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Affordable housing in innovation-led employment strategies

From the AHURI Inquiry: Urban productivity and affordable rental housing supply

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Acronyms and abbreviations used in this report

AHURI	Australian Housing and Urban Research Institute Limited
CBD	Central Business District
HIP	Hunter Innovation Project
IT	Information Technology

Glossary

A list of definitions for terms commonly used by AHURI is available on the AHURI website www.ahuri.edu.au/research/glossary.

Executive summary

Key points

- Smart city governance is becoming increasingly common across Australian cities. Smart city planning involves innovation-led employment strategies, particularly mobilised through innovation districts.

- There is a paucity of peer-reviewed research on successful links between smart cities, innovation, and affordable housing. Internationally, innovation-led employment strategies that recognise the place of affordable housing are likewise rare; those that do, however, prioritise what is termed 'inclusive innovation'.

- Innovation-led employment strategies, including the development of innovation districts, should engage with questions of housing, particularly around affordability, availability and diversity.

- Models of successful innovation districts and innovation-led employment strategies are highly dependent on context. Attention needs to be paid to innovation that is holistic and place-based, leveraging anchor institutions and built through strong and inclusive collaborative networks, appropriate land uses and smart thinking.

Key findings

Urban economies and policy are being transformed by digital technologies. As cities continue the shift from manufacturing to knowledge and innovation economies, emerging 'smart city' strategies are making growing use of digital information and communication technologies (ICT) while reshaping the urban fabric. In Australia, smart cities are oriented around economic development and regeneration, with a key focus being 'innovation-led' employment growth. Through 'smart city'-based strategic planning, this innovation-led employment growth has been targeted in specific agglomeration areas – innovation districts (or 'precincts'). Yet, very little research has focused on how this shift in the urban fabric may intersect with affordable housing. To address this gap, this report investigates the role of affordable rental housing in supporting innovation-led employment growth in Australia's metropolitan and satellite cities. In particular, it explores what possibilities for affordable housing are provided by innovation districts (and hence by smart city strategies), especially for regional and outer metropolitan areas. This report is part of a wider inquiry into the role of affordable housing in the labour market and urban productivity with reference to innovation and smart city policy and planning.

International evidence

Affordable housing underpins models of the smart city. International evidence shows that successful innovation districts require mixed land uses and are socially, culturally, and economically diverse, with a diverse range of housing types, tenures and prices. Now, however, a more nuanced picture of the relationship between affordable housing supply and innovation is emerging.

The negative impact of innovation districts on housing affordability is widely recognised. Prosperous technology-based innovation districts such as Silicon Valley (US) or high-tech clusters near downtown cores are markedly linked to a rise in dwelling prices and rental costs (Katz and Wagner 2014). In attracting knowledge and creative workers, and the services they desire, these linked-in districts are gentrified further as they become even more attractive to well-paid workers. In this respect, innovation districts are known to reduce housing affordability and displace many lower-income earners and long-term residents. If workers – particularly fledgling entrepreneurs – in innovation sectors are unable to secure housing in, or within easy reach of, such innovation districts they are less likely to seek employment there; this deterrent, in turn, reduces the economic competitiveness of said districts (Moonen and Clark 2017).

Regulatory and planning interventions commonly used to mitigate the negative effects of these rising housing costs in innovation districts include inclusionary zoning, tax subsidies, new zoning frameworks and provision of land or subsidies for low-income housing providers. Inclusive planning is central to urban productivity; innovation districts require an ecosystem of established firms, startup and emerging businesses, and public anchor institutions to thrive. Diversity in housing provision is, therefore, an important mechanism when responding to the needs of innovation workforce. A lack of housing diversity is one of the major pitfalls in developing the integrated environments most conducive to supporting innovation (Pancholi, Yigitcanlar et al. 2017). A growth in different housing models, including co-housing and 'live-work' districts, reflects the increasing diversity in housing.

Affordable rental housing, labour market constraints and business location

Innovation sector firms in Australian metropolitan suburban locations and satellite cities face the barriers and opportunities summarised below (Table 1). Startup firms, typically headed by younger people, prioritise the businesses success imperative. Availability of affordable rental housing is thus a secondary, albeit complementary, requirement for the growth of these businesses. Housing that is easy to secure, available for shorter-term rental and close to employment is valued. As indicated by the literature however, this complementary requirement for startup growth becomes a growing challenge as innovation districts prosper, meaning those districts that have addressed housing early in their development will avoid economic stagnation in the longer term.

Younger innovation sector workers in metropolitan locations also advised that they seek to minimise their housing costs by living with parents or extended family members. This support from family networks is key to reducing housing costs for many individuals. In some outer-metropolitan and regional locations the affordability of housing is taken for granted, and factors such as connections to other businesses or entrepreneurs and the affordability of workspaces is given greater priority.

Regional and non-metropolitan areas that are well connected and have the necessary infrastructure to accommodate innovation districts may therefore hold significant potential to contribute to innovation-led employment strategies due to a larger supply of affordable housing. However, this affordability, and in particular its longevity, is not assured, and planning for such areas should include measures for anticipated shifts in housing demand.

Table 1: Key barriers and opportunities for innovation sector employees across inner-city and regional and outer-metropolitan housing

	Barriers	Opportunities
Inner-city housing locations	• Poor transport connections across the city • Lack of super-fast Internet or poor digital connectivity • High cost of living • Lack of housing types amenable to startup/ mobile workforce lifestyle	• Agglomeration of other businesses in the sector/ networking opportunities • Access to co-working spaces • Greater concentration of accelerator programs and funding opportunities • Access to CBD • Lifestyle amenities e.g. restaurants, arts etc. • Anchor institutions provide resources and collaborations
Regional and outer-metropolitan housing locations	• Poor transport infrastructure; • Poor digital and telecommunications infrastructure; • Lack of funding relative to population/potential workforce; • Wage differentials cf. cost-of-living; • Student retention; • Non place-based innovation growth	• Major infrastructure developments e.g. Aerotropolis, Sydney Science Park; • Existence/development of 'eds and meds' anchor institutions; • Context specific innovation foci; • Innovative low-cost and green housing options; • Environmental amenity

Source: author interviews

Emerging models of innovation districts

The international evidence review identified nine examples of innovation districts in which affordable housing and innovation-led employment strategies were considered simultaneously. Across these there is no discernible single approach to affordability. Measures include inclusionary zoning (e.g. Kings Cross, UK; Tonsley, SA), provision of land or subsidies for low-income housing providers (Barcelona, Spain; Cleveland, USA), or new zoning frameworks (South Lake Union, Seattle USA; Chattanooga, Tennessee USA). Also important is an orientation to diversity in housing provision, including, most innovatively, live-work districts (Tonsley, SA; Byron Bay, NSW) or co-housing (Boston, USA). Lessons from these and other case studies informed the development of a model for fostering innovation-led employment prioritising four key areas:

• **Land use:** interventions into supply and access of land and housing, including, for instance, through zoning and funding arrangements and innovative housing typologies;

• **Anchoring:** leveraging the considerable economic weight of local anchor institutions – those embedded in place such as hospitals, universities and cultural institutions – for community-wide benefit; this may include local procurement strategies, collaborative governance, company incubation, workforce training, and social enterprises;

- **Collaboration:** stresses the benefits of a clear and inclusive vision developed and implemented through structured public, private, and not-for-profit partnerships and civic participation; and

- **'Smart' thinking:** incorporates smart society and smart technology, leveraging technological advantages for inclusive, place-based planning.

