses while the price is high and to relocate to lower cost regions. Some of these former residents then utilise LDC practices to work inf their original region (Basson & Basson, 2012).

Nonetheless, the notion that mining companies use LDC as a recruitment strategy of last resort is contested. McKenzie (2010) argues that LDC workers are more mobile and provide mining companies more flexibility to move workers between smaller extraction sites. As a result McIntosh (2012, p233) argues that "*nowadays, however, workers are hired by contracting companies and essentially all new recruits are FIFOs/DIDOs*". Regardless of the motives, the use of LDC in Australia, particularly in rural/remote Australia, is widespread and not confined to mining (Nicholas & Welters, 2016; Skilton, 2015). Accordingly, spatial dependence could distort research findings if not appropriately controlled for in the Australian context. In subsequent sections, the idea of 'regions' will be defined followed by the provision of the working definition of LDC adopted in this chapter; these definitions are employed to build a spatially inclusive model which explores the determinants of the extent of LDC into a region.

4.3 Defining a region in the Australian context

In this study, 'region' represents a spatial unit where areas are grouped together based on similar economic, social and geographic characteristics (Garnett & Lewis, 2007). Overall, three demarcation strategies are commonly employed to define regions. Firstly, population-based demarcations use pre-established government defined regions. These areas are determined based on administrative needs indirectly influenced by population size. Up until 2011, the Australian landscape was divided by Statistical Local Areas (SLAs) and Local Government Areas (LGAs). Population-based demarcations are employed extensively in government data collections such as the Australian census. Regions do not overlap and the entirety of Australia is covered in this approach. Secondly, place-based demarcations use the borders of towns, cities or mining sites to determine regions. This form of demarcation is particularly useful when investigating specific points of interest which need to avoid influences from surrounding areas. Thirdly, activity-based demarcations use commuting behaviour to inform regional boundaries. That is, if the share of people who both live and work in a region surpasses a critical level, the area is considered to be self-contained and a region is declared (Mitchell & Stimson, 2010).

Due to the desire to encompass Australia in its entirety, place-based strategies are inappropriate. An activity based-demarcation strategy, on the other hand, holds value in that it can demarcate regions based on economic activity. Two main factors, however,

determined this strategy to be a non-viable, albeit preferred option. Firstly, shifts in economic activity may lead to shifts in regional boundaries over time. As this study employs a temporal component to the spatial analysis, changes to regional boundaries over time are undesirable. Secondly, activity-based demarcation strategies produce few – and therefore geographically large – regions in rural/remote areas. The majority of LDC workers commute to/from rural/remote areas, thus, an activity-based demarcation runs the risk of obscuring LDC workers, who are identified in the current work through the difference between their region of residence and region of work (see Section 4). Population-based demarcation strategies that currently exist do not suffer from – or experience to a lesser degree – the above problems. Hence, I adopted a population-based demarcation strategy using Local Government Areas (LGAs). LGAs can be populated with ABS census data; this is the only database which provides the necessary scope (i.e. nationwide) and level of detail (i.e. regional) that is required to complete a spatial panel dataset.

I use data for all 670 Australian LGAs in 2006 and 562 LGAs in 2011. I remove 31 regions from the analysis because their low population sizes lead to inconsistent data[5]. An inherent problem arose during data collection due to population changes and the repositioning of the 2011 LGA boundaries particularly for regions in Queensland and the Northern Territory. In 2008, the Queensland government amalgamated 158 LGAs into 74. The majority of these amalgamations were between regions with the same outside boundary (refer to Appendix B). Furthermore, the Northern Territory underwent a restructuring that altered regions for a majority of the territory. Pink (2012) suggested that conversions into different regions achieved better results when a number of smaller regions were converted into larger ones. Therefore, to maintain regional consistency for this study, I introduced the amalgamations evidenced in the 2011 census into the 2006 census data. In case there were no common boundaries between the years, I group regions occupying the same location to form mega-regions. Figure 4-1 depicts the 516 LGA regions (spanning 2006 and 2011) that I include for further analysis.

[5] These regions are Anangu Pitjantjatjara, Aurukun, Burke, Cherbourg, Diamantina, Doomadgee, Hope Vale, Kowanyama, Lockhart River, Mapoon, Maralinga Tjarutja, Menzies, Mornington, Murchison, Napranum, Ngaanyatjarraku, Northern Peninsula Area, Palm Island, Pormpuraaw, Tiwi Islands, Torres Strait Island, Unincorporated Queensland, Unincorporated South Australia, Unincorporated Tasmania, Unincorporated Victoria, Unincorporated Western Australia, Upper Gascoyne, Woorabinda, Wujal Wujal, Yalgoo and Yarrabah.

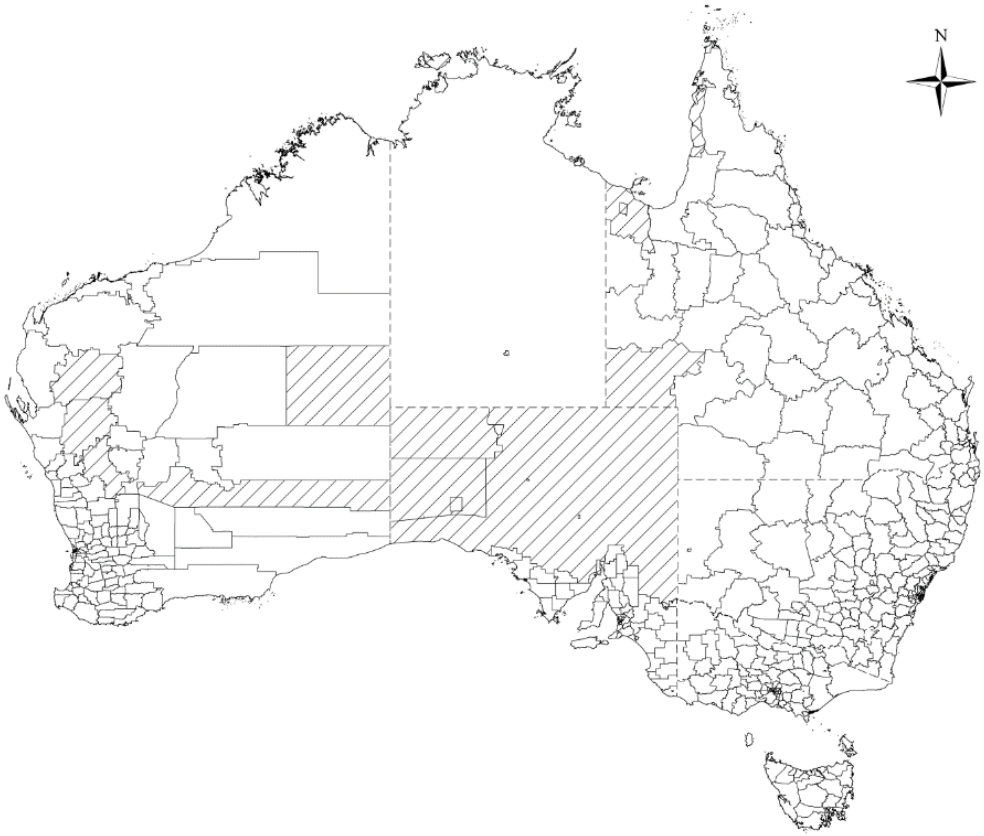

Figure 4-1: Map of selected LGA regional demarcations, shaded areas = regions removed from analysis

4.4 Defining a long distance commuter

For this study, I use a measurement of the proportion of the workforce in a region that engage in LDC to travel to work (proportion of LDC in the workforce) as my dependent variable. To establish the proportion of LDC in the workforce, I used Place of Work and Place of Enumeration data from the 2006 and 2011 ABS censuses for each LGA region in Australia. ABS data are, however, not designed to capture LDC (McKenzie, 2010; SCRA & Windsor, 2013). Hence, there is no definitive way of empirically defining an LDC worker. All methods to define an LDC worker stipulate that an LDC worker must work in a different region than where they reside. The problem with that definition is that it may falsely classify daily commuters as long distance commuters. This is the case for daily commuters who live close to a regional boundary but work on the other side of the boundary, which is especially relevant for densely populated, hence geographically small, regions. KPMG (2013b) therefore imposes an additional requirement, which is that population weighted centres of the two regions need to be at least 200km apart. Skilton

(2015) questions whether that distance is far enough to exclude daily commuting and suggests it should be at least 400km.

In this thesis, an alternative approach developed by Nicholas and Welters (2016) is employed which, instead of distance imposes an additional criteria related to the region's Accessibility/Remoteness Index (ARIA+). To control for daily commuters, I classified regions into four categories; Cities, Rural Centres, Rural Areas and Remote Areas, depending on their remoteness index. Each of these categories has different criteria to control for daily commutes (refer to Section 3.3). The key difference between the approach of this chapter and that of Nicholas and Welters (2016) is that I adopted a more detailed regional classification (i.e. 516 regions versus 325 regions). This reduces the risk of not considering LDC workers particularly in rural/remote regions.

4.5 Potential drivers of long distance commuting

The independent variables (i.e. hypothesised drivers of the proportion of LDC in the workforce) in this study align with the decision-making process of companies in the search for workers and – if the company decides to recruit outside the region - the locational decision of the recruited worker. It is hypothesised that (1) local labour market conditions influence the company's decision on whether or not to recruit locally, and (2) residential attractiveness of the region influences the recruited worker's decision to either relocate or instead become a long distance commuter (Nicholas & Welters, 2016; Storey, 2010).

4.5.1 Local labour market

SCRA and Windsor (2013) summarised that recruitment agencies are finding it difficult to source local labour, this suggests that local labour market conditions may not be influential to rise of LDC. This view is consistent both for the mining industry (McIntosh 2012) and the health care industry (Perkins, 2012). To test whether local labour market conditions influence the extent of LDC into a region, I included the official unemployment rate and the non-participation rate as measures of local labour market tightness. I include the latter to capture discouraged workers who may present themselves for work if it becomes available (Mitchell, Muysken, & Welters, 2014). Utilisation of a spatial panel model will facilitate the establishment of causality, not just correlation,

unlike the analysis provided by Nicholas and Welters (2016). A variable capturing the proportion of labour that would be attractive for the mining companies to raid (i.e. the proportion of construction and agriculture workers in the total labour force) was employed in an attempt to accommodate for the mining industry's preference to recruit from those already employed (specifically in the agriculture and construction industries) rather than the unemployed (Blackman et al., 2014). New is the inclusion of the average age of the regional workforce. SCRA and Windsor (2013) found that mining companies predominantly employ younger individuals even if skilled (older) labour is present within a region.

4.5.2 Residential attractiveness of the region

To proxy the residential attractiveness of a region, the themes that Nicholas and Welters (2016) include in their analysis have been built upon. They employed a housing market theme (McKenzie, 2010; SCRA & Windsor, 2013) and a local service provision theme (Chapman et al., 2015; Sharp et al., 2002) to capture the residential attractiveness of the region. This study additionally considers themes around alternative employment opportunities in the region as well as regional population transience.

Relocation to a region of work becomes more attractive if alternative employment opportunities exist outside of the recruiting industry. This enables the worker's accompanying family to gain employment or the worker themselves to gain another position in the case that they lose their new job (Randall & Ironside, 1996; Tonts et al., 2012). Therefore, I included a Herfindahl type employment industry concentration index. The higher the index, the more concentrated the industry landscape in the region is, which increases the employment vulnerability of the region while decreasing the attractiveness of the region as a residential location. In addition, two more indicators of alternative employment opportunities related to alternative wages form part of the analysis in this chapter. If alternative employment opportunities exist, but at significantly lower wages than the job for which the worker considers relocating, the region loses its attractiveness as a place to reside. Exploiting the fact that the occupation 'Machinery Operator and Driver' is the dominant occupation in the mining industry, I included the average wage earned for that occupation in the mining industry relative to the average wage a worker with that occupation can earn outside the mining industry in the region. The higher this

relative wage is, the less attractive alternative work is in terms of pay. Similarly, I included average income in the mining industry relative to average income outside the mining industry in a region.

Lovell and Critchley (2010) argue that long-term residents of a region which exhibits population churn (for example because of the cyclical nature of mining) gradually develop an 'emotional fatigue' toward building relationships with newcomers which instils hesitancy when an opportunity to build new friendships presents itself (Ooi, Mair, & Laing, 2014). As the social networks between long-term and temporary residents break down so does their trust (Bertotti, Adams-Eaton, Sheridan, & Renton, 2012). For long-term residents concepts like 'outsider' are increasingly used to describe temporary residents, which further alienates the LDC workers (SCRA & Windsor, 2013). With the lack of close friendships and support networks within their region of work, the region itself becomes a less attractive place to move to (Lovell & Critchley, 2010). To capture population transience, I included the share of residents of a region who have lived in the region for at least five years. An increase in population transience is predicted to increase LDC into the region.

The housing market is represented using rental prices and mortgage repayments per bedroom – both are measures of housing affordability. It is expected that reduced affordability will increase LDC (Hajkowicz et al., 2011). Thus I included the proportion of unoccupied dwellings in the region as a measure of housing market tightness.

Given the limited lifespan of the mine and/or construction project (SCRA & Windsor, 2013), workers who are considering a relocation to the region of work might prefer temporary accommodation (i.e. rental houses) over buying a house. That is, it is expected that a negative relationship will exist between the proportions of rental properties to LDC.

I include three variables in the analysis to proxy regional service provision: the average number of teachers (full time equivalent) per student, average number of medical practitioners (MPs) (full time equivalent) per resident and the proportion of dwellings in the region with internet. All three measures are expected to increase the residential attractiveness of the region, hence reduce the uptake of LDC (Poortinga, 2012).

4.5.3 Composition of LDC

Within Australia, the mining industry is typically associated with the use of LDC, hence mining and LDC impacts seem mutually inclusive (Carrington et al., 2012). While this perception has some merit, other industries such as health care (Hussain et al., 2014) and construction (McKenzie, 2010) also use LDC to service rural communities. Using 2011 census data, Skilton (2015) showed that only 21 percent of LDC in Australia was as a direct result of mining, with 52 percent completely unrelated. Accordingly, I included variables measuring the employment industry shares of mining and construction – two prominent adopters of LDC – in this analysis.

4.5.4 Composition of population

Aboriginal and Torres Strait Islander (ATSI) communities make up a higher proportion of the population within rural regions compared to urban regions in Australia. Lawrence (2005) and Tonts and Plummer (2012) have found that training programs designed to encourage indigenous workers to enter the mining workforce have had limited success – potentially suggesting that where the proportion of ATSI peoples in a region is high, LDC rises. Furthermore, I included regional population size as a control for residual daily commutes. LGAs represent the area of influence for local councils, which are centred on a town. Typically, LGAs in metropolitan areas have higher population sizes than LGAs in rural/remote Australia. Since the risk of incorrectly assigning LDC status to daily commuters is higher in geographically smaller LGAs, the inclusion of LGA population size controlled for so far non-captured daily commuting.

4.6 Exploratory data analysis

I used balanced panel data from the Australian Bureau of Statistics' (ABS) 2006 and 2011 census to populate my model for all variables included in Section 5. To prevent the identification of people due to small cell numbers, the ABS randomises cells. This process creates an artificially introduced error; therefore, this study employs the same method as Mitchell et al. (2007) who changed all cell counts of six or less into zero. A preliminary analysis of the data indicates that not all variables are normally distributed. Furthermore, the dependent variable (proportion of LDC in the workforce) and Herfindahl Index have the form of a Poisson distribution. I used a two-step procedure to transform the data. Firstly, I added 0.05 to all data points to allow log transformation, and secondly, I log

transformed the data. This produces variables with distributions closer to normal when compared to other transformation options. The validity of the estimation technique and the model specification technique are maintained with these newly transformed variables. Table 4-1 contains the descriptive statistics of the raw data variables employed in this study.

Table 4-1: Summary Statistics (N = 1032, n=516, T=2)

		Mean	**S.D.**
Dependent Variable:			
Proportion of Long Distance Commuters in Workforce		0.02	0.07
Independent Variables:			
Local Labour Market			
Local Unemployed Pool:	Unemployment Rate		
	Non-Participation Rate	60.34	6.61
Local Employed Pool:	Proportion of Labour Attractive for Raiding	0.23	0.16
	Average Age of Workers	41.53	2.36
Regional Attractiveness			
Local Housing Market:	Rental Price per Bedroom (per week)	58.01	33.16
	Mortgage Price per Bedroom (per month)	420.0	199.4
	Proportion of Rental Properties	0.29	0.11
	Proportion of Unoccupied Dwellings	0.16	0.09
Population Transience:	Proportion of Long-term Residents	0.61	0.08
Local Service Provision:	Teachers per Students	0.08	0.05
	Medical Practitioners per Person	0.01	0.01
	Proportion of Dwellings with Internet	0.65	0.12
Alternative Employment Opportunities:	Herfindahl index	1257.	792.0
	Ratio of Drivers and Machinery Operator's Income inside and outside Mining	0.96	0.07
	Ratio of income inside and outside of Mining	1.06	0.11
Composition of LDC:	Mining Employment Share	0.03	0.10
	Construction Employment Share	0.06	0.03
Composition of Population:	Proportion of ATSI Persons	0.04	0.07
	Population	40,39	72,36

Note: Data source: 2006 and 2011 Australian censuses. S.D. = Standard Deviation.

According to this study's methodology, the overall number of LDC workers has decreased from 96,614 in 2006 to 77,822 in 2011, a decline of 24 percent. Interestingly, Australia's total workforce increased by eight percent over the same time period. While no other national survey exists for direct comparison, state-wide and regional LDC counts have been undertaken, which are summarised in the government inquiry in SCRA & Windsor (2013). The Queensland Office of Economic and Statistical Research (QOESR) provided estimates of LDC workers for select regions to the inquiry. In 2012, these estimates were 25,035 workers in Bowen Basin (Queensland) and 6,445 workers in Surat Basin (Queensland). The Chamber of Minerals and Energy of Western Australia made a submission to the government inquiry and estimated that LDC consisted of 52 percent of the mining industry or 46,800 LDC workers in Western Australia alone. It seems estimates of LDC counts in the current study are conservative compared to existing literature.

In terms of LDC change over time, KPMG (2013b), estimated a 37% increase in LDC from 2006 to 2011 and an 86% increase in the mining sector. These results show the oppose trend. It is likely that KPMG (2013b) is possibility an overestimate, deteriorating housing affordability in capital cities may explain why households are leaving capital cities (tree change) and commute from the periphery. If that commute is more than 100km, KPMG classifies them as LDC, I wouldn't. However, that does not take into account the opposing trend in LDC counts. It is possible that the estimation techniques are imperfect and would advise caution when interpreting the results. This highlights the urgent need for better data collection for national wide LDC counts. Figure 4-2 visually represents LDC across Australia.

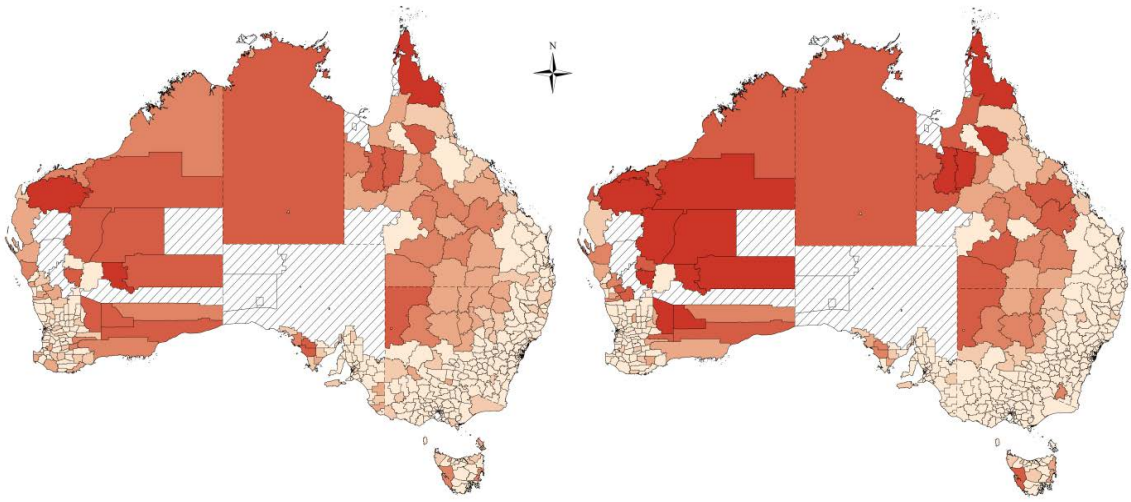

Figure 4-2: Long Distance Commuting across Australia for 2006 (left) and 2011 (right). Data range between: less than 1 percent (pale yellow) to 30 percent and higher (maroon).

I use 'ArcMap10' software to test for the presence of spatial dependence between the regions for which I conducted a Global Moran I test on all variables for 2006 and 2011 (see Table 4-2) to test for the presence of spatial correlation. In addition, I conducted a local Moran I test for the dependent variable (proportion of LDC in workforce) for years 2006 and 2011 (see Figure 4-3). All Moran I tests use inverse (Euclidean) distance matrices with row standardisation and the False Discovery Rate (FDR) correction[6].

Table 4-2: Global Moran I test for 2006 and 2011

		2006	2011
Dependent Variables:			
Proportion of Long Distance Commuters in Workforce		0.15	0.26
Independent Variables:			
Local Labour Market			
Local Unemployed Pool:	Official Unemployment Rate	0.19	0.09
	Non-Participation Rate	0.11	0.09
Local Employed Pool:	Proportion of Labour Attractive for Raiding	0.29	0.30
	Average Age of Workers	0.17	0.19
Regional Attractiveness			
Local Housing Market:	Rental Price per Bedroom (per week)	0.42	0.39

[6] False Discover Rate (FDR) correction is a process developed by Benjamini and Hochberg (1995) to control for the growing probability of type 1 errors when multiple regions are tested for spatial interaction.

	Mortgage Price per Bedroom (per month)	0.41	0.34
	Proportion of Rental Properties	0.18	0.17
	Proportion of Unoccupied Dwellings	0.17	0.26
Population Transience:	Proportion of Long-term Residence	0.19	0.16
Local Service Provision:	Teachers per Student	0.08	0.06
	Medical Practitioners per Person	0.36	0.36
	Proportion of Dwellings with Internet	0.24	0.21
Alternative Employment	Herfindahl Index	0.32	0.30
Opportunities:	Ratio of Drivers and Machinery Operator's Income inside and outside of Mining	0.09	0.13
	Ratio of Income inside and outside of Mining	0.09	0.02
Composition of LDC:			
	Mining Employment Share	0.17	0.17
	Construction Employment Share	0.13	0.07
Composition of Population:			
	Proportion of ATSI persons	0.35	0.35
	Population	0.38	0.36

Note: All coefficients are significant at one percent

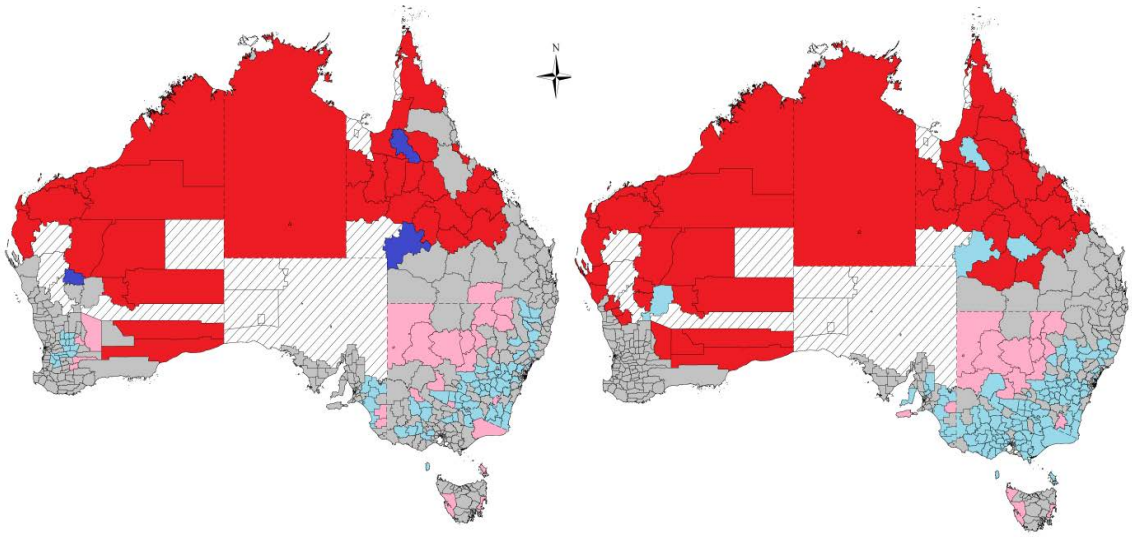

Figure 4-3: Local Moran I cluster map of long distance commuting practices across Australia in 2006 (left) and 2011 (right).