Nurturing a mixture of firms – from startups to larger corporations and public anchor institutions – is crucial to the success of innovation districts. Without the provision of appropriate housing, including public, social, affordable and mid-range housing, as well as other infrastructure for affordable and connected living, innovation districts are unable to retain this critical mix.

Affordable housing has an essential role in maximising productivity in innovation districts. This is particularly true when it is part of a suite of people and place-based planning elements that intersect to allow for fuller and more inclusionary participation through innovation-led employment strategies, leveraging unique regional and suburban advantages.

Policy development options

Through a focus on innovation, smart cities, and affordable housing provision this research found a strong disconnect between policies on innovation and policies on housing. This disconnect – while rendering the drawing of specific policy conclusions somewhat problematic – was found to be the source of many of the issues and challenges facing innovation districts, their housing affordability and productivity. A key policy implication then is simple: that innovation-led employment strategies should explicitly consider their housing foundations and consequences for housing at formulation stage and readdress these as innovation districts emerge and continue to grow.

'Inclusive innovation' with a focus on equity was a common factor across successful international cases. As the case studies – such as Barcelona (Katz and Wagner 2014), Cleveland, and Chattanooga (see chapter two) – demonstrate, housing affordability and diversity is a critical element facilitating the varied skill-sets that support sustainable innovation districts. Planning innovation-led employment strategies that can provide an environment conducive to working and living may enable the growth of knowledge sector firms in high-amenity, satellite city locations. Policies linking housing and smart city initiatives are not yet embedded in Australian metropolitan planning. However, models emerging internationally provide a starting point for emulation.

Two sets of policy implications follow: the first relating to innovation-led employment strategies, and the second to the specific housing elements of those.

Innovation strategies

Australian evidence indicates that there is potential for mobilising significant and new economic opportunities for innovation districts. Strategies to develop these take time however, and success is contingent upon a number of factors, including:

- Strong locational advantages, such as proximity to key existing knowledge clusters, for instance universities or hospitals;

- Access to attractive natural amenities and cultural facilities; and

- Digital and physical connectivity, suggesting the need for digital equity strategies.

Land use planning frameworks may, therefore, support the development of innovation districts through models such as live-work zones, while strategic place-based funding interventions could prioritise connectivity (physical and digital) to enable new firms to operate beyond established central city areas. Providing quality amenities valued by innovation sector workers (local cycle/pedestrian networks, distinctive and sustainable urban design) should also be considered.

Housing strategies

Preserving and providing affordable rental housing is a key challenge for innovation-led employment strategies, depending on strong up-front strategies to embed affordability before districts 'take off' and requiring ongoing adaptation as they develop. Specific affordability strategies are required for emerging innovation districts, particularly those around transformative infrastructure projects. Targeting early-career innovation sector workers through particular housing typologies that cater towards flexible tenures, accessible locations, and high-quality amenities is often a key success factor. Renegotiating regulations and developmental incentives—such as flexible floor space index or relaxation in height controls—can help as potential strategic tool to encourage the growth of diverse housing options at the site. However, maintaining affordability requires added interventions.

Adapting of zoning and taxation should be readily considered in emerging innovation districts as mechanisms to preserve affordability. Policy settings should be flexible to ensure infrastructure, housing and service capacity meets need. This flexibility includes taking seriously innovative models for financing affordable and diverse housing. Smart innovation should be leveraged to improve urban planning systems and productivity losses, including addressing affordable housing provision and availability. Using 'big data' effectively could help to improve urban systems modelling and intergovernmental processes for more inclusive growth. While there has been extensive work on smart houses, smart housing has been a tangential (at best) focus. The Australian Government's *Smart Cities and Suburbs Program* could be more effectively targeted to address housing affordability.

The study

The research presented here is part of a wider AHURI (Australian Housing and Urban Research Institute) Inquiry into urban productivity and affordable rental housing supply. This report orients around the role that affordable rental housing plays in supporting innovation economies, productivity and growth in metropolitan and satellite cities. The research focused on four cities and regional areas: Wollongong New South Wales (NSW), Central Sydney, Western Sydney and Geelong, Victoria.

Digital and innovation strategies are increasingly recognised for their potential to improve city productivity and provide new sources of employment growth (Katz and Wagner 2014). In Australia, the national *Smart Cities Plan* for instance, anticipates the potential for smart technologies to better connect the location of homes and jobs, through the '30 minute city' (Department of Prime Minister and Cabinet 2016: 11). For regions such as Western Sydney in NSW, where there is an estimated deficit of around 200,000 jobs (Saunders 2013), the notion of a '30 minute city' depends on structural changes in the urban and housing system. Where lower paid Q2 workers (including innovation sector workers such as software developers and startup entrepreneurs) are unable to access affordable housing options near work, they and the firms that employ them will relocate to other labour markets or change their patterns of employment, reducing urban productivity.

Conversely, international evidence suggests that localities offering relative housing affordability, particularly when connected to central markets by transport and ICT infrastructure, are starting to perform well in attracting and fostering new economy jobs, for instance in 'health-tech', 'edu-tech', and 'auto-tech' fields (Kurutz 2017; Moonen and Clark 2017).

This research project address three key questions:

1. What is the international evidence on the role of affordable rental housing in supporting digital innovation and employment growth across different urban and regional areas and housing / economic settings?

2. To what extent are Australia's digital and startup firms affected by labour market constraints that relate to the availability of affordable rental housing, and to what extent do these constraints influence their business location decisions?

3. What models of digital and innovation-led employment developments are emerging within new urban and residential development projects, and within renewing suburban and regional settings, and how could such models be fostered?

The research progressed in three stages of data collection and analysis, consistent with its exploratory and preliminary intent. The fieldwork and analysis was conducted in 2018 and 2019. The report findings are derived from the following methods:

• Stage 1: an international evidence review, of significant developments in the United States, United Kingdom and Europe, to identify not only cases where affordable housing was incorporated in innovation-led employment and smart city policies, but also the mechanisms used. The review drew upon academic literature and the grey literature and was iteratively added to when interviews from Stage 2 yielded additional examples. The review examples were analysed in terms of policy, approach to housing and housing affordability, and outcomes.

• Stage 2: an empirical stage consisting of 29 semi-structured interviews held with local and state government strategic planners, local economic development officers, senior state government bureaucrats, and a variety of small businesses and umbrella organisations from across the four case study areas.

• Stage 3: an analytical stage to determine the key barriers and opportunities for innovation sector employees across inner-city and regional and outer-metro housing locations

1. The Role of Housing in Innovation-Led Employment Strategies

- Employment opportunities provided by smart cities and innovation sectors are being explored by cities internationally and in Australia.

- Generating new forms of innovation-led employment is a key component of smart city strategies

- Innovation-led employment typically clusters geographically, more often in inner metropolitan locations.

- Housing, housing affordability, and affordable rental housing are frequently not primary considerations in existing policies or research

- Despite its relative neglect in the literature, affordable housing implicitly underpins innovation-led employment strategies. Successful innovation districts require mixed land uses and are socially, culturally and economically diverse.