Note. Individual colours represent degree of clustering. Red = high to high clustering; pink = high to low; light blue = low to high; dark blue = low to low; grey = no significance.

Global Moran I results in Table 4-2 indicate that the values of all variables both in 2006 and 2011 were spatially correlated. The presence of spatial correlation be it positive (similar values in nearby regions) or negative (dissimilar values in nearby regions), violates the assumption that data are randomly distributed across the sample area (Australia) and thus needs to be taken into account. To provide context for this spatial correlation, I produced local Moran I maps for the dependent variable (see Figure 4-3). For both years I note significant positive spatial correlation in the northern and western regions of Australia (similar high values in nearby regions shown in dark red; similar low values in nearby regions shown in dark blue). Further, I noted significant negative spatial correlation predominantly in south-eastern regions of Australia (high values which contrast with low values in nearby regions shown in pink; low values which contrast to high values in nearby regions shown in light blue). Grey areas indicate no spatial correlation.

Some care needs to be taken when interpreting the results from the local Moran I maps. These tests are two-tailed with the assumption of normality for the analysed variable. In this study, the assumption of normality is not met because the proportion of LDC in the workforce (dependent variable) exhibits a skewed distribution (even after being log transformed). This means the Moran I test has a higher chance of a type 1 error for clustering significance (right-hand tail) and type 2 error for dispersion significance (left-hand tail). To minimise the chance of these errors, I used the FDR correction and implement a distance cut-off point to the inverse distance matrix so regions can only have a maximum of eight neighbours. For regions that have dispersion significance, the Moran I will report an insignificant result. Consequently, an insignificant Moran I does not indicate a lack of spatial correlation, but rather a failure of the statistical technique to identify dispersion patterns. Despite the inability to detect all spatial correlations, the Moran I maps clearly show that spatial dependence is present within this panel data set.

4.7 Model estimation

I used statistical package Stata 13 to determine where spatial dependence occurs within the data set. I used maximum likelihood estimators for both fixed and random effects for

each of the spatial panel models described in this section, using the command xsmle[7]. Further, I used software package 'Geoda' to create a spatial weight matrix, specifically a second order queen contiguity matrix. This matrix models the spatial dependence between regions over time. I used the Bayesian Information Criterion (BIC) as a model specification test to select the appropriate model, which is a spatial autocorrelation panel model with fixed effects[8].

I present the results of the spatial autocorrelation panel model with fixed effects in Table 4-3. Only one local labour market variable is significant: average age of the workforce and LDC exhibit a positive relationship. Secondly, seven regional attractiveness variables exhibit a statistically significant relationship with LDC in a region. The state of the housing market, population transience and local service provision all matter for the extent of LDC in a region – although three statistically significant relationships (mortgage price per bedroom, unoccupied dwellings and proportion of dwellings with Internet) display directions which oppose original expectations. Alternative employment opportunities in the region have no significant bearing on the uptake of LDC. Variables measuring the composition of the LDC variable, both mining and construction variables, are significant. In terms of the composition of the population, the ATSI population variable is statistically insignificant. LGA population is significantly positive which indicates that residual daily commuting is still present in the data despite attempts to control for it in the measurement of LDC.

[7] An alternative estimation procedure used by previous studies focused in regional Australia (Fleming & Measham, 2015a) is the geographically weighted regression (GWR). Both these techniques are valid but have different purposes. The advantage of a GWR is the ability to control for the spatial heterogeneity that might be present in spatial data, whereas the advantage of spatial panel models is the ability to test for and specify where the spatial interactions are in the model.

[8] The Spatial Panel Autocorrelation Model with spatial and time fixed effects has the most efficient estimators (BIC: -1106.177). Post estimate tests reveal, however, that residuals do not follow a normal distribution (Shapiro-Wilk test 0.966, $p < 0.001$) due to either autocorrelation and/or heteroskedasticity. With the panel data only containing two time periods, the likelihood of autocorrelation is remote, although heteroskedasticity remains a possibility. To test for heteroskedasticity, we perform a Chi-square test. The test statistic (χ^2 (19) = 216.72, $p < 0.001$) indicates the presence of heteroskedasticity and/or unusualness in the data. Logged data combined with a non-normally distributed dependent variable support the assumption of unusual data indicated through the Chi-square analysis. Tests for heteroskedasticity do not provide any insight into the nature of non-normal residuals. Therefore, this study will assume that heteroskedasticity is present within the model and apply robust estimates to compensate.

Table 4-3: Estimation of the spatial autocorrelation panel model with spatial and time fixed effects using heteroskedasticity corrected consistent estimates

		Coeff.	(Std Err.)
Independent Variables:			
Local Labour Market			
Local Unemployed Pool:	Official Unemployment Rate	-0.01	(0.04)
	Non-Participation Rate	0.33	(0.26)
Local Employed Pool:	Proportion of Labour Attractive for Raiding	-0.29	(0.20)
	Average Age of Workers	4.15	(1.29)***
Regional Attractiveness			
Local Housing Market:	Rental Price per Bedroom (per week)	0.08	(0.12)
	Mortgage Price per Bedroom (per month)	-0.29	(0.10)***
	Proportion of Rental Properties	-0.70	(0.22)***
	Proportion of Unoccupied Dwellings	0.39	(0.06)***
Population Transience:	Proportion of Long-term Residence	-1.54	(0.30)***
Local Service Provision:	Teachers per Student	-0.09	(0.04)**
	Medical Practitioners per Person	-0.51	(0.25)**
	Proportion of Dwellings with Internet	1.30	(0.25)***
Alternative Employment Opportunities:	Herfindahl Index	-0.09	(0.16)
	Ratio of Drivers and Machinery Operator's Income inside and outside of Mining	-0.10	(0.20)
	Ratio of Income inside and outside of Mining	-0.27	(0.21)
Composition of LDC:			
	Mining Employment Share	0.22	(0.04)***
	Construction Employment Share	0.05	(0.03)
Composition of Population:			
	Proportion of ATSI persons	0.05	(0.06)
	Population	0.95	(0.18)***
Model Information:			
	Spatial Rho	0.08	(0.01)***
	Spatial Lambda	-0.04	(0.02)*
	Sigma	0.03	(0.00)***
	Observations	1032	
	Groups	516	

Time periods	2

Note: * 10 percent significance, ** 5 percent significance, *** 1 percent significance

4.8 Discussion

4.8.1 Study design

I considered the spatial autocorrelation panel model with fixed effects the most efficient model for this study. Using a fixed effect model controls for all non-dynamic factors, including remoteness, distance and resource reservoirs all of which are strong determinants of LDC. Significant spatial rho and lambda results indicated that spatial dependence exists both within the spatially-lagged dependent variable and within the error term. Circumstances surrounding the introduction of LDC practices were influenced not only by the local region's characteristics but also by characteristics of neighbouring regions. Consequently, this study adds to the growing body of work in mining and LDC studies that highlights the need to account for spatial dependence within econometrics modelling over space (Elhorst, 2014; McDonald et al., 2012; Nicholas & Welters, 2016; Perdue & Pavela, 2012; SCRA & Windsor, 2013; Tonts et al., 2012).

The significant positive relationship between regional population and the extent of LDC into a region in the regression analysis suggests that my method to distinguish long distance commuting from daily commuting among employees whose place of residence does not equal place of work is imperfect – especially for city regions (regions with large populations). The inclusion of the regional population in the regression accounts for this imperfection in the analysis. Nonetheless, I call for direct measures of long distance commuting status in future surveys, to resolve the problem of having to estimate the LDC status of a worker (SCRA & Windsor, 2013).

4.8.2 Local labour market

The state of the local labour market has only limited impact on the extent of LDC into a region. Results from this study found no evidence that the availability of unemployed or discouraged workers reduces the uptake of LDC into the region, which is in line with McIntosh (2012), Nicholas and Welters (2016) and Perkins (2012). I offer two potential explanations for these results; (1) Industry is willing to recruit locally (if available), but in general, the size of the local labour market is insufficient to meet the industry's demand

for workers. Consequently, regardless of whether the local labour market is tight or not, industry needs to recruit elsewhere. (2) Industry is simply not willing to recruit from locals, because they want an LDC workforce for cost reasons. LDC workers are more flexible and easier to deploy elsewhere (if need be), both of which reduces costs. With respect to the regional workforce, it was found that an increase in the average age of the regional workforce increases the uptake of LDC into the region – presumably because the mining industry prefers to recruit from relatively younger segments of the labour market. Relevant work experience in the local workforce tends to reduce the adoption of LDC into the region, however, this effect is not statistically significantly different from zero.

4.8.3 Residential attractiveness of a region

Consistent with the findings of Nicholas and Welters (2016), the results indicate that residential attractiveness of a region has a significant influence on the extent of LDC into a region, although some of the impacts are more complex than initially thought.

Variables included as proxies for tightness in the housing market (mortgage price per bedroom [positive] and proportion of unoccupied dwellings [negative]) reduce the uptake of LDC into the region, i.e. encourage workers to relocate to the work region. High wages (e.g. at least paid in the mining industry) perhaps ensure that workers who consider relocating do not see low housing affordability as a concern, as they have the purchasing power to succeed in such circumstances, as opposed to local residents. Further, the proportion of rental in total properties in a region indeed reduces LDC into the region, which suggests it increases the residential attractiveness of the region. Given the limited lifespan of mine and/or construction projects (SCRA & Windsor, 2013), employment in the region will be temporary, which may explain the popularity of rental accommodation. The availability of rental subsidies may further promote the use of rental accommodation (United Research Services, 2012).

Population transience increases the extent of LDC into a region. This is in line with Lovell and Critchley (2010) and Ooi et al. (2014) who argue that population churn reduces the appetite of long-term residents to connect with newcomers. An unwelcome environment may prompt workers who have migrated into the region to move away and become long distance commuters.

Quality service provision, measured by teachers per students and medical practitioners per person, increases the residential attractiveness of a region, as it reduces the extent of LDC into the region (Tonts et al., 2012). Contrary to expectation, the results of this analysis showed that the proportion of dwellings with internet increased the extent of LDC into a region. Perhaps internet availability is not only an indicator of residential attractiveness, but also a solution to the communication problem that arises as a result of LDC, making LDC less problematic.

4.8.4 Alternative employment opportunities

Finally, alternative employment opportunities in the region do not influence the decision to relocate to the region of work or instead adopt LDC into the region.

4.9 Conclusions

Impacts concerning long distance commuting (LDC) have been well researched as LDC is increasingly introduced to meet labour requirements in rural and remote communities. Current research, however, shows no consistency or consensus in how regions may be impacted. Chapman et al. (2015) argue that regional and temporal differences may explain inconsistent results and argue for research that is space and time inclusive. Nicholas and Welters (2016) argue that extra regional differences (causing spatial dependence) may explain inconsistent results and argue for research that controls for spatial dependence. Accordingly, this study represents the first to control for time, space and spatial dependence simultaneously to explain the determinants of the extent of LDC into a region.

Overall, I found that the share of people available but currently without work in the labour force in a region plays no role in the recruitment strategy of companies that typically rely on LDC workers. There is some evidence that such companies include the regional workforce in their recruitment strategies; this study found that an increase in the average age of the workforce increases the uptake of LDC into a region (the mining industry prefers to recruit from relatively younger cohorts). In addition, tight conditions in the regional housing market do not deter workers from relocating to such a region. I argue that their high purchasing power favours them in the housing market relative to local

residents. The availability of rental accommodation also increases the residential attractiveness of a region to workers who are aware that their employment in the region is of temporary nature, hence do not want to commit to buying a house. I also confirm that population churn erodes social capital in regions, making relocation less attractive. Finally, the residential attractiveness of a region increases if education and health provision improve.

Consequently, if the goal is to convince workers to migrate rather than adopt LDC into a host region (and as a result reduce the hollow economy syndrome), policymakers should aim to improve local service provision and/or increase rental accommodation in the host region. The current study further shows that tightness of the labour market and housing affordability are unrelated to the uptake of LDC into a region; hence, should not be priority areas for policymakers who wish to reduce LDC.

Chapter 5 Does social capital help residents cope with the impacts of long distance commuting on their community? The case of Kalgoorlie, Australia

This chapter is a modified version of a research paper submitted to the journal Regional Studies: Nicholas, C., Welters, R. & Murphy, L. Does social capital help communities to cope with long distance commuting? Forthcoming to *Regional Studies*

CHAPTER OUTLINE

5.1 Introduction

This chapter investigates a host community's ability to mediate losses in wellbeing caused by LDC impacts using social capital. Section 5.1 examines literature identifying social capital as a mediator. Section 5.2 provides an overview of the case study area. Section 5.3 explains the research instrument and Section 5.4 describes data collection process, summary statistics and mediation procedure. The results of the mediation procedure are in Section 5.5 and discussed in Section 5.6.

In a cross-sectional study, Chapman et al. (2015) indeed demonstrated that increased exposure to LDC may result in increased stress levels, reduced wellbeing and mental health concerns among residents in the host region. The isolation and harsh climate typically prevalent in host communities amplify the risks associated with wellbeing reductions (Lovell & Critchley, 2010). However, Chapman et al. (2015) also note that regions have unique features that make extrapolation of LDC impacts outside of the area of study difficult. Consequently, research to date struggles to draw general conclusions on how LDC into a host region impacts the wellbeing of the residents of that region.

Nicholas and Welters (2016) showed that circumstances in adjacent regions have an impact on the extent of LDC and hence its impact on a host region. As a result, differences in circumstances in adjacent regions (leading to different spatial interaction effects) may explain why LDC impacts in two otherwise similar host regions vary. Chapman et al. (2015) and Plummer and Tonts (2013) point to temporal effects, highlighting that circumstances in a region (and their characteristics) change over time. Studies that ignore temporal variability may struggle to reconcile diverse LDC impacts in a region over time.

This chapter investigates an alternative explanation; that is, the impact of LDC on wellbeing in a region might depend on circumstances in the host region that cross sectional studies (must) omit. I focus on the potential role of social capital as a mediator between LDC impacts and wellbeing in a host region (Walton et al., 2014). Flint and Luloff (2005, p400) stated "*While community vulnerabilities are real and of consequence, so too are the ability of communities to act*". The ability of a community to embrace change and adapt to external events is an important consideration (McManus et al., 2012). Depending on their adaptive capacity through the use of social capital, the impact of LDC

on an individual's wellbeing in the community may vary. Chapman et al. (2015) acknowledge social capital's potential role as a mediator between LDC impacts and wellbeing outcomes. They attempt to include it in their analysis, but data availability limitations imply their proxies of social capital are rather coarse. They find no strong effects of social capital on wellbeing, but qualify that finding saying

> *However, we would stress that these findings do not necessarily refute the important and positive contribution of human and social capital, but that they leave the question as to its measurement and importance as important areas for further investigation in the context of resource towns* (Chapman et al., 2015, p649).

This study answers that call. It explores the potential mediating role of social capital between LDC impacts in a host region and the wellbeing of the residents of that host region. To achieve the necessary detailed description of social capital, I focus on one host region. I conducted a survey among residents of Kalgoorlie-Boulder, a resource town in Western Australia. I asked residents about their wellbeing, perceptions about their social capital and impacts of inbound LDC on their town.

Social capital is generally categorised into three levels; bonding, bridging and linking. Bonding capital covers networks between individuals who are similar in demographic characteristics and/or ideologies (Besser, 2013). These close networks are inward looking (Poortinga, 2012), creating strong networks but are confined to an individual's social group (Smith et al., 2012). Bridging capital covers networks between heterogeneous individuals (i.e. people with different characteristics and ideologies) at similar authority levels. These networks can be used to obtain resources that would otherwise be unavailable to an individual (Kawachi et al., 2008). Linking social capital describes the networks between individuals of differing levels of authority (i.e. between the community and government) (Poortinga, 2012). Communities with strong levels of each type of social capital enjoy inclusion, cooperation and trust between all social groups, which increases subjective wellbeing in the community (Smith et al., 2012).

The introduction of LDC may affect the relationship between wellbeing and social capital in two important ways. First, the introduction of LDC into a community involves an influx

of people (usually) of a different demography, which erodes (especially bridging) social capital in the community (Tonts & Plummer, 2012). The high turnover of LDC workers further reduces the appetite of local residents to build (bridging) social capital with LDC workers (Lovell & Critchley, 2010). Second, all three types of social capital can mediate the relationship between LDC impacts and subjective wellbeing. Bonding social capital can mediate between LDC impacts and subjective wellbeing through its potential to (1) empower the community or individuals within that community to stand up against what they consider unjust (i.e. the overuse of LDC in their community) (Babaei, Ahmad, & Gill, 2012) or (2) be a survival tool (i.e. the individual may share their concerns with other equally affected community members) (Kawachi et al., 2008). Bridging social capital can serve as a mediator between LDC impacts and subjective wellbeing through its potential to produce civic engagement (Besser, 2013). Linking social capital may provide access to those (in)directly involved in LDC decision-making (leading to a better understanding of or changes to LDC decisions) and consequently serve its role as a mediator (Hawkins & Maurer, 2010). Therefore, relative strengths of bonding, bridging and linking social capital can influence the impacts of the challenges imposed on communities (Besser, 2013), for example as a result of inbound LDC. Importantly, residents need not actively use their social capital for it to play this mediating role. The sheer presence of social capital provides residents with the ability to use it. That ability in itself may mediate the relationship between LDC and subjective wellbeing.

Consequently, there is not only a theoretical rationale for hypothesising that social capital may act as a mediator between LDC and subjective wellbeing, the established empirical links between (1) LDC and subjective wellbeing, (2) social capital and subjective wellbeing, and (3) LDC and social capital also allow us to empirically test the mediation role of social capital.

The structure of this chapter is as follows: it starts with a description of the case study area with a focus on the local and inbound workforce. Subsequently, it provides details of the survey instrument containing descriptions of variables measuring subjective wellbeing, perceived impacts of LDC and mining and perceptions about social capital. The study proceeds with the data collection process and mediation analysis followed by the results, discussion and conclusions, which complete the study.

5.2 Town of Kalgoorlie-Boulder case study

Matsushima and Matsunaga (2015, p1019) caution that '*different aspects of social capital affect one's subjective wellbeing differently'*. Hence it is important to choose a methodology that provides the necessary level of detail and context specific to wellbeing and social capital measurements (Fisher, 2013; Kristoffersen, 2010). A study relying on aggregate regional data does not provide that level of detail; hence, I opted for a case study approach. I focus on one region instead of several, to avoid the challenges of diverse spatial interaction effects (Chapman et al., 2015; Nicholas & Welters, 2016).

For this study, I investigate the town of Kalgoorlie – Boulder. Kalgoorlie – Boulder is a resource town located in Western Australia, Australia, 600km east of Perth, the state capital. Two main considerations influenced the selection of Kalgoorlie – Boulder. Firstly, the case study region must be a significant host region for LDC workers. According to 2011 Census data, Kalgoorlie – Boulder strongly relies on the mining industry (12.5% of the workforce is affiliated to mining, compared to 1.7% nationwide). Since mining is an important adopter of LDC, the share of LDC in the workforce is also substantial. Four percent of the Kalgoorlie – Boulder workforce are long distance commuters compared to the median for Australian (Local Government Areas) regions of 0.1%[9]. Secondly, my investigation requires variation in key perception variables (social capital, LDC impacts and wellbeing). Chapman et al. (2015) argue that mining towns above 5,500 in population have more complex economic structures and higher-order services, which are likely to provide the variation I require. The population during the 2011 census for Kalgoorlie – Boulder was 23,590 within the city proper and another 8,000 in the surrounding region.

The industry composition of LDC workers was different from the general workforce in 2011 (see Figure 5-1). Mining and construction industries are typically associated with LDC; however, they only constituted 37% and 16% of the total LDC workforce, respectively. Other industries used the remainder of the LDC workforce with health care and retail comprising 8% each. The 2011 LDC workforce composition of Kalgoorlie – Boulder reveals two important features of LDC in Kalgoorlie – Boulder. Firstly, mining

[9] The Australian Census does not report LDC workers. Therefore I used Nicholas and Welters' (2016) method to identify LDC workers, which I applied to Kalgoorlie – Boulder.

was the leading user of LDC which is to be expected within a resource town. Secondly, even if construction is considered closely associated to mining activity, then still nearly half of the LDC workforce is unrelated to the mining industry. Consequently, LDC and mining impacts should be investigated separately.

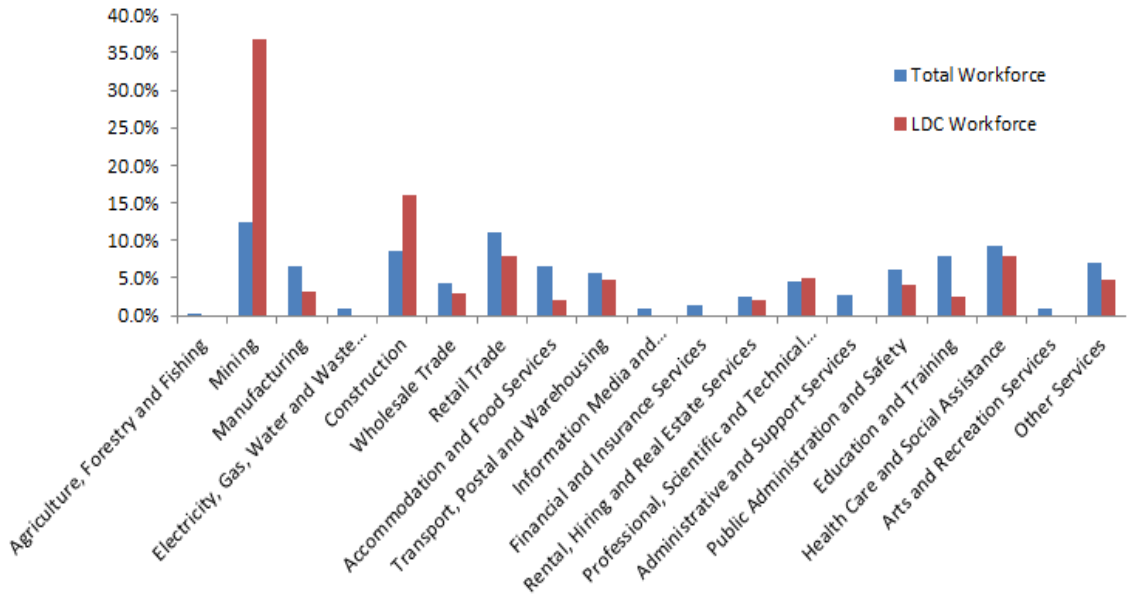

Figure 5-1: Kalgoorlie-Boulder's inbound long distance commuter workforce and total workforce compositions in 2011.

The diversity of industries using LDC as shown in Figure 5-1, may also be reflected in the potential interactions between LDC workers and locals. Mining LDC workers living in work camps further away from Kalgoorlie-Boulder are less likely to interact with (and influence the resident wellbeing of) locals as opposed to LDC workers living nearby or within the town itself. LDC workers in other industries (not associated with mining) are unlikely to stay in work camps, but staying in the town itself, again increasing the potential of interaction with the locals. The potential for interaction is likely to be variable between mining and other sectors, however, the focus of this chapter is to separate mining impacts from LDC impacts.

5.3 Research instrument

I distributed surveys to residents of Kalgoorlie-Boulder (see Appendix C). The survey consisted of four sections; subjective wellbeing, social capital, LDC and mining impacts, and demographics. I used screening questions to remove non-residents from the survey.

I measured subjective wellbeing using a single 'life satisfaction' metric, with the demographic questions acting as controls. I separated LDC and mining impacts to try to distinguish between the two. Social capital questions identified potential and actual social networks that respondents use. I further divided them into the three types of social capital (bonding, bridging and linking).

5.3.1 Subjective wellbeing and controls

While no universal metric exists for subjective wellbeing (Kristoffersen, 2010), life satisfaction and happiness measurements are common proxies (Matsushima & Matsunaga, 2015). Therefore, I asked respondents to which extent (on a scale from zero to ten) they agreed to the following statement 'All things considered, I am satisfied with my life'. However, measuring subjective wellbeing in isolation does not provide enough context for an analysis. The literature has identified a list of control variables to contextualise subjective wellbeing measures. It is common practice to see the following variables: employment status, gender, age, relationship status, health, children, education and income (Cummins, 2007; Dolan, Peasgood, & White, 2008; Larson, 2010; Matsushima & Matsunaga, 2015; OECD, 2013; Poortinga, 2012) in subjective wellbeing studies. I measured health using an eleven point Likert Scale, zero indicating bad health and ten good health.

5.3.2 Long distance commuting and mining impact variables

As LDC is only 37% mining (or 53% if one includes construction), this study attempts to distinguish between mining and LDC impacts. The literature distinguishes a diverse set of impacts that mining can have on a region. Mining can provide financial opportunities within host communities in related industries but deficits in others (Fleming & Measham, 2015b). Rolfe, Miles, Lockie, and Ivanova (2007) described economic stimulus in mining support industries in the Bowen Basin Region in Australia from 2004 – 2006. Overall, mining contributed positively to the Bowen Basin; however, the unavailability of housing and infrastructure pressures offset some of that contribution. Tonts and Plummer (2012) describe increased infrastructure (like roads and communication infrastructure) maintenance as a result of mining industry activity, for which the industry does not contribute adequately, leading to higher council rates. Higher costs of living are a common occurrence in resource towns (Lawrie et al., 2011). On the upside, the mining

industry makes significant contributions to social infrastructure, such as community centres and sporting clubs (SCRA & Windsor, 2013). To capture these possible mining impacts I asked residents to rate (on a scale from zero [strongly disagree] to ten [strongly agree]) six statements, as presented in Table 5-1.

I distinguish LDC impacts from mining impacts with questions that focused on the LDC workers regardless of the industry that employed the LDC worker. The literature distinguishes a set of impacts that LDC can have on a host region. Chapman et al. (2015), relating to the 'social disruption thesis', describe social dysfunction and reductions in social networks (social capital) when a community changed quickly (demographically and/or economically) (Carrington et al., 2012). I expect that respondents will not view LDC workers as an opportunity to expand their social networks. LDC workers are less likely to spend their wages within Kalgoorlie – Boulder, hence creating a 'hollow economy' (McKenzie, 2010; SCRA & Windsor, 2013). This effect would be compounded if the LDC workers themselves felt isolated from the community (SCRA & Windsor, 2013). Industry behaviour can also influence the attitudes of residents. Simply meeting government regulations is no longer sufficient for industries that use a large amount of LDC; it is now necessary to obtain a 'social licence' from residents of nearby communities (Zhang & Moffat, 2015). Residents may form unfavourable attitudes towards LDC if firms are perceived to not fully exploit other recruitment options before using LDC. I included four statements in the survey relating to these potential LDC impacts – see Table 5-1.

5.3.3 Social capital variables and controls

There is a broad array of indicators proposed to measure the different dimensions of social capital. Ryser and Halseth (2010) note that these dimensions need to investigate both the strength and quality of the social networks. I based the dimensions of each type of social capital used in this study on Poortinga (2012).

I divided bonding social capital into two dimensions: strength of social networks and neighbourhood social cohesion. I encouraged residents to consider themselves and their close social networks, rating statements about their friends, family and local neighbourhood. I divided bridging social capital into two dimensions: bridging social

cohesion and heterogeneous relationships. I asked the residents how they fitted into Kalgoorlie – Boulder as a whole, with statements about attachment, belonging and trust towards the whole community. I divided linking social capital into three dimensions; political participation, political efficacy and political trust. With a focus on individuals with authority and power over residents, I asked residents about the effectiveness of local council and state government in dealing with the current mining boom slowdown. I asked residents to rate (on a scale from zero [strongly disagree] to ten [strongly agree]) all statements, as presented in Table 5-1.

I added the length of time the respondents had lived in Kalgoorlie – Boulder to the survey as a social capital control variable. In a town with high rates of population turnover, residents may develop an emotional fatigue towards creating friendships with new residents (Lovell & Critchley, 2010). The result is a breakdown of relationships between temporary and permanent residents, which also reduces trust between the groups (Bertotti et al., 2012). Length of residence increases the (length of) exposure to population turnover. Alternatively, selection effects may warrant the inclusion of length of residence as a control variable. Residents, whose wellbeing is adversely affected by circumstances in Kalgoorlie – Boulder, are more likely to move out. To those that decide to stay (and become long-term residents), circumstances in Kalgoorlie – Boulder more likely contribute positively to wellbeing.

5.4 Data collection and analysis

I distributed the survey through Kalgoorlie – Boulder from December 2015 to March 2016. Cognisant of the difficulty of attaining a sufficiently large sample size to complete my analysis in a remote region, I used two approaches to distribute the survey, I contacted: (1) local council and community groups and asked to distribute an online survey to their members – I recruited 121 valid respondents (respondents who were at least 18 years old and a resident of Kalgoorlie – Boulder) by using this approach; (2) potential respondents face-to-face at different locations across Kalgoorlie – Boulder (including parks, community events, Hannan Street (the main street) and the Kalgoorlie Central Shopping Centre) – I recruited 96 valid respondents using this approach. From the 217 valid responses, 150 respondents completed all relevant parts of the survey, hence were

included in the mediation analysis.[10] I include a dummy variable distinguishing the two respondent recruitment approaches in all my models and dummy variables measuring whether the respondent themselves (residing in Kalgoorlie – Boulder) or any of their friends/relatives are long distance commuters, which – if yes – may perhaps shape their views about LDC impacts.

I used the Kaiser criterion (eigenvalue greater or equal to one) and Cronbach's alpha (alpha > 0.7) to identify statements appropriate for grouping, for which I then used principal component analysis to determine factor loadings. For full details on the principal component analysis, please refer to Appendix D. The 'groups' column in Table 5-1 shows the results of this analysis. Perception variables that were statistically inappropriate for grouping, remain separate in the mediation analysis, hence the term 'separate' in Table 5-1.

Table 5-1 displays the demographic profile of respondents and their perceptions about mining, LDC and social capital. The average respondent lived for 15 years in Kalgoorlie – Boulder; was 44 years old and considered themselves in good health. The respondents were gender balanced, the majority married and half had dependent children. Four out of five (120) respondents were employed; one third (50) were/are an (outbound) long distance commuter themselves; three quarters (113) knew friends or family who were long distance commuters, which highlights the pervasiveness of the practice in the town. Respondents confirm the positive contributions that mining makes to themselves and their town; however, cost of living concerns as a result of mining also resonate with respondents. Respondents affirm the negative impacts of LDC on the town and industry's alleged overuse of the LDC practice. In terms of bonding social capital, respondents

[10] Non-response was scattered across many variables; not any variable in particular. The three variables with the highest incidence of non-response (annual household income, education and 'opinion about the current Kalgoorlie – Boulder population') jointly accounted for a quarter of non-response. Leaving these three variables out of the mediation analysis, did not change the conclusions of that analysis. Additionally, I compared the 37 statement scores on the key variables (subjective wellbeing, LDC and mining impacts, and social capital) in the mediation analysis between those who returned fully completed surveys (150) and those who returned partially completed surveys (67). I found a statistically significant difference between both groups for only one variable ("I regularly have social interactions with work colleagues"), suggesting the non-response was random.

report strong interactions with family and friends, but a mixed picture emerges with respect to the social cohesion of their neighbourhood. Respondents report strong bridging social capital within the town, but question the effectiveness of their linking social capital – especially re the political decision making process.

Table 5-1: Summary statistics and statement groupings

Dependent variable	Groups	Mean	S.E.
Subjective wellbeing			
All things considered, I am satisfied with my life		7.6	1.53
Independent variables of main interest			
Mining impacts			
Positive mining contributions (A.1 – 4: Cronbach α = 0.78)†			
Kalgoorlie – Boulder is better off financially because of the mining industry	A.1	8.39	1.97
I am better off financially because of the mining industry	A.2	7.35	2.94
Mining has helped improve social infrastructure such as community centres and sporting clubs in Kalgoorlie – Boulder	A.3	6.91	2.51
Mining has helped improve communication and information technology infrastructure in Kalgoorlie – Boulder	A.4	6.15	2.72
Negative mining contributions			
Council rates are higher because of mining activity	Separate	5.77	2.89
The cost of living, excluding housing, has increased because of mining activity	Separate	6.8	2.81
LDC impacts			
Positive LDC contributions (B.1 – 2: Cronbach α = 0.70)†			
The presence of LDC workers in Kalgoorlie – Boulder provides an opportunity to extend my social network	B.1	3.78	2.69
LDC workers contribute enough to the local economy	B.2	3.79	2.87
Negative LDC contributions (C.1 – 2: Cronbach α = 0.76)†			
I think industry in Kalgoorlie – Boulder turns to LDC workers too quickly, that is, before trying to hire locally	C.1	6.86	2.77
There are already too many LDC workers in Kalgoorlie – Boulder	C.2	6.39	2.93
Bonding social capital			
Strength of social networks			
I regularly have social interactions with family members	Separate	7.05	3.39
I regularly have social interactions with friends	Separate	7.46	1.99
Neighbourhood social cohesion (D.1 – 5: Cronbach α = 0.87)‡			
I regularly have social interactions with neighbours	D.1	3.93	3.24
People in my neighbourhood can be trusted	D.2	6.20	2.44
I feel like I belong in my neighbourhood	D.3	6.71	2.60
My neighbourhood is close knit	D.4	4.82	2.84

People in my neighbourhood in Kalgoorlie – Boulder are friendly	D.5	6.44	2.51
Bridging social capital			
Bridging social cohesion (E.1 – 4: Cronbach α = 0.89)‡			
Overall, I am satisfied with opportunities for social interaction in Kalgoorlie – Boulder	E.1	6.91	2.05
I feel that I belong to this community (i.e. Kalgoorlie – Boulder)	E.2	7.55	2.38
After being away from Kalgoorlie – Boulder for a short period of time, I am pleased to return	E.3	6.99	2.81
Overall, I feel very attached to Kalgoorlie – Boulder	E.4	7.31	2.71
'Every person for themselves' is a good description of people in Kalgoorlie – Boulder	Separate	4.33	2.69
I regularly have social interactions with work colleagues	Separate	5.54	2.78
My social connections outside of Kalgoorlie – Boulder are equally important to me as my local social connections inside	Separate	7.01	2.26
Heterogeneous relationships			
Most of my friends have similar incomes to me	Separate	5.48	2.48
Residents of Kalgoorlie – Boulder are receptive to new residents in leadership positions	Separate	5.63	2.26
Linking Social Capital			
Political participation (F.1 – 3: Cronbach α = 0.70)‡			
Local residents are willing to have a united voice on issues affecting Kalgoorlie – Boulder	F.1	6.88	2.08
Local residents are able to influence decisions affecting their neighbourhoods	F.2	5.94	2.34
Key people in Kalgoorlie – Boulder are right for the job	F.3	5.52	2.28
Political efficacy (G.1 – 6: Cronbach α = 0.85)‡			
State Parliament balances the needs of both residents and industry in Kalgoorlie – Boulder	G.1	4.01	2.67
There is good planning for the future of Kalgoorlie – Boulder	G.2	5.10	2.45
Kalgoorlie-Boulder will be able to support volunteer community organization in the future	G.3	5.56	2.45
Key stakeholders work together to address problems associated with mining/LDC opportunities	G.4	5.19	2.51
Key stakeholders work together to take advantage of mining/LDC opportunities	G.5	5.43	2.36
Overall, I am satisfied with the way Kalgoorlie – Boulder is responding to the slowdown of the mining	G.6	4.96	2.61
Political trust			
The local police are trustworthy	Separate	7.39	2.20
The local council has the best interests of residents at heart	Separate	5.66	2.75
Independent variables (controls)			
Age		43.69	13.90
Health		8.19	1.35
Education:			
• High school		0.35	0.48
• Diploma		0.15	0.36
• Certificate 3		0.19	0.39
• University		0.31	0.47

Relationship:		
• Single (never married)	0.15	0.35
• Single (widowed, separated/divorced)	0.11	0.31
• Married	0.60	0.49
• Defacto	0.15	0.35
Opinion about the current Kalgoorlie – Boulder population:		
• Needs to be smaller	0.04	0.20
• Just right	0.23	0.42
• Needs to be bigger	0.73	0.45
Gender (1 if male)	0.47	0.50
Any dependent children (1 if yes)	0.55	0.50
Currently employed (1 if yes)	0.82	0.39
Annual household income above $100,000 (1 if yes)	0.66	0.48
Current/ past long distance commuter (whose home region is Kalgoorlie – Boulder) (1 if yes)	0.31	0.45
Friends and/or family are long distance commuter (1 if yes)	0.73	0.44
Time lived in Kalgoorlie – Boulder (in years)	15.05	6.61
Data collection method (1 if manual)	0.39	0.49

Note: See Appendix D for full details on the factor analysis that lead to the groupings † (Tables D 1 and D 2) and ‡ (Table D 3).

5.4.1 Mediation analysis

To determine how social capital influences the relationship between subjective wellbeing and LDC and mining impacts, I use a mediation analysis. This type of analysis consists of three regression models. Model 1 establishes a link between subjective wellbeing and LDC and mining impacts (known as the reduced model). It includes all control variables except the set of social capital variables. Model 2 verifies the link between social capital (mediator variable) and LDC and mining impacts. Model 3 adds the social capital variables to Model 1 (known as the full model) to verify how the addition of the mediator(s) affects the relationship between subjective wellbeing and LDC and mining impacts, for which I used Preacher and Hayes (2004) mediation with bootstrapping method. This method is recommended for small sample sizes. I only included independent variables in the regression / mediation analyses, which were statistically significant at the ten per cent level. Since subjective wellbeing is an ordinal variable, I used an ordinal logit specification to conduct the mediation analysis.

I used Kohler et al. (2011) Stata user-written program 'KHB' to implement the mediation procedure. I chose this procedure, because it standardises the variables in the model allowing mediation with variables of different scales. It also allows the mediation of ordinal logit models that include categorical independent variables and controls. I used bootstrapping-created confidence intervals to test whether the inclusion of mediating variables significantly influences the relationship of LDC and mining impacts to subjective wellbeing. I applied ten per cent rather than five per cent confidence intervals to accommodate for the possibility that the small sample size obscured statistically significant effects. Karlson and Holm (2011) showed through comparisons of mediation methods that skewed data least influenced bootstrapping results. Furthermore, the full model used in the mediation analysis can be interpreted separately to discern direct relationships between dependent and independent variables.

5.5 Results

Results in Table 5-2 show the direct effect of mining and LDC impacts on subjective wellbeing (reduced model – first column). I find that mining impacts positively on subjective wellbeing. That is, positive mining contributions increase subjective wellbeing, whilst most of the negatives of mining have no statistically relevant link to subjective wellbeing. Albeit, I find a small positive effect for the cost of living variable, perhaps measuring the wealth effect of increasing house values for home owners. I find the reverse for LDC impacts. The positives that LDC brings, do not affect subjective wellbeing in a statistically significant manner; the negatives associated with LDC have a negative impact on subjective wellbeing. The three middle columns in Table 4 show the relationship between the three mediator variables (selected because of their statistical importance in the full model – final column) and LDC and mining impacts. I observe that (1) cost of living increases positively associate with family interaction (people bond together when circumstances get tough), (2) positive mining contributions positively associate with social cohesion (benefits are spread across the community reinforcing bridging capital), (3) negative LDC contributions negatively associate with social cohesion (fractionalising the community; reducing bridging capital), and (4) positive LDC contributions positively associate with the importance of non-local social networks (using LDC workers to extend (or bridge) social networks outside Kalgoorlie – Boulder).

Table 5-2: KHB full and reduced model

	Model 1		Model 2		Model 3
	Subjective wellbeing	Family interactions	Bridging social cohesion	Local/outside social network	Subjective wellbeing
Mining Impacts:					
Positive mining contributions (A.1 – 4)	0.40 (0.11)***		0.28 (0.08)***		0.25 (0.11)**
The cost of living, excluding housing, has increased because of mining activity	0.10 (0.06)*	0.10 (0.06)*			0.02 (0.06)
LDC Impacts:					
Positive LDC contributions (B.1 – 2)				0.28 (0.14)**	
Negative LDC contributions (C.1 – 2)	-0.23 (0.12)*		-0.15 (0.09)*		-0.12 (0.13)
Control Variables:					
Age			0.02 (0.008)***	0.03 (0.01)**	
Health	0.65 (0.11)***		0.18 (0.09)**	0.27 (0.12)**	0.48 (0.12)***
Education:					
- High School		reference	reference		
- Diploma		-0.01 (0.47)	0.77 (0.35)**		
- Certificate 3		-0.05 (0.44)	0.16 (0.33)		
- University		-0.90 (0.39)**	0.72 (0.29)**		
Relationship:					
- Single (Never Married)				reference	
- Single (Widowed, Separated/Divorced)				-1.10 (0.65)*	
- Married				-0.95 (0.46)**	
- Defacto				-0.31 (0.56)	
Opinion of current Kalgoorlie – Boulder population:					
- Needs to be smaller		reference	reference		
- Just right		1.49 (0.86)*	-1.27 (0.62)**		
- Needs to be bigger		1.12 (0.81)	-1.18 (0.58)**		
Any dependent children (1 if yes)	-0.40 (0.30)				-0.58 (0.31)*
Currently/ past employed (1 if yes)	-0.92 (0.41)**	-0.90 (0.42)**			-0.39 (0.44)
Time lived in Kalgoorlie – Boulder (in years)	0.07 (0.02)***			-0.07 (0.02)***	0.02 (0.03)
Data collection method (1 if manual)				0.71 (0.37)*	
Bonding Social Capital:					
I regularly have social interactions with family members					0.12 (0.05)**
Bridging Social Capital:					

Bridging Social Cohesion (E.1 – 4)					0.69 (0.13)***
My social connections outside of Kalgoorlie – Boulder are equally important to me as my local social connections					0.22 (0.07)***
Constant			-2.61 (1.03)**		
Number of observations	150	150	150	150	150
LR χ^2	(7) 61.46	(9) 38.80		(8) 35.35	(10) 108.42
Prob > χ^2	0.00	0.00		0.00	0.00
Pseudo R^2	0.12	0.06		0.06	0.20
Log likelihood	-235.64	-284.18		-294.31	-212.15
Approximate Likelihood test of proportionality of odds†	(49) 64.04*				(70) 70.02
F value			(11, 138) 7.27		
Prob > F			0.00		

Note: *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level. The first and third regression in Model 2 are ordinal probit regressions; the second regression is an OLS regression. Only statistically significant variables (at 10% level) included in the analysis for Model 2; variables that are statistically significant (at 10% level) in either Model 1 or Model 3 are included in both models. The correlation matrix of independent variables and variance inflation factor analysis suggest that multicollinearity is not a concern in the models. † The proportional odds assumption is violated (at 10% level) for the reduced model. Closer inspection reveals that this is mainly a result of the 'any dependent children' variable, which is not a variable of main interest in my model.

The final column of Table 5-2 shows the full model, which should be compared to the reduced model. I observe changes to the coefficients of Mining and LDC impacts, suggesting mediation effects of social capital. I conduct mediation with bootstrapping to verify the statistical significance of the mediation effects. Bootstrapping for mediation (Table 5-3) shows insufficient evidence of mediation – the 90% confidence intervals contain zeros. This indicates that the inclusion of social capital variables does not influence the relationship between subjective wellbeing and perceived impacts of mining and LDC in a statistically meaningful way.

Table 5-3: KHB mediation

	Mediation test
	Coefficient (90% bootstrapping confidence intervals)
Mining Impacts:	
Positive Mining Contributions	-1.92 (-4.38 to 0.53)
Negative Mining Contributions:	
The cost of living, excluding housing, has increased because of mining activity	3 (-1.58 to78.58)
Long Distance Commuter Impacts:	
Negative LDC Contributions	-1.79 (-3.90 to 0.31)

Note: Only statistically significant variables (at 10% level) included in the analysis (same variables as included in Models 1 and 3 in Table 5-2).

5.6 Discussion and Conclusions

This study investigated whether residents of a host region use social capital to mediate the impacts of inbound LDC on their subjective wellbeing. To complete that investigation, I required detailed information on residents' social capital, LDC impacts and (closely associated) mining impacts. The only practical way to achieve that level of detail is to conduct a limited number of case studies and since I wanted to rule out the effect of spatial correlation (see Nicholas and Welters, 2016), I restricted the analysis to one case study in a region that experiences considerable inbound LDC: Kalgoorlie-Boulder, Australia.

To ascertain the potential mediating role of social capital on the link between LDC impacts and subjective wellbeing, I first had to disentangle LDC and mining impacts, which are typically intertwined. Results from my principal component analysis suggest that respondents to my survey successfully distinguished between mining and LDC impacts. The latter had a negative association to subjective wellbeing (specifically the industry's perceived overuse of LDC workers), which is in line with McKenzie (2010) and Zhang and Moffat (2015). The former had a generally positive association to subjective wellbeing, which is in line with some (Rolfe et al., 2007), but not all literature (Hajkowicz et al., 2011; Lawrie et al., 2011; Tonts & Plummer, 2012). One possible reason for this is that Kalgoorlie-Boulder and other regional communities in Western Australia benefit from the 'Royalties for Regions' program. This scheme is a driver of growth in Western Australia's rural communities as it reinvests 25 percent of mining royalties (SCRA & Windsor, 2013). Consequently, Kalgoorlie-Boulder residents would see comparatively more investment into their community from mining revenues compared to other states in Australia.

To meet the required level of detail with respect to social capital, I differentiated between bonding, linking and bridging social capital. Only variables from the bonding and especially the bridging domain are (positively) associated to subjective wellbeing – in line with the literature (Besser, 2013; Hawkins & Maurer, 2010; Hellerstein et al., 2014). The importance of bridging capital in rural settings has been noted before, as it provides access to resources, training and personnel outside the community (Ryser & Halseth, 2010).

The mediation analysis, however, demonstrated no statistically significant effect of the presence of social capital on the relationship between LDC impacts and subjective wellbeing. Hence, I do not confirm Walton et al.'s (2014) and Chapman et al.'s (2015) hypothesis that social capital plays that mediating role. By extension, my results indicate that not including social capital or including coarse measures of social capital in studies of the impact of LDC on wellbeing is not the reason why findings of such studies cannot be extrapolated outside the confines of the study area.

However, alternative explanations for my findings may exist. First, Harrison, Montgomery, and Bliss (2016) for example argue that bridging social capital is

ineffective at helping residents to adapt to shocks in their communities, if linking social capital is not present. This argument seems particularly relevant to my case. Decisions to use an LDC workforce or the extent of that workforce – especially in the mining industry – are not made in the region. Mining companies are part of global networks, whose headquarters are in urban centres, who may view "*resource regions ... as a reserve of latent wealth that can be drawn upon for the benefit of the urban 'core'* " (Tonts et al., 2013, p365). The linking social capital that residents of Kalgoorlie-Boulder have access to (and which I identified in this study), may not have the capacity (or willingness) to influence decision making around the appropriate size of the LDC workforce. For example, Carrington et al. (2012) found that communities blamed industry and political leaders (linking social capital) for what they perceived as the favouritism for short sighted economic gains over longer-term social gain. I find some evidence for the limited efficacy of linking social capital, to which residents in Kalgoorlie-Boulder have access. Respondents rate statements related to political efficacy of their linking social capital low, hinting at the ineffectiveness of their linking social capital to address resident concerns. Perhaps it is the ineffectiveness of the linking social capital to which residents have access, which stops linking social capital from acting as a mediator between LDC impacts and subjective wellbeing.

Second, the survey was conducted in the midst of an economic downturn in the mining industry. Consequently, it is likely that the size of the LDC workforce at time of data collection and associated LDC impacts on the host region decreased from the levels at the peak of the mining boom in 2013. If levels of perceived exposure were higher previously, perhaps residents are no longer compelled to discuss LDC among their social networks in today's environment. It is therefore worthwhile to conduct a similar survey during an economic upturn of the industry to explore whether the change in LDC impact matters to the mediating role of social capital on the link between LDC impacts and subjective wellbeing.

Chapter 6 Exploring the dimensions of social capital that are effective mediators of long distance commuting impacts on wellbeing in Kalgoorlie-Boulder.

CHAPTER OUTLINE

6.1 Introduction

There has been a recent increase in research investigating the potential of social capital to better understand the impacts associated with long distance commuting (LDC) on wellbeing in resource communities in Australia (Chapman, Plummer, & Tonts, 2015). Resource communities can experience a variety of social and economic impacts of LDC (Petkova et al., 2009) including a fly-over effect, hollow economic syndrome and fractionalisation of the community (McKenzie, 2010; SCRA & Windsor, 2013; Storey, 2010; Tonts & Plummer, 2012). Social capital may provide the bridge between sociological and economic perspectives by attempting to describe the hidden mechanisms that shape social interactions (Woolcock & Narayan, 2000). Hence, its inclusion is warranted in research investigating the impact of LDC on resource communities.

The search for variables—such as social capital—that may explain the impact of LDC on resident wellbeing in resource communities is important, since that link is not well understood in the current literature (Nicholas & Welters, 2017), particularly in regards to large industry projects (Phelan, Dawes, Costanza, & Kubiszewski, 2017). That is, rural and remote communities, exposed to the sociological disruption caused by LDC (or mining more generally) do not experience similar effects. Instead, researchers have found communities react differently making extrapolation of findings difficult (Chapman et al., 2015; Lawrie et al., 2011; McDonald et al., 2012). In an attempt to understand disparate findings, recent literature has focused on the unique spatial and temporal factors imposed upon resource communities. McDonald et al. (2012) highlighted the importance of a region's location and Nicholas and Welters (2016) found that spatial interactions between neighbouring communities should be considered. Chapman et al. (2015) and Plummer and Tonts (2013) found that the communities themselves (and presumably their spatial interactions) change over time. Nicholas and Welters (2017) built on these studies to incorporate both spatial and temporal interactions in their analysis.