1.1 Introduction

Over the past two decades, Australian urban economies have been dramatically transformed by, and associated with, digital technologies. The development of digital information and communication technologies such as Wi-Fi, Internet, and high speed broadband are, *inter alia*, altering the nature of work and rendering more flexible where work occurs. New digital technology firms such as Facebook or Google, digital hardware firms including Apple and Microsoft, and e-commerce firms such as Amazon have grown in economic significance with a concomitant influence on urban space. Alongside these large corporations are a multitude of small firms, often led by individual entrepreneurs, producing goods and services such as applications for producers and consumers in the digital economy. Digital economies are most often, but not always, geographically concentrated in urban centres characterised by high levels of unaffordable rental housing.

Paralleling these economic developments are shifts in urban economic development policy, and in particular a focus on digital innovation and smart cities. Following the economic success of innovation and knowledge sector regions such as Silicon Valley in California, policy attention has focused on ways to foster and replicate the benefits of clusters of digital economy firms. Internationally, but especially in Australia, smart city strategies have focused on the links between digital technologies, innovation and economic development (Dowling, McGuirk et al. 2019; Maalsen, Burgoyne et al. 2018; Yigitcanlar, Kamruzzaman et al. 2018).

Despite their importance to both research and policy, digital innovation and smart city strategies are rarely considered from the perspective of housing. Thus, this project investigates the role of affordable rental housing in supporting innovation-led employment strategies in metropolitan and satellite cities. In particular, it explores what possibilities for affordable housing supply are provided by smart city and innovation-led employment strategies, especially for regional and outer metropolitan areas. This report is part of a wider inquiry on affordable rental housing supply's role in supporting labour market and urban productivity with reference to digital innovation and smart city policy and planning.

Three overarching research questions guide the project. They are:

1. What is the international evidence on the role of affordable rental housing in supporting digital innovation and employment growth across different urban and regional areas and economic settings?

2. To what extent are Australia's digital and startup firms affected by labour market constraints that relate to the availability of affordable rental housing, and to what extent do these constraints influence their business location decisions? In particular:

   - In locations of affordable rental housing shortage, is there evidence that digital innovation, technology, and startup firms have experienced difficulties in attracting and retaining staff, and how has this impacted on their productivity?

   - What are the barriers and opportunities for digital innovation technology and startup firms in seeking to locate to areas near relative housing affordability, such as metropolitan suburban locations and satellite cities?

3. What models of digital and innovation-led employment developments are emerging within new urban and residential development projects, and within renewing suburban and regional settings, and how could such models be fostered?

The report begins in this chapter with a summary of the policy and research context. Chapter two presents answers to research question one, outlining the perspectives of firms on housing and innovation in inner and outer metropolitan, and regional locations. Chapter three turns to strategies supporting digital innovation and employment growth internationally (research question one) to draw out evidence on key success factors (research question three). Chapter four considers in more detail the policy development options that flow from the analysis.

1.2 Policy context

Innovation-led employment strategies have been the focus of smart city-based urban policy activity in Australia over the past decade. This section outlines key elements of each while also speaking to their disconnect with considerations of housing in the Australian policy setting.

1.2.1 Smart City Strategies in Australian Cities and Regions

The smart city movement is now more than a decade old (McNeill 2016; Alizadeh 2017). Smart cities, catalysed by technology corporations such as IBM and Cisco, offer technological solutions to urban problems such as waste management, community engagement and environmental sustainability. Internationally, a key driver for the popularity of smart city initiatives has been their potential to deliver economic benefits for cities and their governments, businesses, and citizens; and their ability to increase a city's competiveness locally and internationally (Bakıcı, Almirall et al. 2013). The related definition of smart city focuses primarily on two elements: the provision of digital infrastructure, and the pursuit of technological innovation for economic purposes; given its prevalence, it is that definition that has been adopted in this research paper.

Examples of this type of smart city include: Barcelona's Smart City Initiative, which generates and 'supports the development of innovation, urban growth and its citizens' quality of life' (Bakıcı, Almirall et al. 2013: 146); The Greater London Authority's approach to leveraging the 'creative power of new technologies' to serve both the city and its citizens (Angelidou 2015: 102); and in Dublin, where the entrepreneurial urbanism of the smart city is used to revitalise development and attract foreign investment (Kitchin, Coletta et al. 2018). Similar drivers are evident in Asia; India's smart cities program is driven by the promise that 'economic development and activity [in a smart city] is sustainable and rationally incremental by virtue of being based on success-oriented market drivers such as supply and demand' (Puri 2014), while China's first smart city project delivered in Guangzhou in collaboration with Cisco is expected to generate over 100 billion Yuan (AU$19 billion) every year (Xinhua 2016). Internationally, the global market associated with smart cities is expected to grow from US$308 billion in 2018 to US$717 billion by 2023 (MarketsandMarkets 2019).

Smart cities are strongly connected to digital innovation and are a key driver of new businesses and startups (Van Dijk 2015). Economic shifts that are enabled by smart solutions and advanced technologies include shifts towards subscription-based business models and shared use of resources. Smart city advocates suggest smart solutions will also provide economic benefits through enabling better utilisation of existing infrastructures, such as transport systems, energy networks, and waste management. In the Australian case, the provision of digital infrastructure is a foundation for these improvements. The provision of digital infrastructure, in particular high speed broadband such as the National Broadband Network (NBN), opens up new opportunities for the location of jobs. The rollout of the NBN to regional centres such as Armidale in NSW, for example, opens up new possibilities for knowledge workers and tech industries to locate in the region. The elongated time frame of NBN roll out coupled with issues of quality of connection, however, has mitigated some of these potential benefits (Alizadeh 2015). Moreover, research on Oran Park in Western Sydney suggests that the provision of a smart work hub that utilises high speed broadband may have difficulty in supplanting entrenched car-focused lifestyles (Kent, Mulley et al. 2019).

Despite these limitations, smart city policies and digital innovation have been prioritised at federal, state and local government levels in Australia. The Federal Government *Smart Cities Plan* (Department of Prime Minister and Cabinet 2016) seeks to stimulate the role of smart solutions and advanced technologies in building cities that are liveable and productive, and that are places in which people want to live and work. In NSW, the Innovation and Productivity Council (IPC) is pursuing a smart city agenda in order to boost employment and industry (Clark, Moonen et al. 2018). As a result, Australian cities are integrating smart technology into areas of core Council business to harness the potential of technology in delivering liveable, workable, and sustainable cities. The ways in which early-adopter smart cities in Australia are leveraging new technologies to develop regional and suburban economies are summarised in Table 2. Table 2 is not an exhaustive list of smart city activity in Australia but a representative sample of the common ways Australian cities are using smart technologies to drive economic growth. The cities were selected because they are early-adopters of smart approaches and are representative of the types of smart city activities seen in Australia.

Table 2: Innovation and economic development in Australian 'smart city' strategies

Smart City Strategy	Objectives
Sunshine Coast, QLD	Position the Sunshine Coast as Australia's leading smart city region by stimulating local business, generating new investment, and improving service delivery, urban design, safety and quality of life; reducing carbon emissions and energy use with a view to becoming Australia's most renewable region
Newcastle, NSW	Smart infrastructure, including and Internet of Things (IoT) and physical incubation spaces to improve liveability and allow community groups, education and research providers, industry, business, and entrepreneurs to develop their own smart applications and ideas
Geelong, VIC	To deliver benefits for businesses, residents and businesses through the use of modern and progressive technologies
Parramatta, NSW	Leverage the foundations of good urban planning, transparent governance, open data, and enabling technologies that will underpin Parramatta's position as a vibrant, people-centric, connected and economically prosperous city.