Differing levels of social capital may constitute an additional reason why LDC impacts on resident wellbeing in otherwise similar resource communities vary. That is, resource communities can mediate some of the impacts associated with LDC if they are proactive (Ruddell & Ortiz, 2015). Besser (2013) describes social capital as a potential mediator used by residents to anticipate and react to impacts resulting in strong community

resilience. The social capital framework has contributed to community resilience literature by describing the resources within the social networks of individuals/communities and their ability to be mobilised and used (Smith et al., 2012). I theorised this 'ability to act' as individuals using their social capital to mediate the impacts of LDC on their wellbeing. Without the ability to acquire and/or mobilise their social capital, residents are more likely to experience reductions in wellbeing (Poortinga, 2012).

Whilst the literature has addressed social capital and community resilience in resource communities, there has been little research on the mediation role that social capital plays between LDC impacts and resident wellbeing. Chapter 5 investigated the mediation role of social capital between LDC impacts and resident wellbeing and found no such role despite its theoretical potential to serve as a mediator. Consequently, this chapter explores possible reasons why social capital does not serve as a mediator between LDC impacts and resident wellbeing in the resource community of Kalgoorlie-Boulder. Survey data discussed in Chapter 5 provided a measure of social capital within the region, follow up qualitative group interviews provide a greater insight into the 'mechanics' of social capital in Kalgoorlie-Boulder. In the group interviews I explore Kalgoorlie-Boulder residents to explore perceptions of LDC impacts on wellbeing and social capital's (in)ability to mediate these impacts.

I structured the chapter as follows. Section 6.2 investigated LDC impacts through a social capital framework. Section 6.3 described the case study area whilst Section 6.4 described the data collection and analysis procedure. The Leximancer results in Section 6.5 are discussed in Section 6.6.

6.2 LDC impacts through a social capital lens

Examining LDC impacts on resource communities through the lens of social capital can help to understand how socio-cultural dynamics within a resource community influence the perceived impacts of LDC on resident wellbeing (Phelan et al., 2017). Social capital is characterised by the trust and altruism between individuals of a social group. Woolcock and Narayan (2000, p225) summed up social capital as "*it's not what you know, it's who you know"*. The literature has generally categorised social capital into three levels;

bonding, bridging and linking. Bonding social capital consists of relatively small groups of close individuals with similar ideologies and/or demographic characteristics (Besser, 2013). The internal structure of bonding social capital becomes important and the relationships outside of their social groups become less influential (Adler & Kwon, 2002). Bridging social capital refers to networks between individuals of diverse groups (i.e. different ideologies) (Besser, 2013). On a community level this enables connections with outside actors that provide opportunities and resources that would have otherwise been inaccessible (Smith et al., 2012). The use of linking social capital is a recent inclusion in the literature so there is limited knowledge on the subject (Poortinga, 2012). Unlike bonding and bridging social capital, which are focused on horizontal relationships, linking social capital refers to vertical relationships (networks between individuals of unequal authority) (Babaei et al., 2012). Hawkins and Maurer (2010) describe linking social capital as underutilized but far reaching, it has the most associated benefit, because of the connections with people in positions of power.

Communities with strong levels of social capital benefit from high degrees of trust and inclusion (Smith et al., 2012) which, during and after shocks allow communities to maintain their level of wellbeing (Besser, 2013). According to the literature, the three types of social capital can mediate the relationship between LDC impacts and resident wellbeing. Bonding social capital can empower individuals/ groups and be a survival tool. Bridging social capital can enhance civic engagement and can promote unity against industry and government. Linking social capital can influence LDC decision making, directly.

The relative strengths of bonding, bridging and linking social capital can influence how LDC impacts individuals in a resource community. If one type of social capital is relatively weaker than the rest, negative impacts such as dependence and fractionalisation can occur (Woolcock & Narayan, 2000). The utilisation of bonding social capital occurs in conjunction with bridging and linking social capital, or when these other forms of social capital are ineffective (Besser 2013). Bonding social capital is the most influential for promoting empowerment of both the community and individuals within that community (Babaei et al., 2012). The residents of resource towns often perceive a conflict between their long term social gain against the short term economic gain of industry (and sometimes government) (Carrington et al., 2012). In these cases bonding social capital

is used as a survival tool, using shared resources provides better survival odds than trying to survive alone (Kawachi et al., 2008). Furthermore, Besser (2013) describes that leveraging bonding social capital can be very effective at motivating individuals within a community to become active members of that community.

Bridging and linking social capital are used to obtain resources that would otherwise be unavailable to an individual (Kawachi et al., 2008). On a community level, bridging social capital enables connections with outside actors that provide opportunities and resources that were inaccessible (Smith et al., 2012). Within rural communities these networks provide information, training, and resources that are perhaps only available in cities (Ryser & Halseth, 2010). After and during major disruptions to communities (i.e. influx of LDC workers), Besser (2013) found bridging social capital in the form of civic engagement was most effective at improving post-shock wellbeing of residents. For example, within resource towns, disenfranchised residents can band together against the industry and political leaders. The act of banding together in itself can be beneficial to a community's wellbeing. An influx of LDC workers does not need to be a major disruption (causing fractionalisation). Integrating LDC workers within the community could offer both the LDC workers and local residents the opportunity to increase their engagement. The use of linking capital is also important for individuals who are disadvantaged hence must rely on people in positions of power to improve their wellbeing (Babaei et al., 2012). However, too much reliance on bridging and linking social capital (along with weak bonding social capital) can lead to a dependency on government services (i.e. welfare).

It is important to note, that the relationship between social capital and LDC need not be unidirectional. LDC itself may impact social capital in a community. Bell (2009) describes the demise of bonding social capital in communities in the West Virginia Coalfields. Without trust amongst residents, there was no united front to oppose the wishes of industry and government. Additionally, the LDC practice may influence a community's bridging social capital. That is, temporary LDC workers are part of a community's bridging social capital network and as a result, residents have to continuously make new friends in order to associate with them. Over time, residents can develop an emotional fatigue where they start to avoid LDC workers (Lovell & Critchley, 2010), thereby eroding the bridging social capital of the community (Nicholas & Welters,

2017). The situation is amplified by typical 12 hour work shifts, which undermine the potential for social interaction between locals and LDC workers (McKenzie, 2010). Furthermore, the LDC workforce often differs demographically from residents, with LDC workers typically 'single' men with limited education and training (Petkova et al., 2009). Gradually the LDC workers and residents segregate, creating the 'us versus them' mentality (SCRA & Windsor, 2013). This leads to fractionalisation of the community, potentially leading to conflict, but in any case reducing bridging social capital.

6.3 Kalgoorlie-Boulder, resource town case study

The resource town of Kalgoorlie-Boulder is located 600km east of Perth, in Western Australia and according to 2011 census data, has a population of 30 840, with 21 percent of the workforce affiliated with mining, compared to the Australian average of 1.7 percent. Located on the 'golden mile', the extraction of mineral wealth, most notably gold, has been ongoing since the metals discovery in the late 19th century. Currently the KCGM 'super pit', a 3.5km long, 1.5km wide, and 600 metres deep hole dominates the landscape. Whilst this mine does not employ FIFO practices, the numerous smaller mines in the surrounding area do. The 2011 census indicated that four percent of the Kalgoorlie-Boulder workforce used LDC practices. Within Australia, the use of LDC is commonly associated with the mining industry (Carrington et al., 2012). In Kalgoorlie-Boulder, this perception has some merit with 37 percent of the LDC workforce accounted for by mining, whilst construction accounts for 16 percent and other industries not more than eight percent each. The composition of LDC within Kalgoorlie-Boulder is similar to Australia, with over 50 percent of LDC not related to mining (Skilton, 2015), and therefore, it would be prudent to distinguish between mining impacts and LDC impacts.

6.4 Methods

6.4.1 Study Design

The survey consisted of seven sections; demographics, perceptions of mining, perceptions of LDC, satisfaction with life in Kalgoorlie-Boulder, social networks, social capital in Kalgoorlie-Boulder, and perceptions about the future of Kalgoorlie-Boulder (see Appendix C for survey). In total, I collected 217 respondent surveys (1% of the adult population) in February 2016 using two approaches. Firstly, I contacted the local council and community groups and asked them to distribute a link to an online version of the

survey to their members via snowball sampling. Secondly, I approached respondents through face-to-face contact with residents at different locations across Kalgoorlie-Boulder. Survey sites included parks, community events, the CBD and Kalgoorlie-Boulder Central Shopping Centre. Respondents agreeing to fill out the survey did so using either a tablet or paper version.

Table 6-1 provides a demographic profile of survey respondents. Overall, the sample was relatively gender balanced, with an average age of 44, with the majority of respondents living in Kalgoorlie-Boulder for more than 11 years. Most were married with similar percentages with and without dependent children. Respondent's educational attainment clustered around a year 12 certificate or university degree. Eighty-one percent of respondents were active in the workforce. Sixty-three percent of the respondents had annual household incomes of $100,000 and above.

Table 6-1: Demographic profile of survey respondents

Characteristics	**%**
Gender (n = 197)	
Female	55.3
Male	44.7
Age (n = 214)	
18 – 29 years	15.4
30 – 39 years	26.6
40 – 49 years	29.0
50 years or older	29.0
Years Lived in Kalgoorlie-Boulder (n = 216)	
Under 1 year	6.5
1 – 5 years	18.1
6 – 10 years	13.0
11 – 19 years	21.8

20 year or more	41.6
Relationship Status (n = 195)	
Single (never married)	14.4
Single (Separated, Divorced, Widowed)	11.3
Married	59.5
Defacto	14.8
Dependent Children (n = 196)	
No	47.7
Yes	52.3
Educational Attainment (n = 190)	
High School	34.2
Diploma or Equivalent	15.3
Certificate 3 or Equivalent	18.4
University	32.1
Employment Status (n = 216)	
Unemployed or retired	19.0
Employed	81.0
Annual Household Income (n = 189)	
Below $59,999	15.3
$60,000 - $99,999	21.7
Above $100,000	63.0

Respondents to the community survey could indicate their interest in participating in follow-up interviews at the end of the survey, this was how I recruited group interview participants. Overall, nine residents participated in group interview sessions during September 2016. This equated to an 18 percent response rate from the original 50 survey participants who expressed interest. Six of the nine participants had lived in Kalgoorlie-Boulder for at least 11 years, with just over half over the age of 55. More males

participated in the study (eight) with two-thirds of the sample being married (six) and one-third having dependent children (three). Most participants worked in industries of public administration and safety (three) and healthcare and social assistance (two), the remaining four worked in different industries. Due to the small sample size the perceptions below should be treated as personal views and may not represent the wider Kalgoorlie-Boulder residents, therefore, in drawing conclusions, the views of interview participants have been linked back to the larger survey data. Furthermore, it is also recognised that the views expressed below may be shaped by the participants demographics, these cannot be disclosed due to confidentiality reasons.

Group interview sessions lasted two hours in duration with participants allocated into one of three sessions. Firstly, I provided a background briefing to explain that this study was a follow-up to the community survey published as 'Exploring the LDC attitudes and the use of social capital to mediate LDC impacts' and made available to the community via email on request. After this briefing, a moderator conducted the session whilst the researcher observed participant interaction and recorded discussions. Each session consisted of three sections; (1) perceptions of LDC and its impacts on resident wellbeing, (2) density of resident social capital, and (3) dimensions of social capital that are effective at mediating LDC impacts on resident wellbeing. The first two sections were intended to familiarise the participants with impacts of LDC and social capital in their community, which is a pre-requisite for starting a discussion about the potential mediating role of social capital between LDC impacts and resident wellbeing. Table 6-2 provides a summary of the structure of the sessions including the rationale between intermediate steps and the research aim and questions asked in the group interviews. Chapter 6 thus aims to establish possible explanations as to why social capital does not mediate the relationship between LDC perceptions and resident wellbeing.

Table 6-2: Research aims and rational

Intermediate steps / Aim	**Literature Link**	**Purpose/ Explanations**	**Questions** (see Appendix E for group interview slides)
Intermediate step 1: Elucidate Participant perceptions of LDC and its impact on wellbeing	Mining and LDC are perceived as mutually inclusive (SCRA & Windsor, 2013), therefore perceptions towards mining will influence perceptions towards LDC.	Identify existing biases for or against a form of LDC (i.e. mining LDC).	Write down three words that come to mind when shown eight images of LDC workers from different industries.
	There are four impacts associated with the use of LDC (the degree of exposure to these impacts will influence residents' perceptions): (1) the degree of social fractionalisation (Storey, 2010; Tonts & Plummer, 2012); (2) the hollow economy (McKenzie, 2010); (3) the perceived acceptance of LDC (social licence) (Zhang & Moffat, 2015), and;	Explore the presence of negative LDC impacts.	I showed participants results from the Kalgoorlie-Boulder survey (Nicholas, 2016) that measured LDC impacts and asked "Why do you think these perceptions exist?"
	(4) the scale of the LDC workforce (SCRA & Windsor, 2013).		I explored the perception about the scale of LDC further by asking participants, "what percentage of Kalgoorlie's workforce do you think uses LDC?" I compared this to the 2011 census result using

			Nicholas and Welters (2016)'s method for determining LDC counts. I asked participants, who I showed these results (LDC size and composition), "why do you think there was a difference (if any) between your perceived and actual LDC percentage?"
Intermediate step 2: Elucidate the density of participant social capital	The relative strength of each type of social capital influences the social networks used to mediate LDC impacts. The inability to access any forms of social capital would have negative consequences to resident wellbeing (Besser, 2013; Ruddell & Ortiz, 2015).	Explore the density of participant bonding, bridging and linking social capital.	I presented scenarios for each type of social capital. Being in a remote area, I discussed the topic of the role of virtual networks to sustain social networks separately.
	Bonding social capital		The first scenario, titled 'Hosting a BBQ', explored family and neighbourhood connections.
	Bridging social capital		The second scenario, titled 'Going out for the night', explored connections with friends and work colleagues.
	Linking social capital		The town hall meeting scenario explored the

			connections between the participants and government.
Aim: Elucidate dimensions of social capital that facilitate or inhibit its mediating role between LDC impacts and resident wellbeing	Social capital as an effective mediator depends on both the strength of social capital and its effectiveness. That is, the ability to mobilise social capital (Poortinga, 2012).	Discern the effectiveness of social capital for mediating LDC impacts	Inquire if the topic of LDC came up in the social scenarios presented, "does LDC come up as a topic?", "how often do you talk about LDC?" If it did, do those conservations help with your wellbeing?", "do you find that discussing LDC issues helps you cope with the pressures of LDC?" "Do you find that discussions about LDC help?"

6.4.2 Data Analysis

I analysed the collated survey data using Qualtrics – for a detailed overview of the data see Chapter 5. I divided the survey responses and group interviews under the themes 'LDC attitudes' and 'Social Capital'. I used Audacity to record and transcribe the group interviews, an independent person randomly checked sections of the transcriptions. To control for researcher bias when interpreting the data, I employed Leximancer 4.0 to conduct an automated content analysis. Leximancer is a text analytics tool that measures the co-occurrence, frequency and strength of words within a text and provides a visual representation in the form of a heat map (Leximancer, 2011). When a group of words are frequently used together, they are identified as 'concepts' and a group of concepts is known as a 'theme'. Leximancer constructs the heat map with important themes (colour coded in red and yellow) in the centre and less important themes (colour coded green and blue) along the periphery. The important themes are usually comprised of the most number of concepts and therefore appear larger (Angus-Leppan, Benn, & Young, 2010).

Data processing maximised interpretation after an initial run of the program. Group interview participants spoke very casually, thus I merged different variations of words that had the same meaning (e.g. 'yep', 'yes' and 'yeah'). In addition, it is good practice to customise the Leximancer settings so that results are more representative of the data. This included changing the configurations for three main settings. (1) 'Prose Test Threshold' is a cut off for sentences that although containing words related to a concept will not appear unless the frequency is higher than the cut off. This threshold was set to zero by the researcher so all sentences contributing to the concepts were visible. (2) 'Sentences per Block' identifies the unit of measurement for Leximancer; each unit is a block of text analysed for co-occurrence. This was set to '2' sentences per block, because most of the participant responses were around two sentences. (3) 'Duplicate Test Sensitivity' removes blocks of text that are identical in different parts of the data; commonly used in blog analysis. Interview data does not suffer from this limitation. Last of all, I made manual adjustment to the display of the heat maps based on my first-hand knowledge of the data. Display setting include; 'Concept Visibility' - which refers to the percentage of labelled concepts displayed, 'Theme Size' - which changes the number of themes presented, and 'Rotation' - which rotates the heat map. It was important to follow individual participants, to link their LDC perceptions and social capital usage, to detect differences amongst residents. Dialogue tagging in Leximancer allows such an analysis, with pseudo names given to each participant. This function positions the speaker(s) around the periphery nearest to the concepts that are most connected with their discourse.

6.5 Results

To understand the perceived impacts of LDC on residents' wellbeing, I first showed the participants the results of the survey with respect to wellbeing. The survey measured overall wellbeing in Kalgoorlie-Boulder based on agreement with the statement '*All things considered, I am satisfied with my life'* measured life satisfaction. When compared to the national average, Kalgoorlie-Boulder residents rated life satisfaction (7.3 out of 10) approximately equally (-0.3 difference) (Weinberg & Team, 2014).

6.5.1 Perceptions of LDC Impacts

At the start of the group interview, I showed the participants the survey results with respect to perceptions towards LDC. That is, did residents have favourable or

unfavourable views of LDC, and in considering these views, did LDC operators have a 'social licence'. In the survey, I asked respondents to rate their agreement with four statements about inbound LDC workers in general (i.e. regardless of the industry that employs them) (see Figure 6-1). Kalgoorlie-Boulder residents do not think LDC workers provide an opportunity to extend their social networks (3.7). Whilst no explanations were offered, it is possible that broadly speaking, LDC workers and locals do not encounter each other in ways to facilitate this, or more small-scale, residents are tired of trying to extend their social networks due to the temporary nature of LDC workers (i.e. emotional fatigue). In addition, residents believe that LDC workers do not contribute enough to the local economy (3.7); this implies that Kalgoorlie-Boulder may suffer from a hollow economy. Furthermore, residents' agreement with the statement that there are too many LDC workers in Kalgoorlie-Boulder (6.3) and the statement that industry turns to LDC workers too quickly before trying to hire locally (6.8) demonstrates a somewhat negative perception towards LDC.

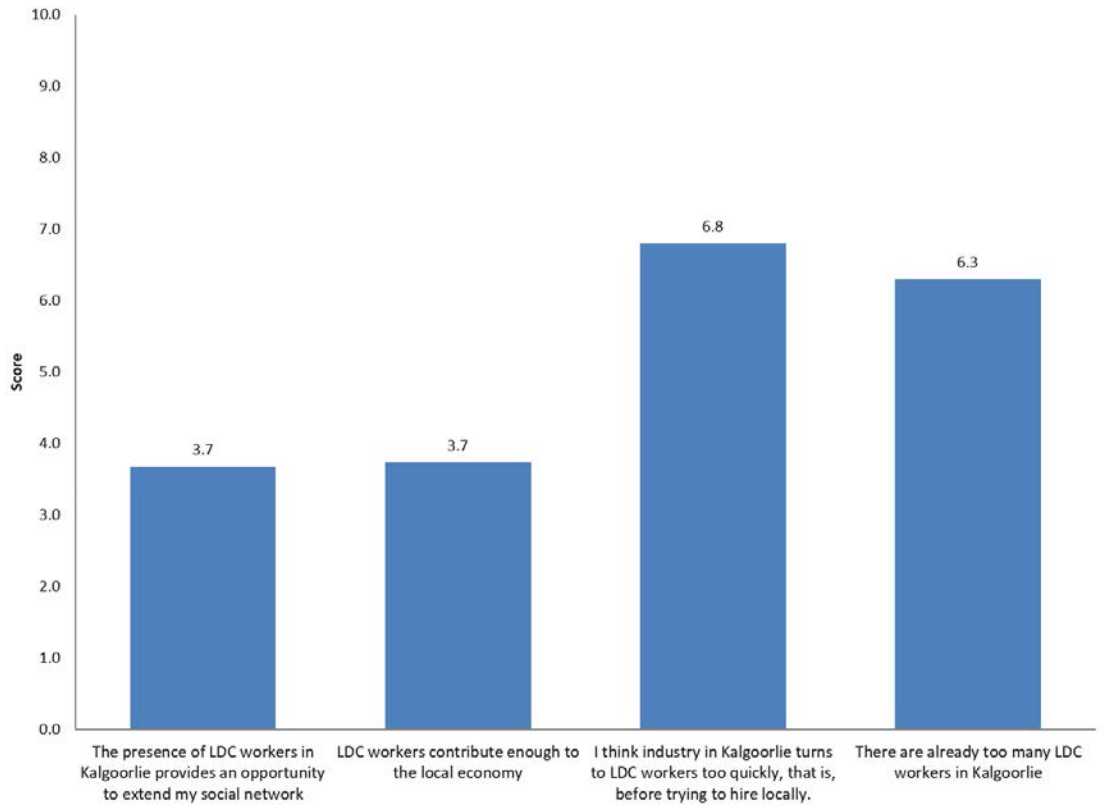

Figure 6-1: Survey respondent opinion of long distance commuting

To further explore residents' perception towards LDC, I processed interview transcripts through Leximancer 4.0. Figure 6-2 provides the conceptual structure of conversations linked to the questions stated in Table 6-2. Leximancer generated three themes (larger shaded circles) which I labelled to reflect the concepts within (smaller grey nodes). The first theme, labelled 'LDC Impacts', described impacts associated with LDC workers themselves (concepts such as: 'twelve', 'issues', 'long' and 'time') and LDC industries ('mining', 'industry', 'government' and 'companies'). The second theme, 'Social Interaction', included conversations around the interactions between LDC workers and the participants ('work', 'time', 'Kalgoorlie'), as well as between LDC industries and participants ('place', 'community', 'Perth'). Finally, 'Social Licence' was the least connected theme and reflected the current perceived behaviour of Kalgoorlie-Boulder LDC industries and whether they have a social licence ('need', 'better', 'social', and 'town'). Whilst all concepts fit within these three themes, some of the concepts can be clustered together, which indicates the topics that were discussed within the same conversations. I will now give individual consideration to the three themes separately.

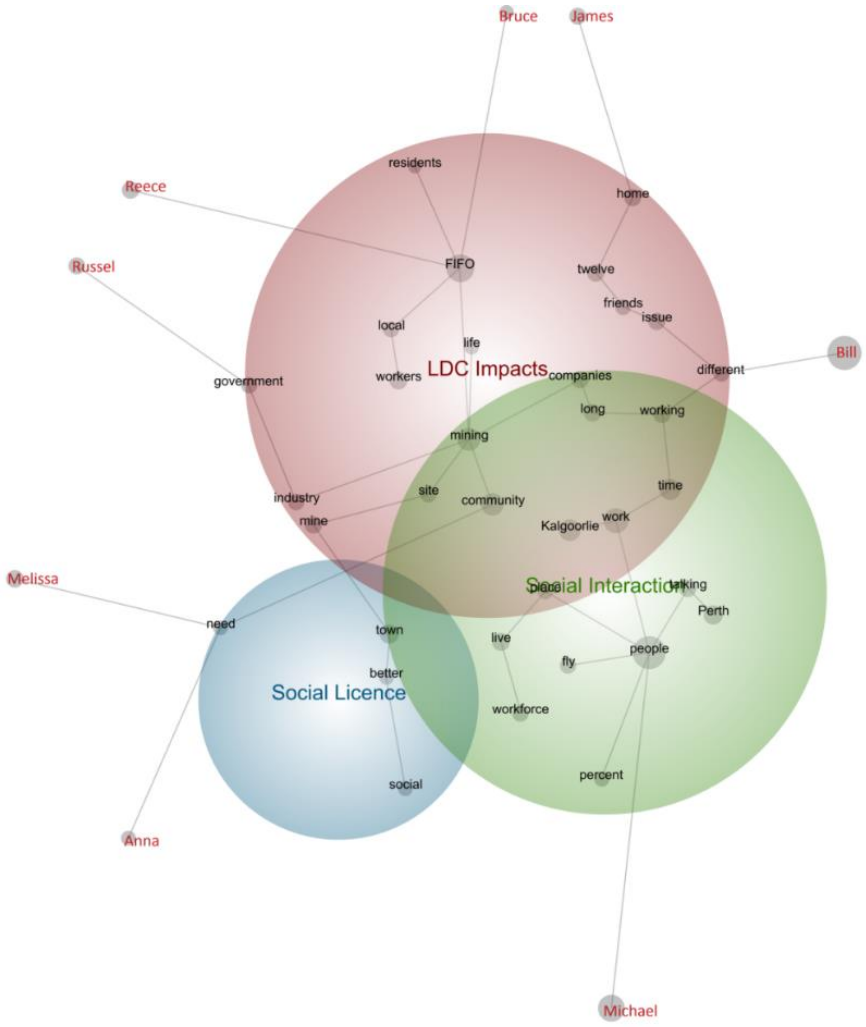

Figure 6-2: Participant perceptions towards long distance commuting ('concept visibility' = 100%, 'theme size' = 50%, 'rotation' = 0%).

Note: The tagging function in Leximancer allows participants to be positioned near the concepts closest to their dialogue. Due to the frequency-based derivation of concepts, it is possible that a participant may not be located if that participant's dialogue is expressed differently to others and/or does not occur with enough frequency. In this analysis, Leximancer was unable to tag 1 participant.

6.5.1.1 LDC Impacts

The central theme expressed by participants during discussion about LDC perceptions was impacts associated with LDC practices. This theme contained 23 concepts; Fly-in Fly-out (FIFO) had the highest co-occurrence with 69 mentions. Concepts, which had the highest likelihood of being discussed with FIFO, were 'issue' (50%, n=9), 'residents' (50%, n=2), 'companies' (44%, n=8), and 'local' (40%, n=6). Using these central concepts as a base point for analysing the discussions, the analysis identified three

underlying LDC impacts; the rise of 12-hour shifts and its implications for work – resident socialising, the impact LDC workers have on the community, and the perceived underuse of local workers.

The participants discussed how the introduction of 12-hour shifts was detrimental to the Kalgoorlie-Boulder community. Residents highlighted how long rosters did not align to the 8-hour workday of local employees, making social interactions with LDC workers difficult:

> "*The thing that needs to be recognised too is that there's very little time for them to interact with anyone. You get a twelve-hour shift, they might have an hour either side or half an hour either side to get here*." (Bill, 26-35 years)

> "*The fact there is twelve hour shifts is almost as bad as FIFO itself but you combine those two and it's a disaster."* (Russel, 66+ years)

Participants elaborated on how these 12-hour rosters also impact the community. That is, these rosters prevent LDC workers from having the opportunity to participate in community activities:

> "*If you're flying, unless you're based here, they just don't see Kalgoorlie as home. They just don't see the same commitment or desire to participate.*" (Bill, 26-35 years)

The perceived impacts of LDC was another topic of discussion. Participants felt that Kalgoorlie-Boulder was suffering from the hollow economy syndrome because the money that was earnt in the surrounding region was not spent there:

> "*All we get out of it, the only thing I think we get out of it is landing fees at the airport, maybe a bus driver to take them to site and I suppose their food and all that would come from Kalgoorlie*" (Bruce, 66+ years)

There was also the perception of 'us versus them', with some tension identified between LDC workers and locals:

"*I think we can sum this up fairly well and certainly from my perspective, I look at the socio-economic inequity between what I do as a long-term resident, fourth generation person and what they contribute to our society and the economy and I can say there's clearly an inequity there that can grate on us who live here*." (Reece, 56-65 years)

The third discussion centred on the perceived underuse of local residents by the mining industry. In particular, group interview participants reflected on the mining company's propensity to hire LDC workers instead of sourcing local workers or encouraging LDC workers to relocate to the community:

"*I don't think they try terribly hard in terms of bringing people here and it becomes this imperative versus long term structure to solve their problem."* (Michael, 56-65 years)

Kalgoorlie-Boulder residents, however, explained how government policy was driving this (and other) undesirable industry behaviour. In the participants' view, the fringe benefits tax was a contributing factor towards the rise in LDC:

"*But if the federal government wanted to change the fringe benefits tax the advantage to the mining companies would be gone in aiding FIFO*." (Russel, 66+ years)

Participants also discussed the mismatch of government funding caused by LDC practices. One example is that council funding is dependent on the number of permanent residents. LDC workers are not permanent residents despite living within a resource community for half the year. The LDC workers, however, use the community's infrastructure and services, which leads to funding shortages:

The second thing is this, when government is looking at providing funds for facilities in a town like Kalgoorlie, they take no notice whatsoever of the number of people who are FIFO who are in camps around the place." (Russel, 66+ years)

"*It means rather than being a city of being maybe fifty or a hundred thousand people and all the benefits that may bring, we don't have it."* (Bill, 26-35 years)

"Our last mayor kicked up a huge stink because they said "your population is 28,000" and he said "Bullshit". At any given night of the week it would be 32,000 because of the people who sleep here" (Melissa, 26-35 years)

Although participants identified a range of industries using LDC practices, all these industries serviced the mining industry.

"*… you take construction; you'd have to break that down to find out how much of that construction is actually directly related to mining*." (Russel, 66+ years)

"*There wouldn't be too much of that manufacturing that would not be mining … professional, technical, scientific services and transport*" (Michael, 55-65 years)

Overall, as shown by the tagging function in Figure 6-2, five of the eight participants (1 participant was not tagged by Leximancer) closely associated 'LDC Impacts' in their perceptions of LDC. That is, James and Bill highlighted the implications of the use of 12-hour shifts for LDC workers and how they can negatively influence social interactions. Reece and Bruce considered the implications for local workers and residents by highlighting inequalities. Russel highlighted the influence of government and industry actions when considering LDC perceptions.

6.5.1.2 Social Interaction

Social interaction was an important topic of conversation amongst participants when discussing their perceptions towards LDC (97% connection to 'LDC Impacts'). This theme consisted of 17 concepts with 'people' having the highest co-occurrence (94 hits). When discussing the concept of 'people', 'talking' (69%, n=11), 'work' (42%, n=19), 'place' (40%, n=6) and 'issue' (39%, n=7) were closely associated. As seen in Figure 6-2, there is substantial overlap with the previous theme 'LDC impacts', which indicates that participants strongly associated both aspects when discussing their thoughts towards

LDC practices. The central concepts of the 'Social Interaction' theme revolved around two discourses; willingness of participants to engage with LDC workers, and sympathy for LDC workers (instead blaming industry and government for LDC impacts).

Firstly, these concepts shape a narrative that shows that, despite the inability of LDC workers to have time to socialise, participants are willing to try if LDC workers share the same attitude:

> "O*riginally, I didn't care at all if I wasn't their friend, but now I probably would try more, I would actually try to be friends with these people and invite them to things no matter what."* (Melissa, 26-35 years)

> "*I sort of feel that we're very accepting of new people. It's one of the strengths of Kalgoorlie but people that don't actually want to be here, I don't really, I don't care, like, there are enough people that do love being here so I'll be around them*." (Anna, 46-55 years)

In terms of scale of LDC in Kalgoorlie-Boulder, participants thought it was between 20 – 30 per cent of the workforce, higher than the estimated proportion of four percent:

> "*I reckon it'd be close to thirty percent*." (Bill, 26-35 years)

> "*I'd have it less than that. Fifteen to twenty*." (Reece, 56-65 years)

As a result, Kalgoorlie-Boulder residents may also be over-estimating the perceived scale of impacts.

Secondly, participants revealed that FIFO workers are not the cause of LDC impacts but are instead symptoms of profit-maximising industries and government. In their opinion, FIFO workers are often not given the option of migrating:

> *"... I talk to **FIFO** people about their ability to participate in the community they often won't give you an answer because they don't know*." (Bill, 26-35 years)

> *"It's not as though people even have the choice and then, you know, someone in support services like a pastor who is talking to people and they're having problems, he can start saying, 'There's this other choice, maybe you should look at this because that will help you get over some of these issues and allow you to better integrate and have a better quality of life.' But that's not even an option and they just got to try and manage these impossibly unhealthy environments where people are addicted to the dollars and they don't look at the long-term community and social and personal health impacts."* (Bill, 26-35 years)

Overall, only one participant related more towards 'Social Interactions' during the group discussions when considering their perceptions towards LDC. Specifically, Michael would relate all conversations back to the community. Three other participants frequently discussed the importance of social interaction, however, only through other themes in Figure 6-2. Melissa and Anna highlighted the need for more social interactions but spoke from a community perspective thus connected with the social licence theme. Whereas Bill discussed LDC impacts first before following up on the social impacts, which caused him to be situated closer to the LDC impacts theme. This highlights the interconnectivity of social interactions.

6.5.1.3 Social Licence

Social Licence was the third-most connected theme to conversations about perceptions towards LDC (8% connectivity to LDC impacts theme). This theme consisted of four concepts, with 'social' having the highest co-occurrence at 13 mentions. The concepts with the highest likelihood of being discussed with 'social' were 'residents' (50%, n=2) and 'issue' (33%, n=6). Drawn together, these central concepts reveal a 'community-as-a-whole' perception held by the participants, which incorporates LDC workers and LDC industries.

With this community-mindset, Kalgoorlie-Boulder residents believe that mining companies need to obtain a social licence, which could be achieved through greater transparency in the recruitment process:

"Some mining companies have a good degree of local but could probably still do better and the transparency around employment numbers for most of the mining companies, apart from KCGM, is very low. You know, so they're not publicly out there saying what their numbers are and I never really see large recruitment pushes like you do for FIFO." (Bill, 26-35 years)

"*They have to have a social licence and that social licence includes that you have to have people who are living here and it's got to be really good reasons why you're not sourcing people locally."* (Anna, 46-55 years)

Overall, two out of the eight participants related more towards 'Social Licence' when considering their perceptions of LDC. Melissa and Anna highlighted community-wide views of LDC workers and LDC industries whilst providing context for a social licence.

6.5.2 Social Capital and its effectiveness to mediate LDC impacts on resident wellbeing

Then, to familiarise the participants with social capital in Kalgoorlie-Boulder, I showed a selection of the survey results with respect to social capital (for a full discussion see Chapter 5). Social capital describes the multitude of social networks between individuals and groups. These networks maintain and create social capital. I asked survey respondents to indicate whether they had regular social interaction (on a scale from zero (disagree) to 10 (agree)) with the following groups; family members, friends, neighbours and work colleagues and where these interactions took place (Figure 6-3). Respondents socialised with family (6.9) and friends (7.4) more frequently compared to neighbours and work colleagues. Meeting at someone's house was the favoured method when respondents socialized with family members (40.9%) and neighbours (46.8%). Interactions with friends (34.4%) and work colleague (35.7%) occurred mostly whilst 'going out'. The use of non-personal communications (phones/social media) to interact was utilised with all social groups, but to a lesser extent with neighbours. The 'other' category showed a large percentage of neighbour and work colleague interactions occurred at other locations.

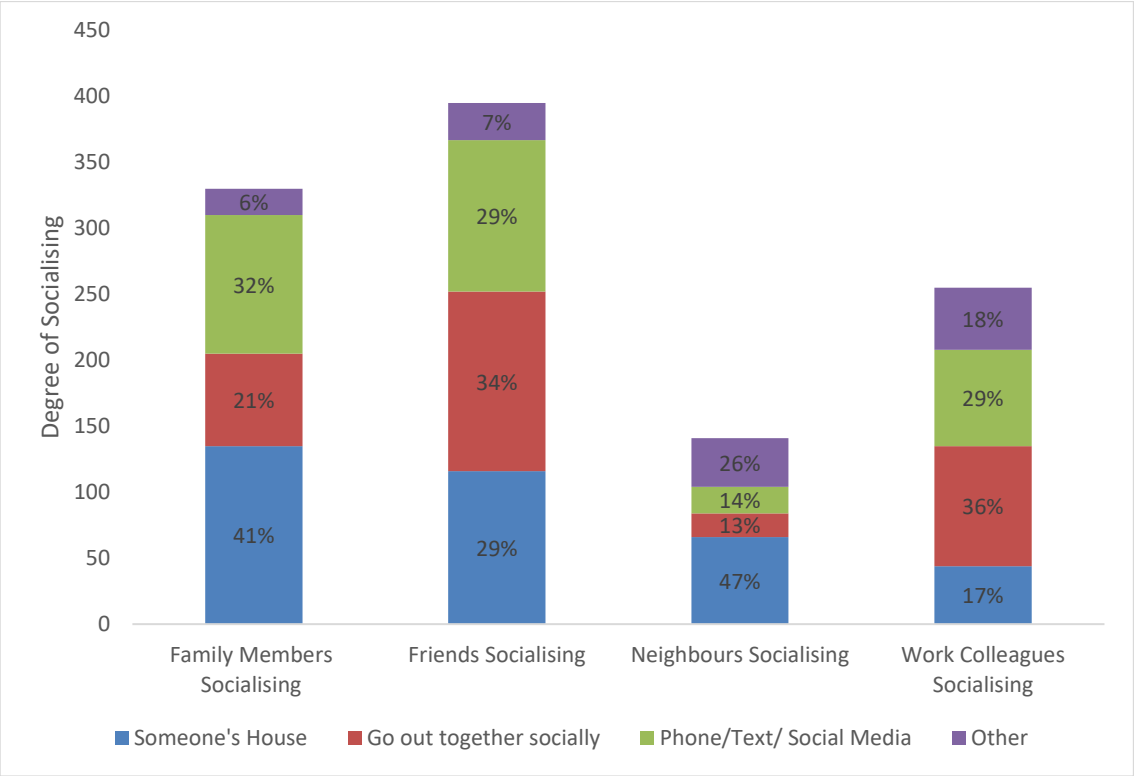

Figure 6-3: Regular social interaction of survey respondents and places of socialising

Note: Degree of socialising can be greater than n=217 (sample size) because respondents could indicate multiple options for places of socialising (colour components of individual columns).

Scenario analysis facilitated further exploration of the usage of these social networks for mediating LDC impacts. Group conversations based on the three scenarios 'Hosting a BBQ', 'going out for the night' and 'town hall meeting' aimed to explore (1) if participants utilised their social capital and (2) if so, whether it was effective to cope with the impacts of LDC – the research aim of this chapter. Figure 6-4 displays the conceptual structure of follow up group interviews around these two aspects. Leximancer produced four themes, which I re-labelled. The dominant theme was 'bridging social capital' which described social connections between different members within and outside of the community ('community', 'talk', 'people', 'Kalgoorlie', 'local'). The second theme was 'bonding social capital' which describes networks between closer individuals ('friends', 'family'). The third theme was 'linking social capital' which describes social interactions between participants and decision makers ('council', 'government', and 'business'). The fourth theme was 'effectiveness of social capital', which described how participants did or did not utilise their social capital to mediate LDC impacts ('conversation').

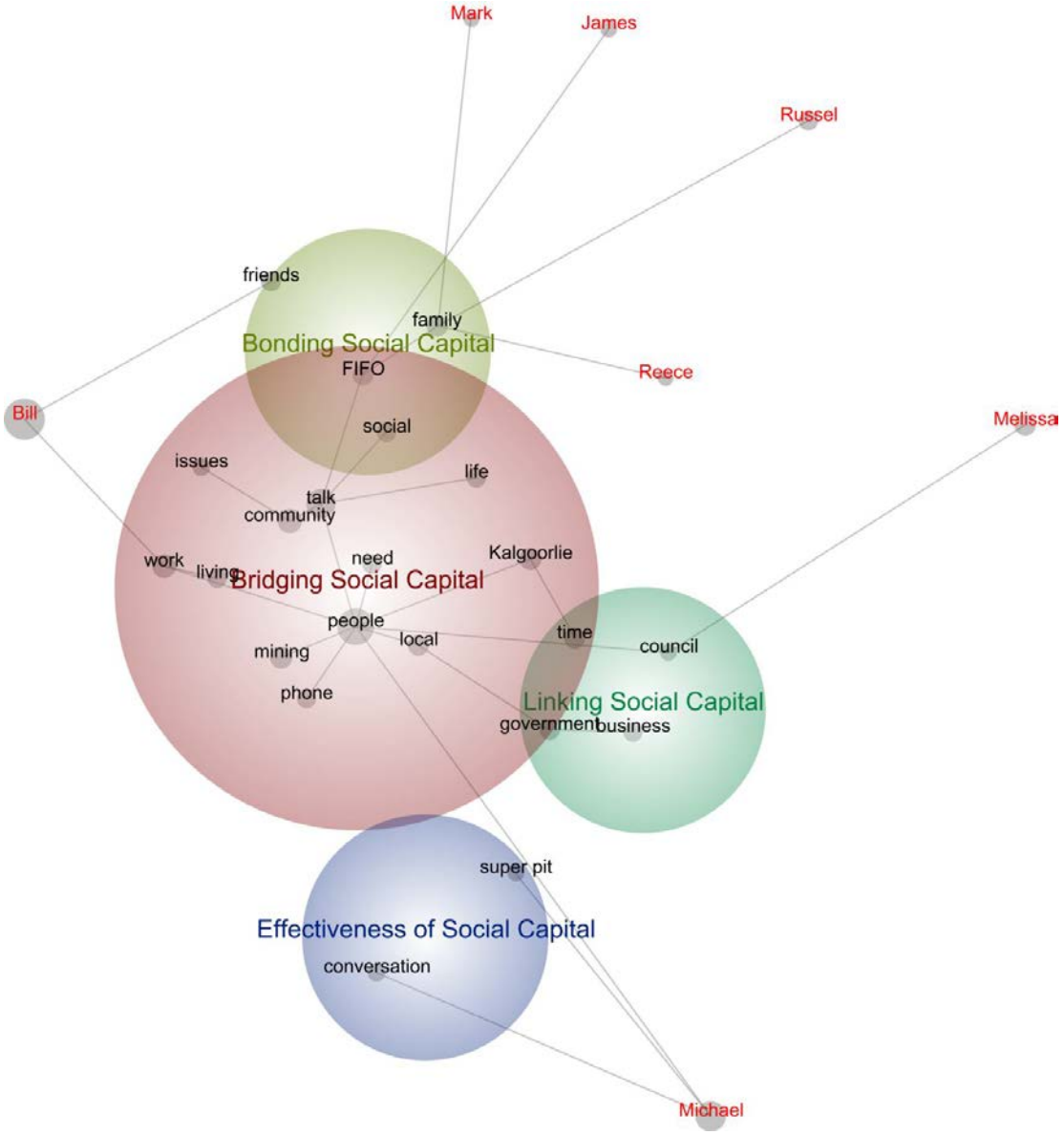

Figure 6-4: Social capital, 'concept visibility' = 100%, 'theme size' = 45%, 'rotation' = 0%.

Note: Leximancer was unable to tag 2 participants

6.5.2.1 Bonding Social Capital

Due to the isolation of regional communities such as Kalgoorlie-Boulder, family and friend connections can be geographically separate. The initial survey focused on community specific bonding social capital i.e. neighbourhoods, with follow up group interviews capturing external connections. These connections should be dense but localised to small groups of individuals. Before discussing bonding social capital in the group interview, I showed participants the survey findings with respect to neighbourhood connections. The structure of bonding social capital was determined by asking about

neighbourhood levels of; trust (6.0), belonging (6.6), friendliness (6.3) and feelings of being close knit (4.7). Overall, the respondents had mixed opinions about their neighbourhoods (see Figure 6-5). Neighbourhoods represented places where the respondents felt they belong (6.6); despite it not achieving a close knit atmosphere (4.7). A lack of bonding social capital can leave individuals within some neighbourhoods feeling isolated.

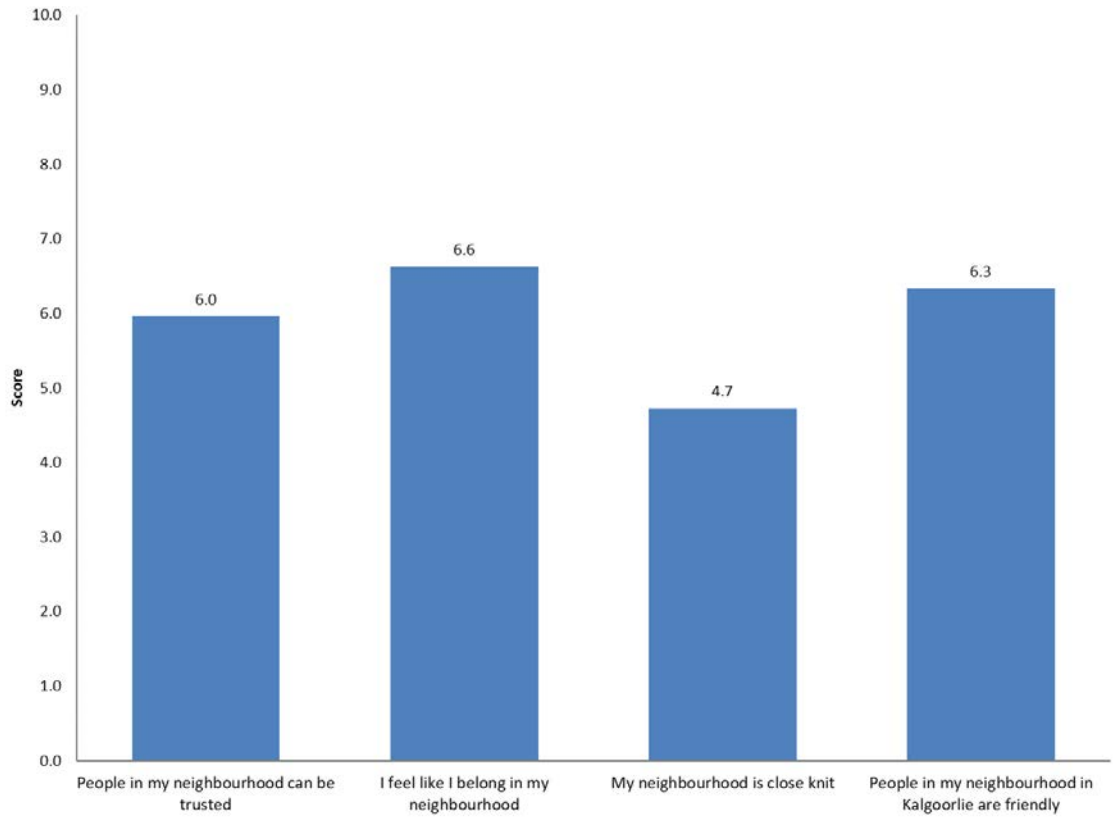

Figure 6-5: Survey respondent opinions of their neighbourhoods

In the follow up group interviews, the theme of bonding social capital covered four concepts; 'family' had the highest co-occurrence with 24 mentions (29% connectivity to bridging social capital theme). The concepts with the highest likelihood of being discussed with 'family' were 'phone' (27% n=3) and 'friends' (15%, n=3). There was considerable overlap between the bridging social capital and bonding social capital themes. This indicates that participants often discuss bonding social capital in conjunction with bridging social capital.

Participants highlighted improved communications infrastructure and social media as important for networking outside of Kalgoorlie-Boulder:

> "*[improved communications infrastructure]… makes life more inclusive probably when you have one member of the family working from a long way away and they have a ten minute 'smoko' break or something like that they can talk to home, find out what's going on and all that sort of stuff. Twenty years ago, you couldn't do it*." (James, 46-55 years)

One participant provided insight into the utility of Facebook:

> "*There's the public that you're prepared to put on there or whatever or discuss publicly but we actually, because we've got family in Perth we never see, we actually have a separate family bit which is private and we do a lot of Facebook stuff through that*." (Russel, 66+ years)

Conversations about the use of FIFO by mining companies are common within close social networks. Kalgoorlie-Boulder residents specifically discussed when companies used FIFO in favour of hiring locals:

> "*There's a fair bit of discussion about that (FIFO). But if it's family and friends barbeque we do get into politics.*" (Russel, 66+ years)

> "*How many people are they going to employ from the workforce that's here? It's always, you know, whenever we go to a preview of what they're doing it's always the focus point*." (Anna, 46-55 years)

These results suggest that the participants have access to bonding social capital and reactively use it to complain about FIFO decisions.

6.5.2.2 Bridging Social Capital

Before discussing bridging social capital in the group interview, I showed participants the survey findings with respect to bridging capital. The survey measured the structure of

bridging social capital by asking about; attachment to Kalgoorlie-Boulder and diversity of social networks. Overall, survey respondents had a sense of attachment and belonging to Kalgoorlie-Boulder and longed to return if away for an extended period of time (see Figure 6-6). Survey respondents expressed diverse views about their social networks. Whilst Kalgoorlie-Boulder residents indicated a reasonable level of agreement with a feeling of belonging (7.4) and attachment (7.1) to the community, they also indicated a degree of importance with social connections outside of Kalgoorlie-Boulder (7.1). There was also evidence of disparity in income between friends (5.5), however, respondents did not feel that every person was out for themselves (4.4).