Source: Maalsen, Burgoyne et al. 2018

1.2.2 Innovation-led employment strategies

Sectors associated with innovation, creativity, knowledge and digital technologies are generally described using the umbrella term 'innovation economies', defined by leading scholars Moonen and Clark (2017) as economic activities in which businesses associate with, and embrace, technology and change. Key 'innovation economy' sectors include advanced materials, financial technology services, advanced manufacturing, artificial intelligence, robotics and data analytics. With the decline of manufacturing across Australian and other Western cities, the ability of these sectors to provide a high quality and quantity of employment for cities is well recognised (Yigitcanlar 2010). In the US, there are an estimated 20 million innovation economy workers, and more than 100 million globally (Clark, Moonen et al. 2018: 7). Innovation-led employment strategies have been a key focus of Australian urban policy, as is discussed in more detail in chapter three. In both Victoria and NSW, an urban policy focus has been on identifying and fostering innovation corridors and districts.

1.2.3 Housing, smart cities and innovation

Neither housing, nor affordable housing have been a focus of smart city policies or innovation-led employment strategies in Australian cities. That is not to say affordable rental housing is completely absent. The NSW Innovation and Productivity Council's smart city agenda, for example, draws out housing in a number of key places. The agenda notes: that 'adequate planning, good design and infrastructure development are needed to protect against reductions in the local availability of affordable housing and decreases in amenity' (IPC 2018: 25); a need for 'access to affordable, diverse housing for workers and students' (IPC 2018: 28); the importance affordable housing for liveability (IPC 2018: 37); and that 'where affordable, diverse housing is offered within precincts it can play an important role in attracting and retaining businesses and workers' (IPC 2018: 37). Similarly, innovation-led employment is central to the Greater Sydney Commission's (GSC) blueprint for Sydney (GSC 2016). GSC envisages a number of innovation districts to be fostered through articulation with the Federal Government's Western Sydney City Deal. However, despite noting the importance of affordable and diverse housing options, and value of the innovation economy, the GSC's 2056 vision approaches these planning and policies areas as independent of each other. The link between provisions of affordable housing and a need to house the workers who underpin the innovation economy is therefore not made.

This divide between smart cities, the innovation economy, and housing is reflected across policy contexts. The Commonwealth's $50 million *Smart Cities and Suburbs* program (Department of Infrastructure, Transport, Cities and Regional Development 2019), which supports the delivery of innovative smart city projects to 'improve the liveability, productivity and sustainability of cities and towns across Australia' (Regional Development Australia 2018), has funded only two projects across two funding rounds (out of 81 successful projects) relating to housing. They are 'Digitised choice-based letting for the ACT public housing portfolio' and Maroondah City Council's project to use 'new online data and spatial analytics planning tools to identify residential precincts with high redevelopment potential… facilitating partnerships between local communities and the development sector to improve housing supply, affordability and diversity' (Department of Infrastructure, Transport, Cities and Regional Development 2019). To better understand this disconnect, in the next section we review academic literature on innovation districts, smart cities, and housing.

1.3 Innovation districts, smart cities and housing affordability: existing research

This section briefly reviews literature on innovation districts and smart cities, followed by a more detailed examination of their intersection and housing foci.

1.3.1 Innovation districts as innovation-led employment strategies

In the context of urban policy, the innovation-led employment strategies have predominantly focused on the geographical clustering of innovation activities. It has been widely documented that innovation businesses geographically cluster in what are loosely called innovation districts: compact, transit-accessible, digitally connected geographic areas in which leading technology and research institutions and companies 'cluster and connect' with startups and business incubators (Katz and Wagner 2014). This physical clustering of innovation activities creates dense networks of firms and workers, and this spatial proximity in turn fosters collaboration across firms and the multiplication of financial value and employment.

Early scholarship and policies assumed innovation districts such as Silicon Valley, which are organisationally driven and have unique contextual elements, were the typical and predominant form of innovation geographies. However, a diversity, or ecology, of innovation places is now widely recognised, encompassing: individual buildings, quarters, vacated site, campus, district, triangle, park, zone and corridor (Moonen and Clark 2017). Innovation economies are dispersing beyond the CBD and its immediate surrounds including, in some cases, to regional centres; this dispersal opens up the possibilities for innovation economies to co-locate with more low-cost and diverse housing. Older industrial cities such as Cleveland are harnessing opportunities associated with lower house and land values, enabling knowledge entrepreneurs to incubate with lower upfront costs (Morelix, Fairlie et al. 2017). Others emphasise the importance of place-based policies which support clusters of local entrepreneurs within environments known to attract and sustain creative and knowledge workers, such as cultural amenities and social diversity (Florida 2002). Recent work in Australia has identified, for example, an innovation corridor in Western Sydney (McNeill 2015).

An important emerging theme relates to 'inclusive innovation': innovation economies with measures to increase local workers and resident participation have strong potential to improve the productivity of lagging or disadvantaged regions and districts (Stanley, Glennie et al. 2018). This has emerged in response to critiques of innovation districts as benefiting those associated with innovation at the cost of the local population (Morison and Bevilacqua 2018). Indeed, urban economies developed with the predominant focus of attracting and retaining elite knowledge workers have had negative consequences for other groups and for overall urban productivity, with impacts on commuting times, housing diversity and affordability, and a range of quality of life measures (Florida 2017). For example, although San Francisco is a key site of innovation, where dominating knowledge economies have emerged organically through accommodating market settings, it has also displaced many existing residents as a result of the increase in housing and living costs associated with the new industry (Morison and Bevilacqua 2018; McNeil 2016).

Internationally, there is growing recognition that such disparities result from a lack of targeted and pre-emptive regulation to ensure the provision 'urbanism for all' (Florida 2017) – that is, development in which opportunities for social mobility for lower-income groups are integrated into planning (Vergara-Perucich 2019). In such cases, negative impacts are also heavily felt by startups and small and mid-level organisations, affecting the diversification of innovation economies and long-term productivity through stunting pathways to growth and cross-pollination.

Both economic diversity and resilience are key to the success of innovation-led employment strategies (IPC 2018); these factors can be achieved through inclusive innovation-led employment strategies in which benefits are broadly felt. To achieve a resilient and inclusive innovation economy therefore requires planning for socio-economic diversity through mechanisms such as the provision of affordable housing and programs to support the participation of under-represented and minority groups in, and adjacent to, the innovation sectors.

1.3.2 Smart cities research

Two streams of the voluminous literature on smart cities (see summary in Karvonen, Cugurullo et. al. 2019) are relevant to this research. The first relates to the extent to which the outcomes of the digital technologies deployed in cities ameliorate or exacerbate existing inequalities. In transport, for instance, while significant smart city applications are emerging to cut commuting times (Woetzel, Remes et al. 2018), the productivity benefits arising from these smart technologies will be nullified or at least minimised by failing to address housing as a concomitant concern. As the report highlights, long commute times disproportionately impact poorer residents forced to live further from work due to unaffordable housing. Even if productivity gains are made through smart commute shortening, without affordable (and social or public) housing provisions closer to workplaces, productivity costs will still fall disproportionately on those lower socio-economic status groups.