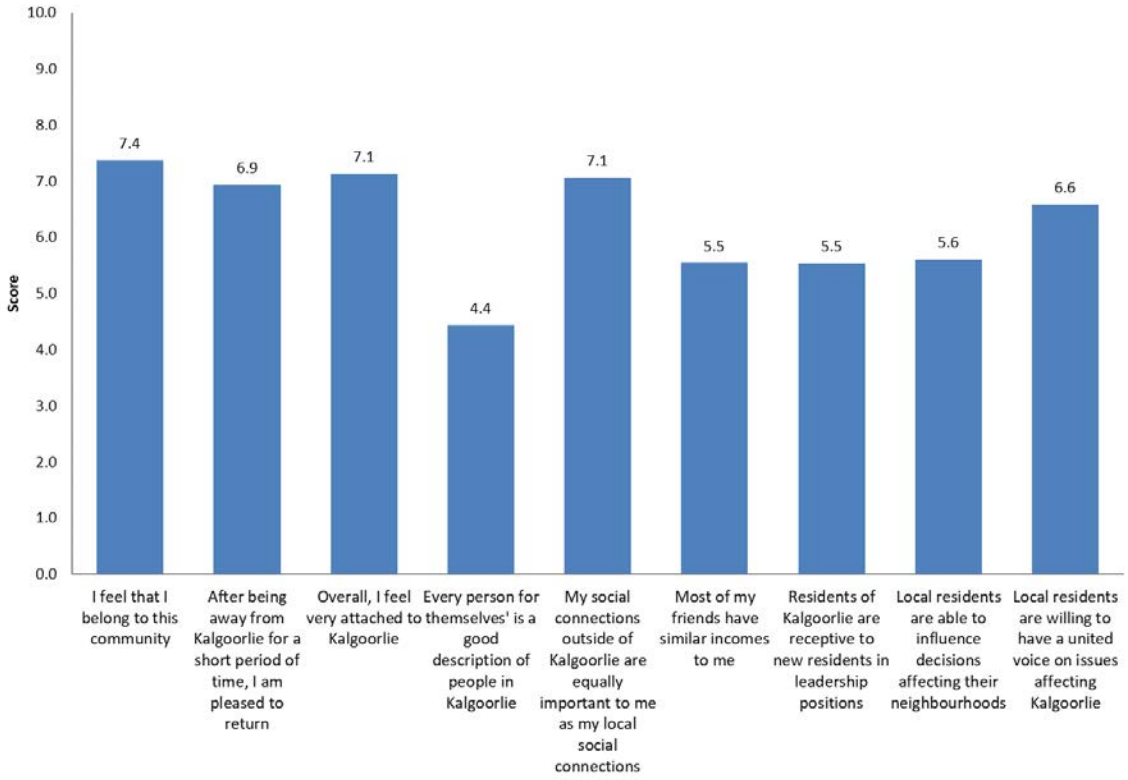

Figure 6-6: Survey respondent opinions of people in Kalgoorlie-Boulder

Bridging social capital as a theme consisted of 12 concepts in the group interviews, with 'people' having the highest co-occurrence at 78 mentions. Concepts with the highest likelihood of being discussed with 'people' were 'work' (48%, n=13), 'phone' (45%, n=5), and 'issue' (43%, n=3). In consideration of the clustered concepts around these central concepts, participants highlighted Kalgoorlie-Boulder's community positively.

This indicates that bridging social capital is present within Kalgoorlie-Boulder and it is having a positive influence on participant's perception towards the community:

> "*It's an interesting thing because we're actually quite multicultural and we'll find that people from New Zealand, people from Africa, when they come to Kalgoorlie they bring their family and invariably they bring their cousins and it's like, for them, they don't want to fly in fly out they actually want to fly in and stay*." (Michael, 56-65 years)

> "*That's the whole reason I live in Kalgoorlie is because it's a part of the country with a sense of community. I've lived in Perth, there's no sense of community in Perth*." (Bill, 26-35 years)

Participants also deliberated on the effort needed to maintain these networks. Local companies encourage work colleagues to socialise through staff social clubs; this can act as a starting point to help new staff integrate into the community:

> "*That activity works really, really well because you just need those couple of invites so you're not going somewhere by yourself and then that starts the ball rolling and all of a sudden people are embraced in the community. So, you've got workplaces that are doing that, it works fantastically*." (Bill, 26-35 years)

Mining companies could use such strategies as a form of initialisation of new FIFO workers to promote better community integration.

One issue, however, is the higher turnover of residents in the community. This means that networks (social or business) established in Kalgoorlie-Boulder often become long distance, with residents continuously needing to create new ones:

> "*Yeah, well, I mean the phone rings constantly and people are, you're talking to family, you're talking to clients, you're talking to…but it's a social thing."* (Michael, 56-65 years)

6.5.2.3 Linking Social Capital

Kalgoorlie-Boulder leadership represents the linking social capital available to respondents. These connections are between individuals and groups where one of them has authority over the other. Before discussing linking social capital in the group interview, I showed participants the survey findings with respect to bridging capital. I determined the structure of linking social capital through opinions on; relationship with council, correct recruitment of key people and trustworthiness of the council and police. Overall, respondents trusted the police (7.2) and to a lesser extent, the local council (5.5) and state government (4.1) (see Figure 6-7). There was doubt the state government is capable of balancing the needs of residents with industry. Despite the willingness to unite (as indicated in this previous section), there were mixed opinions about whether residents are able to influence government (state and local) discussions about matters that affect their neighbourhoods (including LDC scale) (5.6).

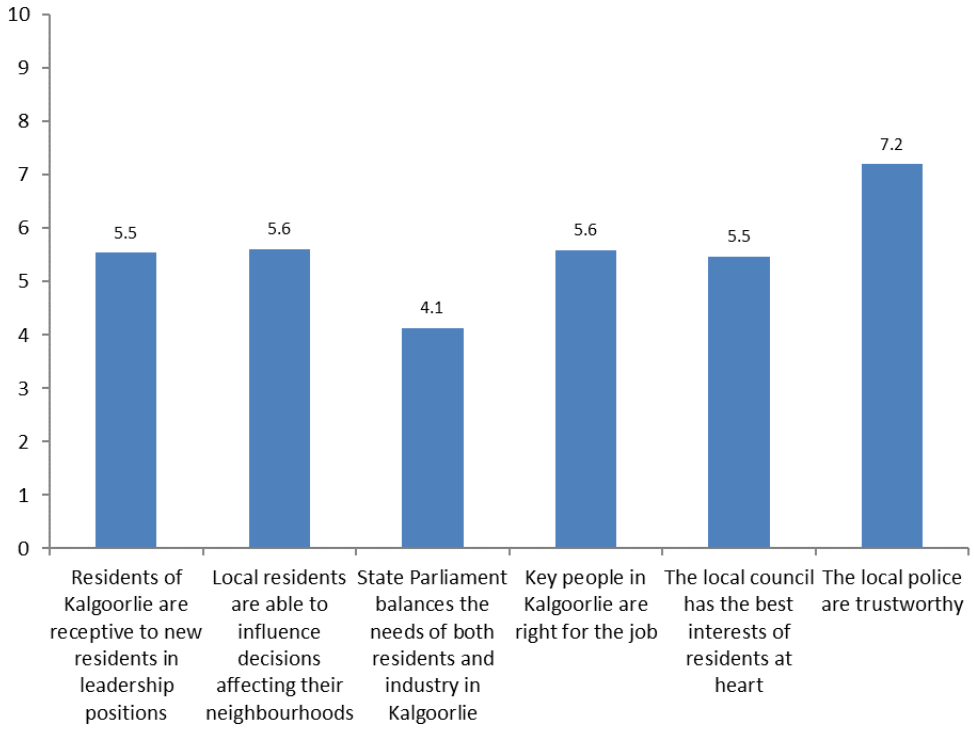

Figure 6-7: Survey respondent opinions of Kalgoorlie-Boulder leadership

In the group interviews, linking social capital consisted of four concepts, with 'business' having the highest co-occurrence at 17 mentions (19% connectivity to the bridging social capital theme). Concepts with the highest likelihood of being discussed with 'businesses' were 'community' (14%, n=4) and 'conversation' (14%, n=2). Conversations around

linking social capital tended to be negative with participants describing a lack of linking social capital. Kalgoorlie-Boulder residents felt the state government was ignoring their community, creating resentment:

> "*So, they've stopped having government workers actually based here. They don't have government departments with their heads living in Kalgoorlie because the perception is that we're going to close down*." (Anna, 46-55 years)

> "*… the state government don't respond, and you feel like, if some of the things happened up north or in the south west, they would get a better response.*" (Melissa, 26-35 years)

There was, however, a difference in opinions towards local council and state government. Participants were sympathetic to the plight of the local council:

> "*So, you know, you've got the poor old council over here that get governed by this incredibly stupid piece of legislation that restricts them to drains and ditches and footpaths but we expect to be out there leading but they don't get any resources to do that*." (Michael, 56-65 years)

6.5.2.4 Effectiveness of Social Capital

This theme consisted of two concepts, with 'conversation' having the highest co-occurrence with 14 hits (5% connected to the central bridging social capital theme). The concept with the highest likelihood of being discussed with 'conversation' was 'phone' (27%, n=3). The overall sentiment from the participants was that social capital in the form of bonding and bridging were accessible and used to improve participant wellbeing:

> "*The conversations generally help us to…help us with our quality of life."* (Michael, 56-65 years)

These bonding social capital networks improved resident wellbeing through means of simply sharing negative experiences with family and friends. In particular, networks with

fellow Kalgoorlie-Boulder neighbours were most effective as they allowed the opportunity to share the same experiences, which served as a form of casual counselling:

> "*Talking to friends and family helps you cope*." (Melissa, 26-35 years)

Participants also identified bridging social capital as prevalent in Kalgoorlie-Boulder and that they are active in maintaining it:

> *"That's the whole reason I live in Kalgoorlie is because it's a part of the country with a sense of community."* (Bill, 26-35 years)

Despite access to, and usage of, social capital in improving wellbeing, participants struggled to identify social capital as a mediator of LDC impacts on wellbeing:

> "*I don't think you can say that talking about **FIFO** improves the quality of our life*." (Anna, 46-65 years)

Participants were quick to highlight that FIFO was not a common talking point in social gatherings:

> *"I don't know that we particularly talk about **FIFO** that much*." (Michael, 56-65 years)

This contrasts to conservations about mining, where participants vented their frustration about mining companies:

> "*We do talk about mining a lot, but I wouldn't think we talk about DIDO, maybe a little bit of FIFO.*" (Melissa, 26-35 years)

Interestingly, these mining-related conversations revolved around the lack of local hiring:

> "*People should be talking about it but they don't. I think it comes up if people start talking about a new mine or something so you get on occasions, if a new*

mine was opening up and it was reasonably well known that they're going to source most of their people from a FIFO perspective it might come up a bit". (Bill, 26-35 years)

Participants also expressed negative opinions towards political and industry leaders with respect to dealing with the outcomes of FIFO:

"*I think there's very little leadership in the business community and with the Mayor and the chamber of commerce and the chamber of minerals and energy, they're the senior people in the community*." (Russel, 66+ years)

With respect to differences amongst individual residents, Leximancer identified that seven out of the nine participants favoured one type of social capital. Four of the seven participants related more to bonding social capital when discussing social capital and effectiveness. James focused on the improvements of social media when connecting with family whilst Russel described the helpfulness of friends and family overall. Two participants related more to bridging social capital with both discussing the people in Kalgoorlie-Boulder. On the one hand, Bill focused on his personal networks and 'living' in Kalgoorlie-Boulder, whilst Michael discussed Kalgoorlie-Boulder as a whole. Finally, one of the seven participants related more to linking social capital. Melissa expressed concern for the effectiveness of local council with a lack of support from the state government.

6.6 Discussion

Overall, participants had a negative view of LDC as a strategy of employment and expressed the view that LDC workers did not contribute to the local economy or community. These perceptions align with the current consensus that an influx of LDC workers leads to community fractionalisation and a hollow economy (McKenzie, 2010; SCRA & Windsor, 2013; Storey, 2010; Tonts & Plummer, 2012). These conclusions, however, are not useful for policy recommendation, because it is unknown whether the negative perceptions resulted from attitudes towards industry, the workers, or mining in general. The perceived underuse of local workers by the mining industry found in the current study offers some insight. The negative perception towards LDC is only

associated with the mining industry, despite the moderator revealing the diversity of industries using LDC in Kalgoorlie-Boulder. In Australia, there is a perception that mining and LDC are mutually inclusive (Nicholas & Welters, 2017). McIntosh (2012) explains the hiring of construction workers by the mining industry. Participants believed this was the case for Kalgoorlie-Boulder as well, with many industries (not just construction) being either directly or indirectly influenced by the mining industry.

Secondly, participants considered the local labour market to be underused even though the LDC workforce only consisted of 4.5 percent of the total workforce in Kalgoorlie-Boulder. Residents believed that mining companies had not earnt a social license. Whilst residents did reflect on the efforts of some mining companies to improve community relations, overall, they felt that there was not enough collaboration with the community. Carrington and Pereira (2011), however, suggested that an LDC workforce of less than 25 percent would be enough to earn a social license. In the group interviews, the perceived extent of LDC workforce in Kalgoorlie-Boulder was 20 to 30 percent, much higher than my estimates based on 2011 census data. Therefore, when taking perceptions into account, this study agrees with Carrington and Pereira (2011).

Responses from the follow up group interviews were generally consistent with the initial community survey results. That is, participants expressed dense bridging social capital, moderate bonding social capital and a lack of linking social capital. Participants favoured friends and family (regardless of distance) over close proximity relationships (e.g. neighbours). Bridging social capital revealed a sense of community, however, this only extended to long-term residents from other backgrounds and nationalities and not long distance commuters. Linking social capital was absent at the state level, which participants considered important for influencing the scale of LDC in Kalgoorlie-Boulder.

Participants indicated that due to geographical distance between their families, there was a higher reliance on bridging social capital to improve their wellbeing. This provides support for the argument posed by Smith et al. (2012) in that bridging social capital plays an important role in improving resident wellbeing in remote communities. Networks between members of the community (regardless of demographics or ideologies) were strong. Interestingly, however, bridging social capital did not appear play a role in coping with LDC impacts. One way of mediating LDC impacts through bridging social capital

is uniting as a community and protesting the use of LDC. Although respondents complained amongst themselves about new LDC contracts, they do not unite in protest. A reason could be the perceived lack of effectiveness in protesting, with a perceived disconnect between the goals of the community and the state government/ mining industry. Simply put, uniting, as a community in protest does not influence LDC decisions. Whilst residents formed connections with other long-term residents employed within the mining industry, they could not connect with short-term LDC workers. The issue with LDC workers is that structural limitations associated with this type of workforce inhibit the development of social capital. Despite the willingness of Kalgoorlie-Boulder residents, the 12-hour shifts employed by the mining industry limit opportunities for social interactions. SCRA and Windsor (2013) summarised that the introduction of 12-hour shifts lead to declines in community engagement by LDC workers. In addition, the establishment of self-contained work camps outside of town means that LDC workers have no need to integrate with the community. Subsequently, LDC workers tend not to engage with local community life and events, again limiting the opportunity for social integration, fuelling fractionalisation. Hence, bridging social capital may not mediate LDC impacts because they are simply 'out of sight, out of mind'.

Bonding social capital was the main forum for discussing LDC impacts, instead of the relatively stronger bridging social capital. Participants indicated that the use of technology was an important part of maintaining contact with friends and family. Technology was effective in improving residents' wellbeing; it provided a sense of connection to family who are mostly located outside of the community. Similar to bridging social capital, bonding social capital was not effective in mediating LDC impacts. The ineffectiveness of bonding social capital could be due to the nature of bonding social capital for individuals in remotes communities. Their bonding social capital encompasses both geographically distant and close family and friends. Distant family and friends have different socio-economic pressures that may not be comparable. Without similar experiences (i.e. LDC impacts) their helpfulness to function as an empowerment and/or survival tool against LDC impacts would be limited. On the other hand, friends and family living in Kalgoorlie-Boulder would experience similar socio-economic pressures (i.e. impacts of LDC), yet the respondents considered bonding social capital ineffective to deal with LDC impacts. Perhaps the continuous impacts of LDC on their wellbeing leads residents to avoid the topic in conversation—LDC fatigue.

Comparatively, Kalgoorlie-Boulder residents utilised linking social capital the least. Participants were supportive of the local council and believed they were responsible for the strong sense of community through their proactivity in providing numerous community-based events. Zhang and Moffat (2015) highlighted the importance of government playing a supporting role, as social pressure on mining companies increases. However, participants also held a view that council was ineffective when it came to convincing mining companies to minimise the use of LDC workers. Beyond the council, participants did not report access to any other linking social capital (such as state government or mining companies). This could be reflective of the perceived ineffectiveness of linking social capital (in particular, the state government) to provide support to Kalgoorlie-Boulder residents.

So far, however, this research assumed that participants would utilise available social capital to mediate LDC impacts. Data collection coincided with a relative slow period in commodity prices resulting in a reduction in LDC employed by the mining industry in Kalgoorlie-Boulder. It is, therefore, possible that participants did not need to use their social capital to mediate LDC impacts. For example, participants identified that FIFO is discussed only in relation to new mining projects (which are rarer in slow mining periods). Kalgoorlie-Boulder residents' wellbeing is similar to the national average indicating the mediating effects of social capital despite no direct usage (i.e. lack of conversation about LDC). Therefore, when mining practices are not as extensive as previous periods, the possession of social capital (opposed to utilisation) could mediate LDC impacts. An alternative explanation is that respondents did not feel the need to bother with mediating impacts at all. Unfortunately, the survey was not designed to test the validity of the assumption about the need to utilize social capital to address LDC concerns.

6.7 Conclusions

Overall, this study explored the effectiveness of social capital as a mediator of LDC impacts on resident wellbeing within Kalgoorlie-Boulder. Research about social capital has repeatedly demonstrated that dense and equal networks within an individual's family and friends (i.e. bonding capital), work colleagues and acquaintances (i.e. bridging capital) as well as government and industry leaders (i.e. linking capital) lead to resilient

communities. If, however, one of these social capital forms is deficient, the community becomes less resilient with residents more likely to experience a reduction in their wellbeing based on an event (i.e. LDC employment).

Both the initial community survey and follow up group interviews generally agreed on the density of social capital. That is, the presence of relatively dense bridging social capital, moderate bonding social capital and limited linking social capital. Importantly, the bridging social capital between residents and LDC workers was weak. This may be due to structural limitations that prevented the establishment of social networks between residents and LDC workers. Participants specifically identified the use of 12-hour shifts for LDC mining workers and the construction of work camps outside the community as inhibitors of social opportunities. Future research should investigate whether reducing shifts to for example 8-hour shifts increases interaction between residents and LDC workers. The same applies to locating work camps adjacent to community boundaries or at least providing transportation between the community and work camps. Both these initiatives may facilitate LDC workers' engagement in community events and social clubs, which may strengthen social capital ties between residents and LDC workers. It is important though that only positive interactions are being promoted. Carrington, Hogg, & McIntosh (2011) cautioned that off-roster LDC workers with nothing to do may impact the community in a negative manner through violence and community disorder.

Whilst residents utilise social capital to improve their wellbeing, it does not appear to directly help them to cope with LDC impacts. This may be due to the helplessness of the situation in which participants perceived themselves to be. Residents perceived the council as powerless to dictate the size of the LDC workforce in Kalgoorlie-Boulder. Participants manifested this sense of helplessness with their negative perceptions towards LDC. Another reason is that residents may not need to directly use their social capital to mediate LDC impacts during the slow phase of the mining cycle. However, knowing their networks are available if needed could in itself be a mediator. One commonly held perspective was that the mining industry had not earnt a social licence to operate near Kalgoorlie-Boulder. I recommend that greater transparency in justifying the use of LDC, and more importantly, better community engagement would earn them a social licence.

Although achieving the study aim, some challenges provide avenues for future research. A limitation when conducting this research was the lower than expected sample size. The survey achieved one percent of the adult population coverage with 217 participants. The follow up group interviews, however, numbered nine participants. The use of a case study approach also limits the extrapolation of results outside the study area. Future research would benefit from larger sample sizes (by either increasing the study area or implementing additional approaches to data collection). Furthermore, the use of this study as a point of comparison with additional case studies would provide greater insight into the role of social capital in mediating LDC impacts.

Chapter 7 Thesis Conclusions, Implications and Future Directions

CHAPTER OUTLINE

7.1 Introduction

This thesis investigated the determinants of the scale of LDC in a host region and whether a host region's social capital can mediate the associated impacts on wellbeing. I proposed three research questions to explore this research topic: **(1)** what circumstances in a region affect the extent of LDC into that region, and do circumstances in neighbouring regions matter as well? **(2)** Does social capital mediate the impacts of inbound LDC on resident wellbeing in a host region? **(3)** What – if any – dimensions of social capital are effective in mediating the impacts of LDC on resident wellbeing in a host region? Chapter 7 provides a summary of the thesis according to the following structure: Section 7.1 summarises the key findings of the thesis and draws conclusions. Section 7.2 presents the contributions of the thesis, with limitations in Section 7.3.

7.1 Key findings

This thesis hypothesised that awareness of spatial dependence is critical for understanding both the scale of inbound LDC in a host region and its impact on resident wellbeing in a host region. To test this, I conducted three studies – one at the regional level to explore the scale of LDC and two at the community level to investigate LDC impacts. Spatial panel modelling (i.e. regional level analysis) revealed that both regional and extra-regional characteristics were important for understanding the scale of LDC present in host regions. The relevance of extra-regional characteristics indicated the presence of spatial dependence. The case study of the city of Kalgoorlie-Boulder (i.e. community-level analysis through resident surveys and group interviews) concluded that the available social capital (a proxy for within-regional spatial dependence) was ineffective at mediating LDC impacts on resident wellbeing; the perhaps most effective type of social – linking social capital – was not sufficiently available.

Overall, spatial interactions at both the regional and community level suggest that LDC, which favours the home region, creates asymmetrical linkages between the home and host regions. Firstly, there was no evidence that a host region's local labour market is a driver of LDC. This indicates a lost employment opportunity (and the potential follow-on benefits) for the host region, one of which is not experienced in the home region. Secondly, in Kalgoorlie-Boulder, there was a negative perception of LDC; residents indicated the presence of a hollow economy. That is, LDC workers do not contribute

enough to the local economy. This adds credence to the core – periphery model and the concept of resource banks (Chapman et al., 2015). Thirdly, at the regional level, imported capital and labour into the periphery (host region) are funnelled into extractive industries; however, the benefits generated are exported to the core before the periphery can benefit (Nicholas & Welters, 2016). Further conclusions arising from the research are presented according to three spatial scales: (1) regional (2) extra-regional and (3) within-regional.

7.1.1 Regional circumstances associated with the scale of LDC

This thesis investigated whether the characteristics of a region influenced the scale of inbound LDC in that region. Chapter 4 found that local labour market characteristics had no influence on the scale of LDC, suggesting companies do not consider labour market characteristics when considering the use of LDC. I provide two possible reasons for this result; (1) either industry is willing to recruit locally but the scale of employment is too great for locals to fulfil, or (2) industry is not willing to recruit locals due to cost reasons. Workers consider the availability of regional services rather than housing affordability when deciding to long distance commute or migrate into a region. In addition, population transience of the host region increases the scale of inbound LDC. Not surprisingly, the presence of a mining workforce within a region increases the scale of LDC.

7.1.2 Extra-Regional Circumstances associated with the scale of LDC

This thesis investigated whether characteristics in neighbouring regions influence the scale of LDC within a region. In Chapter 4, Moran I tests indicated presence of spatial clustering of long distance workers in the remote areas of Australia. Spatial panel modelling confirmed the presence of spatial dependence with respect to the dependent variable and error term. This means the scale of LDC in the neighbouring region influences the scale of LDC in the region under investigation, as do circumstances in the neighbouring regions, which I did/could not include in the model. Missing variables may include social capital proxies.

7.1.3 Within-Regional Circumstances associated with LDC impacts on resident wellbeing

Chapter 5 identified that Kalgoorlie-Boulder residents separate LDC and mining impacts; mining contributed positively to subjective wellbeing whilst LDC contributed negatively.

Bonding and bridging social capital contributed positively to wellbeing. Whilst there was a positive association between social capital and wellbeing, there was no statistical evidence that social capital mediated the perceived impacts of LDC on the wellbeing of Kalgoorlie-Boulder residents.

Chapter 6 explored resident perceptions and the nature of social capital in Kalgoorlie-Boulder to mediate LDC impacts. Group interview respondents reported a lack of linking social capital, they did not possess this type of social capital thus could not use it as a mediator between LDC impacts and wellbeing. There was a sense of helplessness based on a perceived inability to influence the scale of LDC (thus the size of the impact). Respondents were empathetic towards the local council (their linking social capital), however, participants perceived the council as powerless to influence the size of the LDC workforce in Kalgoorlie-Boulder. Respondents also identified structural limitations in LDC employment such as 12-hour shifts, which impeded any attempt to build (bridging) social capital between residents and the LDC workforce.

7.2 Contributions

7.2.1 Policy Contributions

The policy goal of this thesis is to improve the wellbeing of individuals living in regional/remote communities of Australia. The use of inbound long distance commuting in regional/remote communities is widely acknowledged to reduce life satisfaction in host communities; community fractionalisation and the hollow economy syndrome are the most referred to explanations. In order to counter these reductions in perceived aspects of wellbeing, I recommend the following three policy reforms:

Policy option 1: Reduce the scale of LDC without impacting industry

In-migration – a substitute for inbound LDC – would reduce the impacts of LDC (e.g. community fractionalisation and hollow economy syndrome) whilst maintaining the necessary mining workforce. These in-migrating workers would live within the community as opposed to work camps. Placement within the community would provide workers more opportunities to integrate, thus potentially reducing community fractionalisation. Furthermore, a higher proportion of wages earnt by these new residents

would be spent within the community, which could reduce the hollow economy syndrome.

For regional communities who wish to reduce inbound LDC, efforts towards improving regional attractiveness may convince potential LDC workers to migrate. Tightness of the labour market and housing affordability were unrelated to the uptake of LDC into a region. Hence, these factors should not be priority areas for policy makers who wish to reduce LDC. If the goal is to convince workers to migrate into a host region rather than adopt LDC (and as a result reduce the hollow economy syndrome), policy makers should instead aim to improve local service provision and/or increase rental accommodation in the host region.

There are two potential problems with this policy options; (1) its reliance on industries to provide an opportunity for its workers to in-migrate, and (2) convincing workers to in-migrate instead of LDC. McIntosh (2012) and Perkins (2012), however, have suggested that LDC adoption sometimes is not employee driven. If LDC is the preferred option and in-migration is discouraged, or workers may simply refuse to in-migrate then this policy recommendation would be ineffective.

Policy option 2: Accept LDC but reduce community fractionalisation

For regional communities already impacted by LDC, or if LDC use is inevitable, this thesis provides guidance for reducing community fractionalisation between LDC workers and residents. If LDC workers are provided the opportunity to integrate into the community, a reduction in fractionalisation of the community may result. This could be facilitated by reducing the shift hours of LDC workers from 12 to 8 hours, and/or locating LDC camps close to the city/town. The current length of LDC shifts offer few opportunities for workers to integrate within the host community. Reductions in the shift length from 12 to 8 hours give the worker down time, which may be used for community involvement. Similarly, the location of the work camps is important; locating them within the host community would allow workers easy access to community facilities and services.

This policy option, however, may not be cost effective and/or feasible. The LDC block roster is designed to maximise productivity. Any reductions in shift length will result in lower productivity, and subsequently, make the firm less competitive. Similarly, locating the work camp within the host community is more expensive than near the mining site. If the work camp was within the host community, additional land would need to be purchased (at a higher price compared to land near the mining site).

Policy option 3: Accept LDC, but empower the host region (provide linking social capital)

This policy option focuses on governance, and in particular, empowering the host region to influence discussions around LDC (i.e. increase their linking social capital). Impacts of LDC are a top-down problem with a larger entity disrupting a region. Therefore, ground-based (e.g. resident-based) solutions are ineffective without top-down solutions. Such solutions may include joint commitments: (1) for (government) investments in regional infrastructure, which would raise the residential attractiveness, and (2) to emphasis 'best efforts' for businesses to prioritise locally, then regional, then national and finally international. These are based on the examples of the 'Community Benefit Plans' used in some Canadian resource towns (SCRA and Windsor 2013). These plans set local labour and supplier provisions with the inclusion of equity programs. In both the labour and supplier contexts, companies need to justify what they do and penalties may be impose if they cannot. Carrington and Pereira (2011) has suggested that mining worker compositions of less than 25 percent can earn a social license.

7.2.2 Methodological Contributions

Contribution 1: Alternative method to operationalise LDC empirically

Methodologically, this research successfully operationalised variables which, in the past, have been elusive to researchers. Specifically, measures of the scale of LDC are problematic because no 'best practice' measure exists (Haan, Walsh, & Neis, 2014). Previous methods have relied on straight line distance between regions and set arbitrary distance cut offs like 100km (KPMG, 2013b) and 400km (Skilton, 2015), or have directly sampled at airports (Blackman et al., 2014; Cummings, 2008; United Research Services, 2012). This thesis developed a proxy method for estimating LDC through the combination of local government areas (to provide the scope) and a remoteness index

based off road distance; not straight-line distance (to control for daily commuters). Control for daily commuters by using road distance is a superior method because it is a more accurate representation of a daily commuter (i.e. commuters travel along roads).

Due to limitations with census data, it was necessary to derive the LDC count through proxy. I included a region's population size in the analysis to gauge the effectiveness of the applied strategy to isolate long distance from short distance (daily) commuters. The population control variable was positively significant which indicated that some daily commuters, particularly in the populated regions, counted as LDC. Therefore, the remoteness index restrictive sampling design was imperfect.

To gauge accurate numbers of LDC, the lowest cost method would be to incorporate a question into the Census. However, it is not as simple as that. The census uses 'usual residence' for population counts; usual residence is where someone resides for six months or more (ABS, 2013). This implies some LDC workers will indicate their usual residence as their place of work whilst others will indicate their place of residence. The only way to rectify this is to identify LDC workers directly. Firstly, there is a need to identify how long an individual remains at their usual place of residence during the year. This could be achieved by adding a question about 'additional place of usual residence' and asking respondents to indicate the percentage of the year spent at each location. Secondly, the question: 'do you daily commute from your place of usual residence to your place of work?' should be asked for place of usual residence.

Contribution 2: Space matters in mining/LDC research

Space is an important consideration in mining/LDC research. Since mineral deposits are clustered throughout Australia, and the mining industry is the dominant employer of LDC, the clustering of mineral deposits causes the spatial correlation of the proportion of LDC (the dependent variable in my model). Spatial interaction between neighbouring regions may cause spatial correlation of regional characteristics (the independent variables in my model).

This thesis used spatial panel modelling which allowed spatial interactions between regions to be considered. Advances in econometrics have allowed these models to

incorporate complex spatial interactions. For example, the specific employment of spatial panel modelling in the current research addressed two criticisms of LDC modelling. Firstly, the spatial and temporal heterogeneity of regional characteristics (Chapman et al., 2015). Secondly, spatial interactions between regions cause spatial dependence. Accordingly, this model represents the first to control for time, space and spatial interaction simultaneously to explain the determinants of the extent of LDC into a region.

The use of LDC can obscure the applicability of Tobler's law though, which assumes spatial interactions decrease over distance. Spatial economic modelling assumes this law to be true. This can be resolved with advanced spatial econometrics; that is, adjusting the designation of a 'neighbour region'. In the case of Australia, fly-out hubs could be estimated using census data and weighted as neighbours (alongside a region's geographical neighbours) in the spatial weight matrix.

Contribution 3: Separate measures for LDC and mining impacts

Past research has generally treated LDC and mining impacts as one and the same. The case study of the city of Kalgoorlie-Boulder, however, revealed that residents can successfully distinguish between the two impacts. Residents indicate that inbound LDC negatively influenced their wellbeing, whilst mining contributed positively towards it. In particular, Kalgoorlie-Boulder residents identified increased financial status and improved infrastructure from mining, whereas LDC did not expand social opportunities. This result is important with the rise of non-mining LDC in the remote areas of Australia. In the future, researchers will need to distinguish between mining and LDC impacts.

Contribution 4: Measuring social capital at a (remote) community level and its role as a mediator of LDC impacts on wellbeing

This thesis positions the concept of social capital as an explanatory tool for discerning why communities react differently when exposed to LDC. The two-step procedure utilised to assess social capital's potential mediation role between LDC impacts and resident wellbeing contributed to the limited research on the underlying mechanisms of social capital in resource communities (Bell, 2009; Chapman et al., 2015). Firstly, resident surveys facilitated the direct measurement of social capital and allowed

quantitative mediation modelling. Secondly, follow-up group interviews added clarity to the mechanisms of social capital as a mediator of LDC impacts on resident wellbeing.

A limitation relevant to research conducted in rural communities is the relatively lower sample sizes caused by smaller populations. The Kalgoorlie-Boulder community survey attracted 217 participants with 150 fully completed surveys. Although the survey captured 0.7 per cent of the adult population, the sample was at the lower boundary for quantitative modelling. The sample was big enough for data saturation; however, it was not representative of all Kalgoorlie-Boulder residents. The participation of only nine survey respondents in follow-up group interviews exacerbated the issue.

Kalgoorlie-Boulder respondents used bonding and bridging social capital to improve their wellbeing. Specifically, communication with friends and family were important along with a strong sense of community. Linking social capital was not effective at improving wellbeing but offers a potential way of mediating LDC impacts on wellbeing. At the community level, Kalgoorlie-Boulder residents attempted to use social capital to mediate the impacts of LDC. Inadequate access to linking social capital, however, limited successful mediation. Company headquarters (in capital cities or overseas) make the LDC decisions; residents' linking social capital does not influence decisions there.

The relevant dimensions of social capital can be reduced to a few key questions, which could be included in a census questionnaire. Firstly, a question indicating the quantity of communication with friends and family. Secondly, the cohesiveness of the community; this includes quantity and quality of communication with members of their community and frequency of attended community events (e.g. sporting events, festivals). Thirdly, a measure of the perceived effectiveness of local and state governments for balancing community and industry needs. If social capital can be measured easily at the community level and if a direct measure of LDC is included in the census, then a macro-analysis of the effect of LDC on resident wellbeing at the community level can be conducted.

7.3 Research Limitations and Future Research

Limitations are present in all research; this thesis is no exception. The downward LDC trend from 2006 to 2011 derived in Chapter 4 is the opposite from the literature. This

suggests the methods used to derive LDC counts are imperfect, and therefore, I would advise caution when interpreting the results. Spatial panel models incorporate both spatial and temporal interactions into a single model. For the current research, this meant an increased precision for predicting the drivers of LDC. Panel modelling requires data that are broad in scope but also detailed. Spatial panel modelling requires data for each spatial unit (LGA) over time; this assumes that the spatial unit does not change. Due to variations in Census questions (i.e. the lack of a 'place of work' question) and changes in spatial units over time, data were unavailable prior to 2006.

Furthermore, data restrictions implied that I had to conduct the spatial panel model at the regional rather than the community level. Again, this was due to the proxied LDC variable; controlling for daily commuters at the community level was impractical. These data limitations also restricted the number of hypothesises tested in Chapter 4, future research on the rise of LDC should include costs (LDC versus local residential) and attractiveness of a regional relative to the home region. The spatial panel model detected spatial interactions within the error term, an indication that the regional level analysis did not account for all spatial interactions.

Chapters 5 and 6 addressed this issue by demonstrating the potential of social capital mediation as a proxy of within-regional interaction. However, the insignificant social capital mediation rendered its incorporation in the spatial panel model unnecessary. Furthermore, use of a case study approach for Chapters 5 and 6 limits the extrapolation of results outside the study area. It would be pertinent to collect real data on the real impacts of LDC (e.g. hollow economy) within a case study context. Future research needs to focus on an appropriate proxy of social capital mediation at the regional level and to incorporate that into the spatial panel modelling.

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Appendix A: Regional Selection Procedure

This study incorporated 544 Local Government Areas (LGA) dispersed across Australia's six states and two territories. In order to identify the most appropriate region for case study analysis, I applied a four-criterion region-removal process. The following information details the stage at which each region was removed (if applicable).

Step 1: Removal of regions with an LDC count of 0

Cowra (A)
Albury (C)
Ashfield (A)
Balranald (A)
Bathurst Regional (A)
Berrigan (A)
Bland (A)
Blayney (A)
Blue Mountains (C)
Bombala (A)
Boorowa (A)
Burwood (A)
Byron (A)
Camden (A)
Cessnock (C)
Conargo (A)
Coolamon (A)
Cooma-Monaro (A)
Cootamundra (A)
Corowa Shire (A)
Deniliquin (A)
Dungog (A)
Forbes (A)
Gilgandra (A)
Gloucester (A)
Goulburn Mulwaree (A)
Greater Hume Shire (A)
Greater Taree (C)
Gundagai (A)
Harden (A)
Holroyd (C)
Hunters Hill (A)
Hurstville (C)
Jerilderie (A)
Junee (A)
Kiama (A)
Leeton (A)
Liverpool Plains (A)
Lockhart (A)
Mid-Western Regional (A)
Murrumbidgee (A)
Nambucca (A)
Narromine (A)
Oberon (A)
Orange (C)
Palerang (A)
Queanbeyan (C)
Richmond Valley (A)
Shellharbour (C)
Temora (A)
Tenterfield (A)
Tumbarumba (A)
Upper Hunter Shire (A)
Upper Lachlan Shire (A)
Uralla (A)
Urana (A)
Wakool (A)
Walcha (A)
Warrumbungle Shire (A)
Weddin (A)
Wellington (A)
Wingecarribee (A)
Wollondilly (A)
Yass Valley (A)
Young (A)
Alpine (S)
Ararat (RC)
Baw Baw (S)
Bayside (C)

Benalla (RC)
Buloke (S)
Campaspe (S)
Cardinia (S)
Central Goldfields (S)
Colac-Otway (S)
Corangamite (S)
Gannawarra (S)
Golden Plains (S)
Greater Shepparton (C)
Hepburn (S)
Horsham (RC)
Indigo (S)
Latrobe (C)
Loddon (S)
Macedon Ranges (S)
Manningham (C)
Mansfield (S)
Maribyrnong (C)
Maroondah (C)
Melton (S)
Moira (S)
Moorabool (S)
Mount Alexander (S)
Moyne (S)
Murrindindi (S)
Nillumbik (S)
Northern Grampians (S)
Pyrenees (S)
Queenscliffe (B)
South Gippsland (S)
Strathbogie (S)
Towong (S)
Warrnambool (C)
West Wimmera (S)
Yarra Ranges (S)
Yarriambiack (S)
Barcoo (S)
Blackall Tambo (R)
Croydon (S)
Goondiwindi (R)
Adelaide Hills (DC)
Barossa (DC)
Barunga West (DC)
Berri and Barmera (DC)
Campbelltown (C)
Clare and Gilbert Valleys (DC)
Copper Coast (DC)
Flinders Ranges (DC)
Franklin Harbour (DC)
Gawler (T)
Goyder (DC)
Grant (DC)
Holdfast Bay (C)
Karoonda East Murray (DC)
Kimba (DC)
Kingston (DC)
Light (RegC)
Loxton Waikerie (DC)
Mallala (DC)
Mitcham (C)
Mount Barker (DC)
Naracoorte and Lucindale (DC)
Northern Areas (DC)
Orroroo/Carrieton (DC)
Peterborough (DC)
Playford (C)
Port Pirie City and Dists (M)
Prospect (C)
Robe (DC)
Tea Tree Gully (C)
The Coorong (DC)
Victor Harbor (C)
Wakefield (DC)
Walkerville (M)
Wattle Range (DC)
Yankalilla (DC)
Yorke Peninsula (DC)
Armadale (C)
Bassendean (T)
Beverley (S)
Boyup Brook (S)
Bridgetown-Greenbushes (S)
Brookton (S)
Bruce Rock (S)
Busselton (S)
Capel (S)
Chapman Valley (S)
Chittering (S)
Claremont (T)
Coorow (S)
Corrigin (S)
Cottesloe (T)
Cranbrook (S)
Cuballing (S)
Cunderdin (S)

Dalwallinu (S)
Dardanup (S)
Donnybrook-Balingup (S)
Dumbleyung (S)
East Fremantle (T)
Gingin (S)
Goomalling (S)
Harvey (S)
Irwin (S)
Jerramungup (S)
Kellerberrin (S)
Kent (S)
Kojonup (S)
Koorda (S)
Manjimup (S)
Mingenew (S)
Moora (S)
Mosman Park (T)
Mount Marshall (S)
Mukinbudin (S)
Murray (S)
Nannup (S)
Narembeen (S)
Narrogin (S)
Narrogin (T)
Nungarin (S)
Peppermint Grove (S)
Pingelly (S)
Plantagenet (S)
Quairading (S)
Sandstone (S)
Serpentine-Jarrahdale (S)
Tammin (S)
Toodyay (S)
Trayning (S)
Victoria Plains (S)
Wandering (S)
Waroona (S)
West Arthur (S)
Wickepin (S)
Williams (S)
Wongan-Ballidu (S)
Woodanilling (S)
Wyalkatchem (S)
York (S)
Derwent Valley (M)
Dorset (M)
Flinders (M)
George Town (M)
Kentish (M)
King Island (M)
Sorell (M)
Southern Midlands (M)
Tasman (M)
Casey (C)
Frankston (C)
Charles Sturt (C)
Wyong (A)
Onkaparinga (C)
Penrith (C)
Moreland (C)
Marrickville (A)
Brimbank (C)
Norwood Payneham St Peters (C)
Strathfield (A)
Marion (C)
Whittlesea (C)
Hornsby (A)
Kogarah (C)
Banyule (C)
Campbelltown (C)
East Gippsland (S)
Bunbury (C)
Stonnington (C)
Randwick (C)
Whitehorse (C)
Darebin (C)
Wyndham (C)
Wellington (S)
Bankstown (C)
Mandurah (C)
Blacktown (C)
Fairfield (C)
Glen Eira (C)
Bega Valley (A)
Canterbury (C)
Eurobodalla (A)
Ku-ring-gai (A)
Wollongong (C)
Burnside (C)
Ipswich (C)
Leichhardt (A)
Tweed (A)
Ballarat (C)
Gosford (C)
Bundaberg (R)
Joondalup (C)
Greater Dandenong (C)

Waverley (A)
Greater Geelong (C)
Bayswater (C)
Moonee Valley (C)
Kingston (C)
Pittwater (A)
Surf Coast (S)
The Hills Shire (A)
Sutherland Shire (A)
Mosman (A)
Greater Bendigo (C)
Murray Bridge (RC)
Gosnells (C)
Kalamunda (S)
Knox (C)
Hobsons Bay (C)
Rockdale (C)
Vincent (T)
Maitland (C)
Gwydir Tamworth Regional
Alexandrina (DC)
Parramatta (C)
Port Stephens (A)
Fraser Coast Gympie
Salisbury (C)
Mundaring (S)
Auburn (C)
Melville (C)
Port Adelaide Enfield (C)
Newcastle (C)
Rockingham (C)
Logan Scenic Rim
Unley (C)
Southern Grampians (S)
Cambridge (T)
Muswellbrook (A)
Augusta-Margaret River (S)
South Perth (C)
Monash (C)
Great Lakes (A)
Manly (A)
Sunshine Coast (R)
Boroondara (C)
Nedlands (C)
Meander Valley (M)
Hawkesbury (C)
North Burnett (R)
Hume (C)
Bass Coast (S)
Armidale Dumaresq (A)
Swan Hill (RC)
Northam (S)
Gold Coast (C)
Lake Macquarie (C)
Huon Valley (M)
Renmark Paringa (DC)
Glen Innes Severn (A)
Wanneroo (C)
Mornington Peninsula (S)
Kingborough (M)
Bellingen (A)
Shoalhaven (C)
South Burnett (R)
Toowoomba (R)
Woollahra (A)
Somerset (R)
West Torrens (C)
Victoria Park (T)
Clarence Valley (A)
Kyogle (A)
Warringah (A)
Yarra (C)
Lane Cove (A)
Griffith (C)
Fremantle (C)
Mitchell (S)
Redland (C)
Willoughby (C)
Mount Gambier (C)
Singleton (A)
Port Macquarie-Hastings (A)
Moreton Bay (R)
Hindmarsh (S)
Cockburn (C)
Liverpool (C)
Mid Murray (DC)
Central Coast (M)
Murray (A)
Narrandera (A)
Dubbo (C)
Adelaide (C)
Wodonga (RC)
Albany (C)
Ballina (A)
Canning (C)
Port Phillip (C)
Wagga Wagga (C)
Kwinana (T)
Lockyer Valley (R)

North Sydney (A)	Tatiara (DC)
Northern Midlands (M)	Coffs Harbour (C)

Step 2: Removal of regions classified as 'cities'

Darwin (C)	Sydney (C)	Clarence (C)
Palmerston (C)	Wangaratta (RC)	Brighton (M)
Litchfield (M)	Melbourne (C)	Hobart (C)
Swan (C)	Belmont (C)	Perth (C)
Stirling (C)	Unincorporated ACT	Lithgow (C)
Brisbane (C)	Glenorchy (C)	Lismore (C)
Ryde (C)	Subiaco (C)	Collie (S)
Canada Bay (A)	Boddington (S)	Botany Bay (C)

Step 3: Removal of regions with towns that are 80 percent or less than the region's population

West Tamar (M)	Leonora (S)	Southern Mallee (DC)
Westonia (S)	Glamorgan/Spring Bay (M)	Cook (S)
Perenjori (S)	Laverton (S)	Bulloo (S)
Unincorporated NSW	McKinlay (S)	Shark Bay (S)
Northern Territory Region	Ashburton (S)	Northampton (S)
Snowy River (A)	Banana Western Downs	Broomehill-Tambellup (S)
Cabonne (A)	Whitsunday (R)	East Pilbara (S)
Wiluna (S)	Kondinin (S)	Yilgarn (S)
Etheridge (S)	Walgett (A)	Latrobe (M)
Lower Eyre Peninsula (DC)	Cassowary Coast (R)	Meekatharra (S)
Tablelands (R)	Break O'Day (M)	Boulia (S)
Mount Remarkable (DC)	Isaac (R)	Kempsey (A)
Elliston (DC)	Central Darling (A)	Dandaragan (S)
Wentworth (A)	North Western Australian	Barcaldine (R)
Central Highlands (M)	Region	Waratah/Wynyard (M)

Carrathool (A)	Maranoa (R)	Longreach (R)
Central Highlands (R)	Carnamah (S)	Tumby Bay (DC)
Kangaroo Island (DC)	Brewarrina (A)	Ceduna (DC)
Hinchinbrook (S)	Winton (S)	Coonamble (A)
Carpentaria (S)	Carnarvon (S)	Mildura (RC)
West Coast (M)	Cue (S)	Coolgardie (S)
Southern Downs (R)	Glenelg (S)	Charters Towers (R)
Circular Head (M)	Gladstone (R)	Bourke (A)
Mullewa (S)	Balonne (S)	Gunnedah (A)
Kulin (S)	Richmond (S)	Mackay (R)
Lachlan (A)	Warren (A)	Murweh (S)
Wudinna (DC)	Roebourne (S)	Morawa (S)
Cleve (DC)	Dowerin (S)	Bogan (A)
Narrabri (A)	Rockhampton (R)	Parkes (A)
Denmark (S)	Tumut Shire (A)	Torres (S)
Dundas (S)	Paroo (S)	Cairns (R)
Guyra (A)	Flinders (S)	Port Hedland (T)
Burdekin (S)	Moree Plains (A)	Hay (A)
Exmouth (S)	Mount Magnet (S)	Wagin (S)
Gnowangerup (S)	South Western Australian	Cobar (A)
Streaky Bay (DC)	Region	Coober Pedy (DC)
Quilpie (S)	Three Springs (S)	Merredin (S)
Cloncurry (S)	Inverell (A)	

Step 4: Removal of regions without a large enough population

Roxby Downs	Weipa	Kathanning

After this four-step region removal process, 12 regions remained (see Table A 1):

Table A 1: Final stage regional selection

Region	LDC (%)	Remoteness	Population	Regional Hub	Regional Hub Population	% of RH pop

Launceston (C)	1	3	64,510	Launceston	64,510	100
Townsville (C)	1	3	178,375	Townsville	157,752	88
Port Augusta (C)	1	3	14,249	Port Augusta	13,504	95
Devonport (C)	1	3	23,978	Devonport	22,769	95
Geraldton-Greenough (C)	2	3	36,488	Geraldton	31,347	86
Broken Hill (C)	2	3	18,806	Broken Hill	18,430	98
Whyalla (C)	2	3	22,196	Whyalla	21,736	98
Port Lincoln (C)	2	2	13,937	Port Lincoln	13,937	100
Burnie (C)	2	3	19,114	Burnie - Somerset	19,114	100
Alice Springs (T)	2	2	28,080	Alice Springs	24,209	86
Kalgoorlie/ Boulder (C)	6	1	31,963	Kalgoorlie/ Boulder	30,840	96
Mount Isa (C)	10	1	23,283	Mount Isa	20,569	88

Appendix B: Manual Conversion of 2006 LGA to 2011 LGA

The correct demarcation of regions within this analysis needs to be consistent between 2006 and 2011 census periods. As discussed in the 'define a region' section, I chose the conversion of 2006 statistical local areas (SLA) to 2011 local government areas (LGA). The majority of the 2006 LGAs have outer boundaries that are consistent with the boundaries of the 2011 LGAs. Figure B 1 highlights the regions that are not consistent between the two census periods.