A second relevant stream is the intersection of the smart city with existing urban strategies. While early smart cities were either new developments such as Songdo in South Korea or Masdar City (Cugurullo 2018), smart city strategies are now, to a limited extent, being implemented as part of urban policy and planning. In other words, digital technologies are being used to enhance urban management and address the multifaceted challenges of urbanisation (Luque-Ayala and Marvin 2016). Smart city technologies are being used to respond to context-specific urban challenges (Barns, Cosgrave et al. 2017; Coletta, Evans et al. 2019) and grafted through traditional urban planning techniques (Taylor Buck and While 2017).

1.3.3 Smart cities, innovation districts and affordable rental housing

A systematic literature review was conducted to examine the extent to which housing affordability has been addressed in the research literature on planning for smart cities through innovation-led employment strategies. A wide-ranging set of search terms were used following the approach of Adams, Smart et al. (2017). These were digital innovation, digital economy, smart city, urban productivity, new economy, startup, knowledge economy, innovation district, employment growth, innovation, innovation economy and variants of affordable, rental, and housing.

Despite the prominence of innovation and smart city policies in economic development strategies worldwide, the key finding of the systematic review is that there is a significant lack of research that addresses housing in the context of smart cities and innovation districts. The systematic review outlined above identified limited scholarship that considered innovation and housing. Affordable housing was linked with 'urban productivity', 'new economy' and 'knowledge economy', but not from planning and policy perspectives. Smart cities and affordable housing were even fewer in number, with one result for 'digital innovation', three for 'digital economy', and one for 'innovation district'. More broadly, housing is rarely explicitly included in smart city literature. A review of the literature by Maalsen (2019) found that in the period from 2007-2017 only 13 sources referred to smart cities *and* smart housing, despite a growing literature on smart cities and smart homes. Smart homes are equipped with digital technologies that anticipate and respond to occupants' needs (Darby 2017). Furthermore, the field of computer science dominates this literature (Maalsen 2019).

Overall, our review of the limited research evidence revealed that in many places, innovation is associated with less rather than more affordable housing. Technology districts such as Silicon Valley, or high-tech clusters near downtown cores, have long been associated with a rise in house prices and rental prices (Katz and Wagner 2014). In attracting knowledge and creative workers, and the services they desire, these areas become even more attractive to well-paid workers and become further gentrified. In this respect, innovation districts reduce the supply of affordable housing. It is in relation to amenity that housing, and housing affordability enters research discussions.

Functioning, vibrant innovation districts are expected to have residential land uses (Pancholi, Yigitcanlar et al. 2018b). A lack of affordable housing is identified as one of the major challenges in developing an environment conducive to supporting the innovation economy (Pancholi, Yigitcanlar et al. 2017). Identifying and implementing policies to ensure a balance of affordable housing in such locations is central to addressing this challenge. If workers in innovation sectors are unable to secure affordable housing in or nearby innovation districts then they are less likely to seek employment there, in turn reducing the economic competitiveness of that location (Moonen and Clark 2017). Despite the lack of direct reference to the need for affordable housing in planning innovation-led developments, the availability of housing options that can attract and retain a diverse workforce underpins the ongoing success of these models. Successful innovation districts require mixed land uses and are socially, culturally and economically diverse.

Likewise, the framing of smart cities as part of innovative, creative, and entrepreneurial approaches to the economy is one way in which we can see housing emerge in the smart city. Investment, efficiency and optimisation are key features of smart city economies, driven by innovation and entrepreneurialism characterised by startup business models. Similar logics of investment seen in the smart city are evident in housing markets; it is in the application of entrepreneurial and innovation logics to housing that smart cities begin to intersect with housing – smart housing. As with the smart city, smart housing incorporates 'smart' ways of doing housing including platform and digital real estate (Rogers 2016a; 2016b); sharing economies (Gurran and Phibbs 2017); entrepreneurial solutions to providing and accessing housing such as housing startups including Bedly.com; and smart entrepreneurial housing models such as co-living, which is increasing in popularity across the UK, Europe, India and the US. As such, smart housing is situated in the contexts of changing housing markets, new sharing economies, and smart city debates.

The link between smart housing and innovation economies is twofold. Firstly, many models of smart housing emerge from the startup and innovation sector. Secondly, such models and platforms can help solve the housing needs of innovation sector workers, through models which make it easier to search for; or supply, share or short term rental accommodation; or which facilitate new forms of co-operative tenure and development (Maalsen 2018; 2019). However, despite these potential benefits, these digitally underpinned models of housing have potential to discriminate; critical literature illustrates how the technological transformation of housing mediates housing investment and financial accumulation and amplifies the uneven power balance between tenants and landlords (Fields 2019). Pettit, Crommelin et al. (2018) observe that while technology has the potential to disrupt housing markets in positive ways, it can also have negative impacts by restructuring the market and mediating access to housing. This reconfiguration of the market and its negative effects are most commonly illustrated by Airbnb which research has shown presents significant planning and regulatory challenges, along with the potential for displacement of renters (Gurran and Phibbs 2017).

To conclude, housing and strategies to supply affordable rental housing rarely figure in academic research on either digital innovation or smart cities. Where they do, it is implicit rather than explicit. Innovation districts in central cities are associated with declining affordability, while digital technologies can potentially support more flexible access to rental housing and more agile construction. Chapter two examines international innovation districts to present evidence on these intersections.

1.4   Methods

This research used a qualitative approach to investigate the relationships between affordable rental housing in supporting digital innovation and employment growth in metropolitan and satellite cities. In particular, the research examined the barriers and opportunities around particular locations for knowledge economy firms, including the relative trade-offs made between the benefits of clustering and agglomeration in strategic central city locations, versus labour market access, transport costs, and housing choice. Through an international evidence review, case studies, and interviews with urban planners, firms, and others, it draws exemplar smart city and strategies for innovation districts that could support innovation-led employment near affordable rental supply.

Specifically, the research:

- Reviewed the international evidence on the role of affordable rental housing in supporting digital innovation and employment growth in metropolitan, suburban, and satellite city areas;

- Examined the labour market constraints and location decisions of digital and startup firms and the role of affordable rental housing options in supporting access to a deep labour pool, in selected Australian metropolitan and satellite cities; and

- Developed potential models of digital and innovation-led employment drawing on cases and emerging examples within new urban and residential development projects as well as within renewing suburban and regional settings.

Table 3, below, outlines the methods used to address each of the research questions, including key sources and justification for the case study selections. Detailed methodological descriptions are also provided in each chapter.

It is worth noting that interviews with startup and digital businesses proved difficult to acquire. Reflections with those interviewed suggested that these difficulties were largely due to the time and financial pressures of running such businesses, which meant that contributing to research projects was not given high priority.

Table 3: Methods, data sources and case study selection in relation to research questions

Research question	Methods	Data/case study selection
What is the international evidence on the role of affordable rental housing in supporting digital innovation and employment growth across different urban and regional areas housing and economic settings?	Structured evidence review of key literature on links between housing affordability, digital innovation including smart cities, and productivity, particularly those relevant to the Australian context.	• Productivity Commission (2017) five-year review. • Australian Government's (Department of Prime Minister and Cabinet 2016) smart cities strategy. • Brookings Institute's innovation districts report (Katz and Wagner 2014). • Relevant AHURI reports (e.g. Pettit, Crommelin et al. 2018). • Nesta's innovation policy report (Stanley, Glennie et al. 2018). • Grattan Institute's *Renovating Housing Policy* report (Kelly 2013) • Innovation Productivity Council, NSW (IPC 2018) report. • Moonen and Clark (2017), Clarke and Moonen (2018), and others.
To what extent are Australia's digital and startup firms affected by labour market constraints, which relate to the availability of affordable rental housing, and to what extent do these constraints influence their business location decisions?	29 semi-structured interviews (mix of phone and in-person) ranging from 30-75 minutes each, with: • local and state government strategic planners • local economic development officers • senior state government bureaucrats • small businesses • umbrella organisations	Focus on perceived locational dis/advantage in areas where affordable rental housing is more available. Interview locations (Wollongong, Central Sydney, and Western Sydney, NSW and Geelong, Victoria) selected based on emerging and planned innovation economies, anchor sites, access to planners, bureaucrats, and startups, regional economy transformations; and local smart city strategies.
What models of digital and innovation-led employment developments are emerging within new urban and residential development projects, and within renewing suburban and regional settings, and how could such models be fostered?	Structured evidence review of key literature and identification of models of digital and innovation-led employment drawing on cases and emerging examples within new urban and residential development projects as well as within renewing suburban and regional settings.	Australian and international reports relating to smart cities, productivity and innovation were used to source notable Australian and international examples. Academic literature was then systematically scoured using key search terms. Identified case studies were examined further through grey literature, government websites and news publications.

Source: Authors

2. Innovation Districts and Strategies: Insights from an International Evidence Review

- Recent international examples highlight an interest in inclusive innovation in which cultural and income diversity can underpin economic success

- Small cities in the United States such as Chattanooga and Cleveland, and Adelaide in Australia, provide evidence of inclusive innovation

- Innovation districts are underpinned by anchor institutions, especially universities, collaboration, land-use flexibility and smart thinking

2.1 International evidence review

As outlined in chapter one, cities across the world are attempting to foster innovation-led employment, though infrequently in tandem with affordable housing strategies. In this chapter we address research question one and research question two. We firstly outline international evidence on incorporating affordable rental housing. The bulk of the chapter considers the models of innovation districts that are emerging, in particular outlining foundational elements of successful innovation-led employment strategies.

2.1.1 Method

The project conducted a scan of the significant developments in the United States, United Kingdom and Europe in order to identify not only cases where affordable housing was incorporated, but also the mechanisms used. Three different sources were used to identify potential cases upon which to base the review. First, cases used in academic research (as identified in the systematic literature review described in chapter 2) were noted and followed up. Purposeful focus on both higher profile sites such as Silicon Valley (US), the home of Amazon and South Lake Union, Seattle (US) and lower profile cases including Chattanooga innovation district (Tennessee US) characterised this element of the search. Second, the voluminous 'grey' literature on innovation districts was systematically scoured. Influential reports including Moonen and Clark (2017), the Brookings Institute innovation districts report (Katz and Wagner 2014), and from NSW, the Innovation and Productivity Council (IPC 2018) report provided national and international case examples. Notable Australian and international reports relating to smart cities, productivity and innovation were also systematically scoured using key search terms. Finally, interviews conducted in project C of the inquiry occasionally yielded additional examples. Together, the three sources resulted in a list of potential cases. This compendium was then analysed on the basis of the literature review above. That is, each were analysed in terms of policy, approach to housing and housing affordability, and outcomes. The results of these analyses are presented in Table 4 and below and the remainder of the chapter extracts key lessons from both Australian and international experience.

Table 4: Selected international models of innovation districts

Project	Description	Key features and strategies	Issues and challenges
Boston Waterfront Innovation District, Boston MA (USA)	• 1,000 acres redeveloped in 2010 • Major technology tenants and startups • 12,000 new residential units	• 'Innovation housing' including 15 per cent 'micro-units' intended as affordable, flexible accommodation for young professionals limited by Boston's rental market	• Lack of regulation limiting intended affordability • Locational advantages (anchor institutions and amenities) difficult to replicate elsewhere
Brooklyn Tech Triangle, New York, USA (see Brooklyn Tech Triangle 2015; Brooklyn Navy Yard 2019)	• Includes Brooklyn Navy Yard, DUMBO and Downtown Brooklyn • Rising and established startups	• Housing and co-living startups disrupting traditional models of housing provision • New zoning frameworks	• Housing affordability crisis exacerbated by innovation sector
Chattanooga Innovation District, Tennessee, USA (see Box 2; Innovation District of Chattanooga 2019)	• Developed 2015 to maximise advantages of the 'Gig' Internet (a 1 gigabit-per-second fibre optic network) in the mid-sized city • Includes diverse technology startups, and other innovation corporations	• Digital equity focus with targeted opportunities for underrepresented groups • Affordable housing supported through local land-use tax breaks	• Need for more affordable housing and other affordable infrastructure including transportation and food and social options

Project	Description	Key features and strategies	Issues and challenges
22@ project, Barcelona, Spain	• Post-industrial renewal commenced in 2000 • Technology and innovation district with housing, amenities and green areas • 50 per cent devoted to residential use.	• Landowners required to cede up to 30 per cent of their land to deliver subsidised housing and other amenities • High-quality public realm and urban design to attract knowledge workers	• Preserving and delivering affordable housing a key challenge with the success of the precinct • Affordable housing units comprise only about 5 per cent of total stock
Kings Cross Innovation District, London UK (see Kings Cross Central Limited Partnership 2019)	• Mixed use commercial, residential, entertainment, education • Tenants include Google and Universal Music	• Inclusionary zoning underpinned 22 per cent affordable and social housing units • Specific housing projects for key workers and students • Share housing and affordable home ownership options	• Locational advantages (anchor institutions, amenities and transport) of the site may be difficult to replicate • Requirement for ecosystem of affordability in high-cost areas with mixed-income housing
One North, Singapore (see JTC Corporation 2019)	• State-led public-private partnership launched 2001 • Various knowledge clusters across 200 hectares including startups, anchor institutions and established firms • Supported by strong infrastructure and high amenity	• Profits maintain public housing (for ~80% of residents), education and other infrastructure - no huge state subsidies for the private sector with little public return	• Strongly state-led public-private partnership unique to Singapore's governance model that prevents profit-driven private corporations from directing policy
Greater Circle Initiative, Cleveland, Ohio (see Glanville 2013)	• Anchor-based community wealth building program 'buy local, hire local, live local, connect' • Now Cleveland's second most dense 'job hub' and cultural mecca with 9500 plus residents	• Ecosystem supported by local procurement and purpose-created co-operatives. • Forgivable housing loans promote wealth and reduce commutes • Supported by good transport access to downtown Cleveland	• Demands strong leadership and collaboration • Long-term, community-wide benefit requires commitment • Support limited to workers within initiative organisations not other groups of low socioeconomic status
Innovate Albuquerque, New Mexico (see InnovateABQ 2019)	• public-private partnership development due 2024 • Seven acres of physically compact, technically-wired, walkable space around the University of New Mexico's (UNM) Innovation Academy to bring together innovators to foster long-term job creating ventures and improve community-wide opportunities	• UNM housing within Innovation Academy building including specific housing for Navajo STEM students. • Includes focus on startups and programs for minorities and low-incomes • FUSE Makerspace community centre for design, prototyping and manufacturing	• Emergent district, outcomes unknown
South Lake Union, Seattle (see Discover South Lake Union 2019)	• Disinvested industrial estate redeveloped into med/biomed/life sciences hub • Since 2012, companies such as Amazon, Google and Facebook occupy the majority of prime office space	• Mandatory Housing Affordability Reform from 2017 (2019 city-wide) sees companies pay millions of dollars to the City for housing programs, prior to which there were only isolated affordable housing targets and projects	• Reactionary and piecemeal approach to housing affordability has failed to counter significant housing affordability problems in South Lake Union and across Seattle • Significant public investment to support development of corporate enclave, while lower socioeconomic areas go without