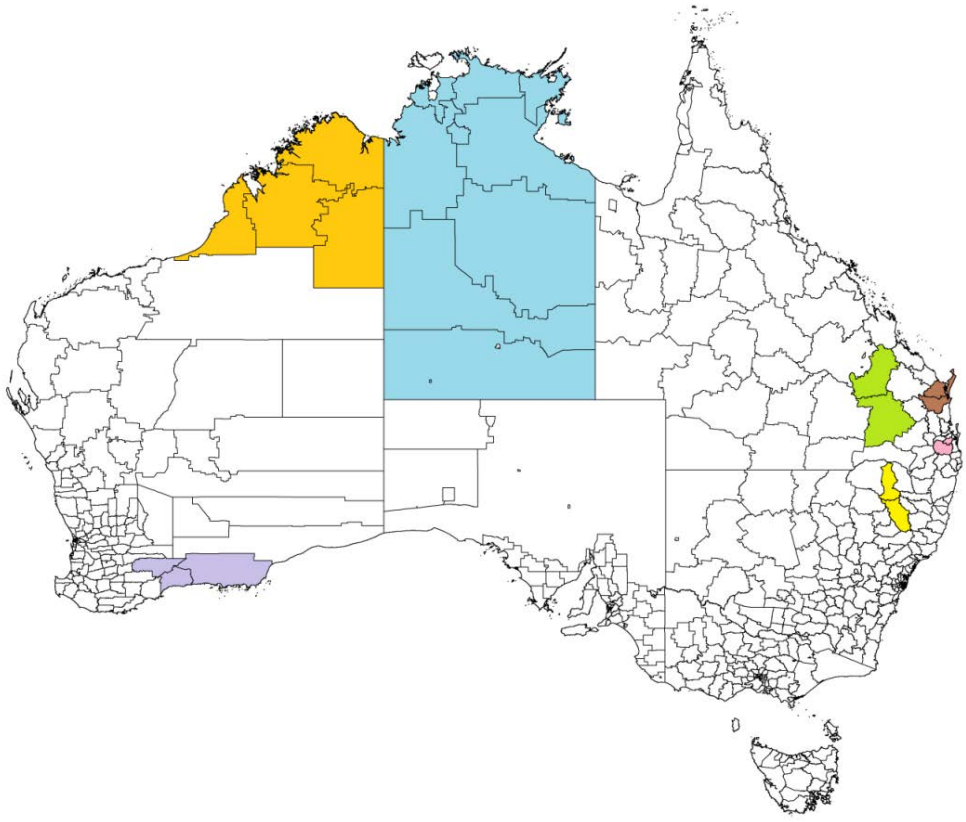


Figure B 1: LGA 2011 and 2006, non-consistent regions are highlighted, different colours indicate the new megaregions that were created

To alleviate these problems, the inconsistent boundaries are encapsulated by the creation of mega regions that run along the closest consistent LGA boundaries. Table B 1 lists the mega regions and the associated LGAs that I amalgamated.

Table B 1: Megaregions and their constituent LGAs

State	Megaregions	Local Government Areas
Queensland	Banana Western Downs	Banana, Western Downs
	Fraser Coast Gympie	Fraser Coast, Gympie
New South Wales	Gwydir Tamworth Regional	Gwydir, Tamworth Regional
Northern Territory	Northern Territory Region	Barkly, Belyuen, Central Desert, Coomalie, East Arnhem, Katherine, MacDonnell, Roper Gulf, Victoria-Daly, Wagait, West Arnhem, Unincorporated NT
Western Australia	North West Region	Broomie, Derby-West Kimberley, Halls Creek, Wyndham-East Kimberley
	South West Region	Esperance, Lake Grace, Ravensthorpe

Appendix C: Community Survey

What is Long Distance Commuting?

A long distance commuter is a worker who does not commute daily between their workplace and residence. Instead they stay at their work place for several days before traveling back home. Upon their return home they spend a few days relaxing before repeating the cycle. Depending on the mode of transport, LDC workers can, for example, use Fly-in; Fly-out (FIFO) or Drive-in; Drive-out (DIDO) modes of mobility.

Why should you be involved in this study?

The increased reliance on long distance commuting has become a controversial topic in Australia as well as internationally. While mining companies see LDC practices as a way of increasing worker flexibility and reducing costs, the communities that host these workers (while they are at work) may view them as disruptive and damaging to their local identity. However, the severity of impacts a community suffers is not entirely dependent on the size of the LDC workforce. Industry and community behaviours when faced with these impacts also have an influence.

Taking part in this 10 minute survey will allow researchers to measure Kalgoorlie resident's behaviour and how that influences their perceptions of LDC impacts. Participation is voluntary and confidential.

Question 1:

Are you a resident of Kalgoorlie?

- ☐ Yes
- ☐ No

Question 2:

For how many years have you lived in Kalgoorlie?

- ☐ less than 1 year
- ☐ 1 – 2 years
- ☐ 2 – 5 years
- ☐ 6 – 10 years
- ☐ 11 – 20 years
- ☐ more than 20 years

Question 3:

In what year were you born? _____

Question 4:

Are you currently employed?

☐ Yes

☐ No

Question 5:

In what industry are you currently employed?

☐ Agriculture, Forestry and Fishing
☐ Manufacturing
☐ Construction
☐ Retail Trade
☐ Transport, Postal and Warehousing
☐ Financial and Insurance Services
☐ Professional, Scientific and Technical
☐ Public Admin and Safety
☐ Healthcare and Social Assistance
☐ Other Services
☐ Mining
☐ Electricity, Gas, Water and Waste
☐ Wholesale Trade
☐ Accommodation, Food Services
☐ IT and Telecommunication
☐ Rental, Hiring, Real Estate
☐ Admin and Support Services
☐ Education Training
☐ Arts and Recreation Services
☐ Not Applicable

Question 6:

What is your current occupation?

☐ Manager
☐ Technicians and Trade
☐ Clerical and Admin
☐ Machinery Operators and Drivers
☐ Other
☐ Professional
☐ Community and Personal Service
☐ Sales
☐ Labourers

Question 7:

'All things considered, I am satisfied with my life'

Strongly Disagree Strongly Agree

0 1 2 3 4 5 6 7 8 9 10

Question 8:

'Overall, I am satisfied with opportunities for social interaction in Kalgoorlie'

Strongly Disagree Strongly Agree

0 1 2 3 4 5 6 7 8 9 10

Question 9:

We would like to know more about who you socially interact with on a regular basis. To what extent do you agree or disagree that you socialize on a regular basis with the following groups of people:

Scale: 0 = strongly disagree, 10 = strongly agree

0 1 2 3 4 5 6 7 8 9 10

Family Members

Friends

Neighbours

Work Colleagues

Question 10:

Where do you interact with your regular social groups? (Can tick multiple answers)

	Someone's House	Go out together socially	Phone/ text/ social media	Other	Not Applicable
Family Members					
Friends					
Neighbours					
Work Colleagues					

Question 11:

In regards to your sense of attachment to Kalgoorlie, please indicate your level of agreement with the following statements:

	Scale: 0 = strongly disagree, 10 = strongly agree										
	0	1	2	3	4	5	6	7	8	9	10
I feel that I belong to this community											
After being away from Kalgoorlie for a short period of time, I am pleased to return											
Overall, I feel very attached to Kalgoorlie											

Question 12:

Thinking of your local neighbourhood in Kalgoorlie, please indicate your level of agreement with the following statements.

	Scale: 0 = strongly disagree, 10 = strongly agree 0 1 2 3 4 5 6 7 8 9 10
People in my neighbourhood can be trusted	
I feel like I belong in my neighbourhood	
My neighbourhood is close knit	
People in my neighbourhood in Kalgoorlie are friendly	

Question 13:

Thinking about the people who live in Kalgoorlie, please indicate your level of agreement with the following statements:

	Scale: 0 = strongly disagree, 10 = strongly agree 0 1 2 3 4 5 6 7 8 9 10
Most of my friends have similar incomes to me	
'Every person for themselves' is a good description of people in Kalgoorlie	
Residents of Kalgoorlie are receptive to new residents in leadership positions	
My social connections outside of Kalgoorlie are equally important to me as my local social connections	

Question 14:

Thinking about Kalgoorlie as a community, please indicate your level of agreement with the following statements:

	Scale: 0 = strongly disagree, 10 = strongly agree 0 1 2 3 4 5 6 7 8 9 10
Local residents are willing to have a united voice on issues affecting Kalgoorlie	
Local residents are able to influence decisions affecting their neighbourhoods	
The local council has the best interests of residents at heart	
The local police are trustworthy	
State Parliament balances the needs of both residents and industry in Kalgoorlie	

Question 15:

Focusing on the mining industry, please indicate your level of agreement with the following statements:

	Scale: 0 = strongly disagree, 10 = strongly agree 0 1 2 3 4 5 6 7 8 9 10
Kalgoorlie is better off financially because of the mining industry	
I am better off financially because of the mining industry	
Mining has helped improve social infrastructure such as community centres and sporting clubs in Kalgoorlie	
Council rate are higher because of mining activity	
The cost of living, excluding housing, has increased because of mining activity	

A long distance commuter (LDC) is someone who does not commute daily to and from their workplace. Therefore, it is appropriate for them to stay at their place of work for several days before traveling back home. Upon their return home they spend a few days relaxing before repeating the cycle. Depending on the mode of transport, LDC workers can undertake Fly-in; Fly-out (FIFO) and/or Drive-in; Drive-out (DIDO)

Question 16:

Are you or have your ever been a long distance commuter (LDC)?

- ☐ Yes
- ☐ No

Question 17:

Are any of your friends or family a long distance commuter?

- ☐ Yes
- ☐ No

Question 18:

Focusing on long distance commuters to Kalgoorlie (which may or may not be related to mining), please indicate your level of agreement with the following statements:

	Scale: 0 = strongly disagree, 10 = strongly agree 0 1 2 3 4 5 6 7 8 9 10
The presence of LDC workers in Kalgoorlie provides an opportunity to extend my social network	
LDC workers contribute enough to the local economy	
I think industry in Kalgoorlie turns to LDC too quickly, that is, before trying to hire locally	
There are already too many LDC workers in Kalgoorlie	

Question 19:

Considering the recent slowdown of the mining boom and the future of Kalgoorlie as a community, please indicate your level of agreement with the following statements:

	Scale: 0 = strongly disagree, 10 = strongly agree 0 1 2 3 4 5 6 7 8 9 10
There is good planning for the future of Kalgoorlie	
Key people in Kalgoorlie are right for the job	
Kalgoorlie will be able to support volunteer community organisations in the future	
Key stakeholders work together to address problems associated with mining/LDC practices that affect Kalgoorlie	
Key stakeholders work together to take advantage of mining/LDC opportunities	
Overall, I am satisfied with the way Kalgoorlie is responding to the slowdown of the mining boom	

Question 20:

What is your opinion of the current size of the permanent resident population of Kalgoorlie?

- ☐ Needs to reduce greatly
- ☐ Needs to reduce slightly
- ☐ It's just right
- ☐ Needs to increase slightly
- ☐ Needs to increase greatly

Question 21:

What is your gender?

- ☐ Male
- ☐ Female

Question 22:

What is your relationship status?

- ☐ Single (never married)
- ☐ Single (widowed)
- ☐ Single (Separated/Divorced)
- ☐ Married
- ☐ Defacto

Question 23:

To what extent do you agree or disagree with the following statement:

'I am in good health'

Strongly Disagree Strongly Agree

0 1 2 3 4 5 6 7 8 9 10

Question 24:

Do you have any dependent children?

- ☐ Yes
- ☐ No

Question 25:

How many dependent children do you have?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ more than 3

Question 26:

What is your highest level of educational attainment?

- ☐ Year 10 certificate
- ☐ Year 12 certificate
- ☐ Certificate level 3
- ☐ Diploma
- ☐ Bachelor degree
- ☐ Graduate diploma
- ☐ Postgraduate degree
- ☐ other _____

Question 27:

What is your gross household income?

- ☐ Under $40,000
- ☐ $40,000 – $59,999
- ☐ $60,000 – $79,999
- ☐ $80,000 – $99,999
- ☐ Above $100,000

Question 28:

Would you like the opportunity to participate in a group interviews to discuss these issues further? All participants of these group interviews will receive a $20 voucher, if so please leave your email address.

_____

Thank you for participating

Appendix D: Factor Analysis Groupings

Table D 1: Mining impact variables and principal component factor loadings.

Statements	**Positive Mining Contributions**
Kalgoorlie – Boulder is better off financially because of the mining industry	0.467
I am better off financially because of the mining industry	0.470
Mining has helped improve social infrastructure such as community centres and sporting clubs in Kalgoorlie – Boulder	0.574
Mining has helped improve communication and information technology infrastructure in Kalgoorlie – Boulder	0.481
Council rates are higher because of mining activity	Separate
The cost of living, excluding housing, has increased because of mining activity	Separate
Cronbach Alpha	**0.78**
Kaiser – Meyer – Olkin = 0.65	

Note: A Kaiser – Meyer – Olkin test score above 0.50 indicates the statements are appropriate for factor analysis.

Table D 2: LDC impact variables and principal component factor loadings.

Statements	**Positive LDC Contributions**	**Negative LDC Contributions**
The presence of LDC workers in Kalgoorlie – Boulder provides an opportunity to extend my social network	0.757	
LDC workers contribute enough to the local economy	0.653	
I think industry in Kalgoorlie – Boulder turns to LDC workers too quickly, that is, before trying to hire locally		0.699
There are already too many LDC workers in Kalgoorlie – Boulder		0.696
Cronbach Alpha	**0.70**	**0.76**
Kaiser – Meyer – Olkin = 0.58		

† A Kaiser – Meyer – Olkin test score above 0.50 indicates the statements are appropriate for factor analysis.

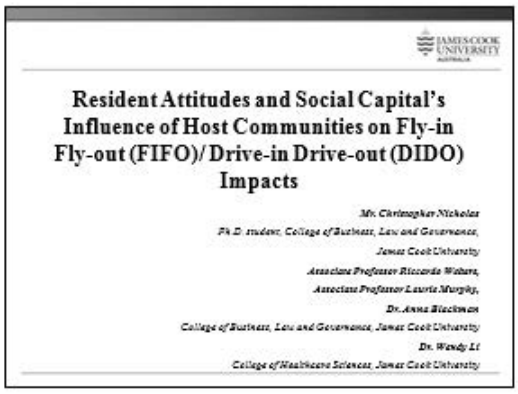
Table D 3: Social capital variables and principal component factor loadings.

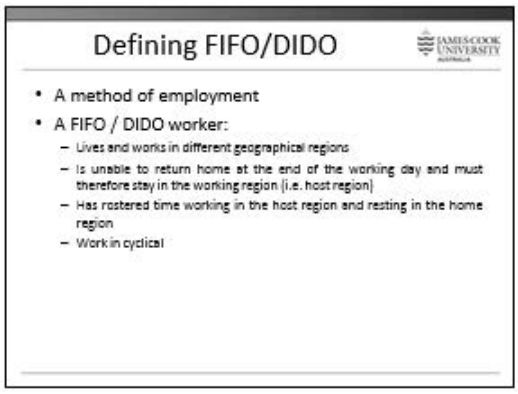
Statements	Neighbourhood Social Cohesion	Bridging Social Cohesion	Political Participation	Political Efficacy
I regularly have social interactions with family members		Separate		
I regularly have social interactions with friends		Separate		
I regularly have social interactions with neighbours	0.305			
People in my neighbourhood can be trusted	0.356			
I feel like I belong in my neighbourhood	0.466			
My neighbourhood is close knit	0.507			
People in my neighbourhood in Kalgoorlie – Boulder are friendly	0.517			
Overall, I am satisfied with opportunities for social interaction in Kalgoorlie – Boulder		0.344		
I feel that I belong to this community (i.e. Kalgoorlie – Boulder)		0.425		
After being away from Kalgoorlie – Boulder for a short period of time, I am pleased to return		0.475		
Overall, I feel very attached to Kalgoorlie – Boulder		0.495		
'Every person for themselves' is a good description of people in Kalgoorlie – Boulder		separate		
I regularly have social interactions with work colleagues		separate		
My social connections outside of Kalgoorlie – Boulder are equally important to me as my local social connections outside		separate		
Most of my friends have similar incomes to me		separate		
Residents of Kalgoorlie – Boulder are receptive to new residents in leadership positions		separate		
Local residents are willing to have a united voice on issues affecting Kalgoorlie – Boulder			0.584	
Local residents are able to influence decisions affecting their neighbourhoods			0.478	
Key people in Kalgoorlie – Boulder are right for the job			0.265	

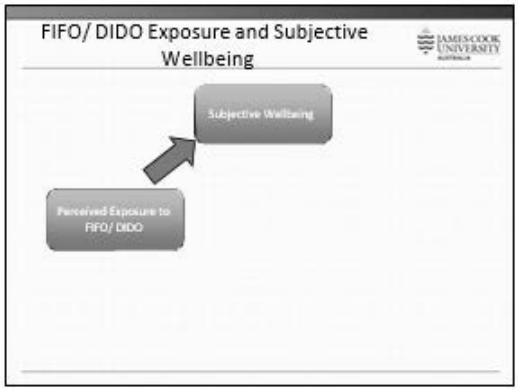
State Parliament balances the needs of both residents and industry in Kalgoorlie – Boulder				0.300
There is good planning for the future of Kalgoorlie – Boulder				0.302
Kalgoorlie – Boulder will be able to support volunteer community organisations in the future				0.366
Key stakeholders work together to address problems associated with mining / LDC opportunities				0.394
Key stakeholders work together to take advantage of mining / LDC opportunities				0.411
Overall, I am satisfied with the way Kalgoorlie – Boulder is responding to the slowdown of the mining				0.398
The local police are trustworthy	separate			
The local council has the best interests of residents at heart	separate			
Cronbach Alpha	**0.87**	**0.89**	**0.70**	**0.85**
Kaiser – Meyer – Olkin = 0.88†				

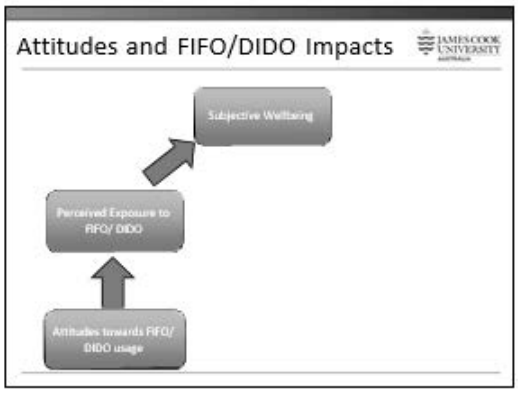
† A Kaiser – Meyer – Olkin test score above 0.50 indicates the statements are appropriate for factor analysis.

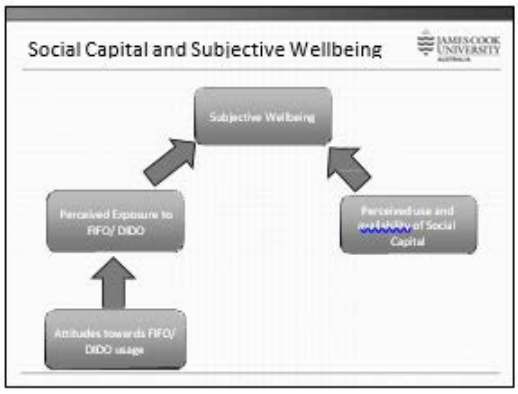
Appendix E: Group Interview



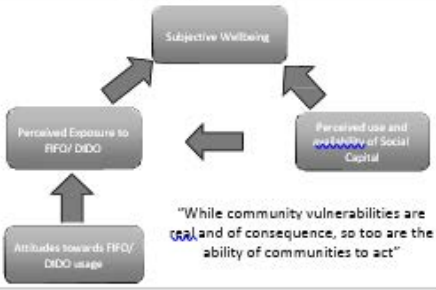








Influence of Social Capital on FIFO/DIDO Exposure



"While community vulnerabilities are real and of consequence, so too are the ability of communities to act"

Purpose of this Workshop

Follow up on the community survey ***"Attitudes towards Mining, inbound LDC and the Structure of Social Capital in Kalgoorlie – Boulder"***

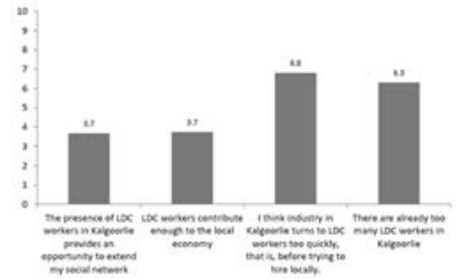
Workshop Structure

- Two Parts:
  a) Attitudes towards FIFO/ DIDO usage
  b) Availability and use of Social Capital

Part A: Attitudes towards FIFO/DIDO usage

Looking at the 8 images individually and write down the first 3 words that come to mind.

Kalgoorlie-Boulder Perceived Exposure to FIFO/DIDO

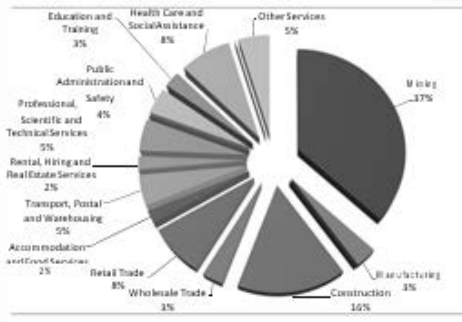


Attitudes towards FIFO/DIDO usage

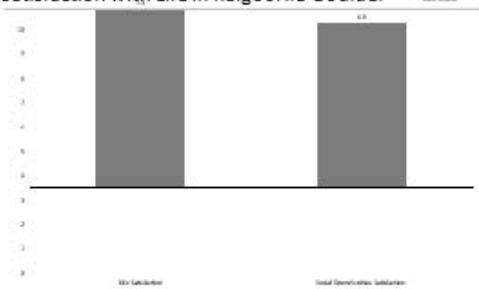
Exploring your attitudes towards the use of FIFO/ DIDO in Kalgoorlie-Boulder.

- What percentage of the workforce uses FIFO/ DIDO?
  - The answer according to the 2011 census was **4.5%**
  - Agree or disagree?

Kalgoorlie - Boulder Industry Composition

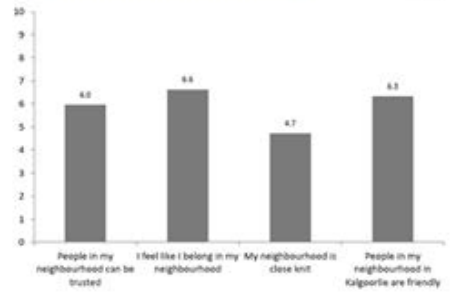


Satisfaction with Life in Kalgoorlie-Boulder



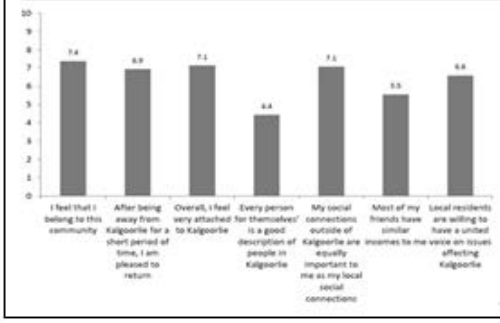
Part B: Availability and use of Social Capital

Neighbourhood Connections



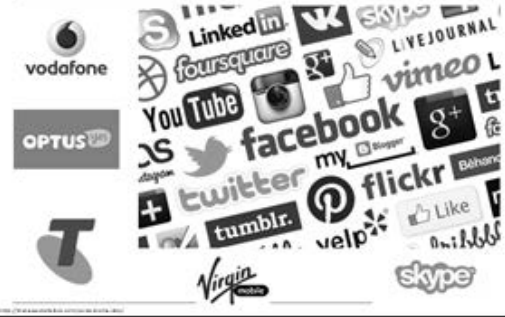
Hosting a BBQ

Residents of Kalgoorlie- Boulder

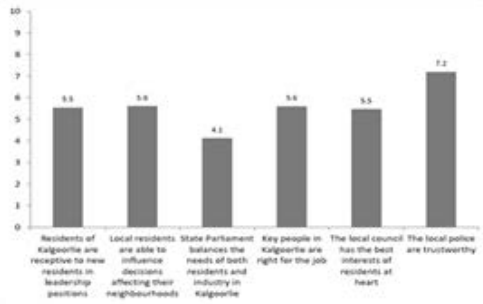


Going out for the night

Virtual Networks



Kalgoorlie – Boulder Leadership



Town Hall meeting on the future of Kalgoorlie – Boulder

In February 2014 KCGM announced its Life of Mine Plan which sees mining in the Fimiston Open Pit scheduled to end in 2019 with processing of low grade stockpiles to continue to 2029.

Countdown on as production end looms at the Super Pit

What would Kalgoorlie-Boulder be like without the Super Pit?

Open discussion on open pits

Any other comments about FIFO/DIDO in your community?

Thank-you for your contributions!