Source: Authors' evidence review

Table 5: Selected Australian models of innovation districts and live-work districts

Project / innovation district	Description	Key features / strategies	Issues and challenges
Tonsley Innovation, Adelaide, SA	• Commercial and residential precinct underpinned by high speed Internet and connectivity	• Fifteen per cent inclusionary housing requirement • Affordable and connected 'smart homes' part of plan to attract scientists, 'techpreneurs' and startups	• SA's long-standing inclusionary housing requirement and lower base land values means affordability may be difficult to replicate
Hunter Innovation Project (HIP), Newcastle, NSW (see Hunter Innovation Project 2019)	• Smart city infrastructure, innovation hub and digital precinct to give competitive advantage to the region • Funded in 2016 by NSW government, Newcastle City Council and Newcastle University	• Multifaceted approach to support businesses and startups through access to worlds-best technology • Incorporates smart city technology and public Wi-Fi; part of Newcastle's smart city strategy	• Early development stages • Need for accompanying affordable housing strategies recognised but yet to be developed (see Department of Planning 2016)
Byron Arts and Industrial Precinct, NSW	• Emerging live-work precinct • Local firms and startups in IT, creative manufacture, food, and arts industries • In former industrial zone.	• Live-work models with housing units and high-quality infrastructure and amenity • Online marketing and proximity to Brisbane allows relocation / establishment in lower cost region. • Lower production cost units aim to offer modest home ownership/rental options	• Maintaining affordability relative to local wages remains a challenge in this high amenity tourist region. • No inclusionary planning requirement means purpose-built 'affordable' options remain unaffordable to low-/moderate-income renters.
Carrington Rd, Marrickville, NSW (see Ethos Urban 2018)	• Planned high-rise mixed-use development at existing small manufacturing/creative industries site • In Sydenham to Bankstown growth corridor, near Tempe, Marrickville and Sydenham stations.	• Planned mixed-use renewal opposed by existing creative industries/small manufacturing on-site	• Likely displacement of actual productive and creative uses in the guise of a new cultural precinct • Plan eschews industrial, migrant and working-class skills and legacies for a gentrified aesthetic.

Source: Authors' Evidence Review

The examples depicted in Tables 4 and 5 were chosen because of the attention paid to housing affordability in planning and implementation. Based on a systematic review of the literature around housing and innovation districts, they represent the diversity of housing affordability measures – as well as key challenges – present from small to large scale, and across urban to regional innovation economies. The table identifies a range of affordability measures suited to different place, market, and innovation contexts. These measures include inclusionary zoning (e.g. Kings Cross, UK; Tonsley SA), provision of land and/or subsidies for low-income housing providers (Innovate Albuquerque, USA; Barcelona, Spain), tax subsidies (Chattanooga, USA) or new zoning frameworks (Brooklyn Tech Triangle, USA). Also important is an orientation to diversity in housing provision, including, most innovatively, live-work districts (Byron Bay, NSW) or co-housing (Boston, USA).

Notwithstanding the benefits of these measures, the examples outlined also highlight a number of critical points in their provision, boiling down to the need for an ecosystems approach. Specifically, the examples indicate significant problems arising from: delayed consideration of affordability; failure to adequately regulate housing typologies and adjust zoning; injudicious inclusionary planning and public benefit; avoidance of a long-term vision and on-going diligence; lapses in collaboration and leadership and; neglect of pathways to growth through startups, students and/or community building.

While diverse housing is a key factor to maximise productive innovation districts, it should be part of a suite of people and place-based planning elements that intersect to allow for fuller and more inclusionary participation, leveraging unique regional and suburban advantages in a coordinated and considered approach. Variations in place and scale, as well as a lack of data made any meaningful systematic evaluation of the cost of the international cases unachievable within the remit of this report. However, the successful models discussed highlight that sustainable innovation is strongly connected to an attunement to place. Innovation districts rely on a mixture of firms from startups to larger corporations and public anchor institutions. Without the provision of appropriate housing, including public/social, affordable and mid-range housing, as well as other infrastructure for affordable and connected living, innovation districts are unable to retain this crucial mix.

2.2 Models for situating and fostering innovation-led employment in new urban and residential development projects, within renewing suburban and regional settings

Within renewing suburban and regional settings there is not one model for success in fostering innovation-led employment. Rather, as we outline in this section, there are four areas of focus for emerging models of digital and innovation-led employment developments: land use, anchoring, collaboration, and 'smart' thinking. The last of these also underlines some of the unfulfilled potential of smart technologies for inclusive urban planning purposes. Table 6 summarises key learnings presented throughout this section; the table demonstrates how they overlap and intersect to form successful innovation districts, underscoring the essential role of affordable and diverse housing within a holistic system promoting participation and improving productivity.

2.2.1 Land use

The benefits of 'total place' or 'whole ecosystem' perspectives emerge from the literature; these perspectives are increasingly orienting land-use planning around innovation districts (Moonen and Clark 2017). While proximity of different types of firms and institutions is a crucial factor for productive innovation districts, more models are taking into account the wider conditions of affordability and access. The international evidence demonstrates a critical need to manage housing and other supportive infrastructure alongside the growth of innovation districts. Numerous cases highlight significant productivity costs when such policies are delayed or ill considered. Responses implemented once these issues already exist are much less effective and more costly than pre-emptive actions. As Project One in this Inquiry documents (Hulse, Reynolds, Nygaard, Parkinson and Yates 2019), interventions that address rental supply alone will not solve issues of housing need; they should be accompanied by provisions specifically for public/social and affordable housing including agile, affordable and public/social zoning and funding arrangements. These provisions should equally apply to flexible and innovative housing types and tenancies that are increasingly common in innovation districts. Innovation district models that have built wider systems of equity, access, affordability and community wealth building around affordable and diverse housing arrangements are those best able to maintain the diversity and growth required for productive and sustainable innovation districts.

Strong international evidence supports this need for pre-emptive planning for affordability and a whole-ecosystem perspective. The case of South Lake Union, Seattle (see Table 4) reiterates the findings of Project 1 in this Inquiry research program. The area of inner Seattle, dominated by firms such as Amazon, Google, Apple and Facebook, saw a doubling of apartment stock in four years. By the middle of 2018, however, 14 per cent of the units were vacant due to unaffordability. In Sweden, failure to plan housing around a booming tech sector has contributed to a housing shortage for tech workers and others, and inflated household debt to the highest levels in the OECD (Dickson and Goarant 2016). The housing shortage has directly deterred organisations such as e-commerce company CupoNation who wanted to move from Munich to Stockholm to link into its agglomeration, demonstrating the stagnating effects that can occur without planned growth. Back in Seattle, the city now has the third highest homelessness rate in the US, and there is recognition that economic growth failed to coordinate with appropriate investments citywide.

The Seattle case underscores the need to take equity seriously in innovation-led land use change, particularly when anticipating significant local economic change. Considerable public funding in the city that went toward infrastructure and amenity was distributed to the benefit of the large firms based in South Lake Union, widening disparities across Seattle. The lack of equitable planning for the city's rapid transformation led to significant displacement of existing residents, a decline in housing choices, particularly low-cost housing, declining access to parks, schools and transport and significant impacts of neighbourhood character. To remedy the housing crisis, the city of Seattle has introduced a Mandatory Housing Affordability Reform (City of Seattle 2019) in South Lake Union in 2017 and then citywide from 2019. This reform involves zoning changes and requires new developments to include affordable homes or contribute to a housing fund. The Reform now raises substantial funds for the city, however the widespread impacts of the city's unfettered economic growth continue to be felt. In contrast, the development of the @22 district in Barcelona was tied to state requirements for land owners to cede up to 30 per cent of their land to deliver subsidised housing and amenities, which provided affordable housing from the district's early stages (see Table 4).

Another key issue that emerged from the literature in relation to supply growth alone in innovation districts is the lack of suitable housing meeting the needs of students, postgraduates and young entrepreneurs. Enabling area-wide systems that promote strong participation and facilitate a critical mass of startups along with higher-growth companies requires regulating to retain and provide a housing mix. In Shenzhen, China, for example, while workers with good salaries in the city's innovation sectors have little difficulty finding suitable housing, there is a shortage of affordable neighbourhoods meeting the housing needs of recent graduates and early-career creatives (Bontje 2016). The difficulty for these groups limits the potential diversity, collaborative potential and productivity of the city. This case mirrors the concerns of Australian workers and firms outlined in Section 2 of this report, indicating a need for planning which incorporates a mix of housing types that are accessible and affordable for different groups.

The potential for creativity in housing types is typically greater in regional areas and new knowledge economy developments in peri metropolitan areas, where there is greater access to greenfield (previously undeveloped) sites. Several models also point to land-use changes available to promote housing diversity in more urban areas, however. The affordability regulated into Singapore's state-dominated housing system, for instance, has supported One North's (Table 4) attractiveness to postgraduate students and young tech workers, nurturing a sustainable mix of startups, and medium and large-sized firms, along with productive research and development collaborations with university departments as anchors. Other emerging innovation districts have also recognised the importance of these innovation pathways. Innovate Albuquerque, USA (Table 4) for example, has embedded student housing within their innovation building through mixed-used zoning, also extending a proportion specifically to First Nations Navajo students within STEM degrees (science, technology, engineering and maths). Such innovative and adaptable housing typologies, as well as flexible tenancies and co-living are increasingly emerging to promote more affordable and diverse options for housing in innovation districts.

These new housing types can have positive affordability outcomes, however their success in this regard is also tied to their zoning targets. The international evidence shows that without mandating spaces for low-/no-income earners through inclusionary zoning or other regulative measures, housing affordability in knowledge economies can quickly lose out to market pressure. For instance, in Boston, high demand for 'micro units' intended as affordable options for tech workers at the Seaport District actually drove prices up and out of reach of the District workers (see Table 4). Similarly, in Byron Bay, low production-cost units in the live-work arts and industrial precinct are unable to maintain affordability relative to local wages due to the absence of an inclusionary planning requirement. Emerging platforms like WeLive that offer co-living and temporary options for mobile workers are high in amenity and flexibility, yet their costs are tied to the market and not suited for those on lower incomes.

In contrast, innovation district developments such as Kings Cross in the UK and Tonsley in South Australia had inclusionary planning requirements of 22 per cent and 15 per cent respectively *from the planning stages*, meaning their diverse housing options are able to be utilised as intended. In Kings Cross, these options include student studios, as well as four-bed family homes and supported housing for the elderly. In Tonsley, supported by 'the Gig' (1 gigabit-per-second) high-speed Internet, smart homes have attracted scientists, 'techpreneurs' and startups as part of the 'affordable and connected' residential community. Although South Australia's lower base land values support the overall affordability of Tonsley, this type of inclusionary zoning is a critical step for new innovation-led employment developments, particularly when land-value appreciation is anticipated.

Even with planned provision for diverse and low-cost housing, the international evidence demonstrates that innovation districts can struggle without more holistic and inclusive, place-based planning, and an ongoing commitment to ensure sustainable growth as their popularity increases through small and large measures. As the growth of an innovation sector outpaces inclusive growth, however, even innovation districts with zoning provisions for affordable housing such as 22@ project, Barcelona (see Table 4) may struggle to deliver and preserve affordability. These cases present a stark warning to Australia's many emerging innovation economies, including NSW's Aerotropolis, and more established ones such as Tonsley (SA), Pivot City and Innovation Campus (VIC). Considering and planning for affordability in and around emergent zones will create a more inclusive innovation ecosystem. Cleveland's sweeping and coordinated strategies for economic inclusion and community participation in the growth of the Greater Circle district allow for sustainable inclusion of the existing population in the city's developing knowledge economy (see Box 1 and below). As an example of a smaller intervention, local place-based planning in the Chattanooga district saw the opening of a low-cost grocery store to counter what was in effect a 'food desert' for low-income residents in the city's downtown area.

In addition to critical zoning changes, access can be afforded through targeted financing and tax interventions, helping to retain local workers, improve productivity through shorter commute times, improved amenities and quality of life. As has occurred in Cleveland (see Box 1), such schemes, including grants for rent, renovation or purchasing assistance, can provide pathways to home ownership and community wealth building. They also can help to improve disinvested housing stock and attract new populations and firms. In Chattanooga (see Table 4), private developers can receive property tax freezes for up to 14 years if they offer 50 per cent of rental units to those earning less than 80 percent of median income, flipping incentives previously used to attract large companies. Chattanooga, USA has also changed land-use regulation to promote housing stock diversity, density, mixed-use development and walkability, physically connecting the innovation district with the area's diverse neighbourhoods and opening up movement in the streetscape (Esmaeilpoorarabi, Yigitcanlar et al. 2018), a benefit also seen at One North, Singapore (Esmaeilpoorarabi, Yigitcanlar et al. 2020). As discussed in the sections below, and in Boxes 1 and 2, however, the ultimate success of the Cleveland and Chattanooga models lies in their extension beyond land-use changes to a whole-ecosystem approach.

Finally in relation to land-use changes, the evidence for inclusionary and place-based growth also points to a need to question entrenched visions of deindustrialisation for innovation-led development (Grodach and Gibson 2018). The resurgence of industrial zones and makerspaces internationally, particularly in the USA (see Innovate Albuquerque and Brooklyn Tech Triangle -Brooklyn Navy Yard in Table 4), has led to growing calls in Australia to protect urban industrial sites, which are often readily converted into tech-based 'innovation hubs' or housing. Such hubs often lack the preconditions for success and, in turn, diminish economic diversity and productivity. In Munich, Germany, the Weksvivertel or 'factory quarter' was developed on one of the last remaining large brownfield (previously developed) sites in the city. The collaboration of nine landowners has become a model for inclusive planning without destroying existing assets (Moonen and Clark 2017). The popularity of commercial tenancies at the Brooklyn Navy Yard (Table 4) reflects the diminishing availability of industrial spaces across New York. The 'mission-driven' Yard also hosts an Employment Centre, focusing on placing local, particularly low-income, residents in jobs. Moreover, its community partnerships facilitate an equitable approach to economic development by creating an 'ecosystem of businesses operating at the intersection of manufacturing, design, and technology' (Brooklyn Navy Yard 2019). This equity-based makerspace model is gaining traction across the US (see Innovate Albuquerque in Table 4).

The popularity of the new industrial-based innovation districts highlights a need to view innovation and knowledge more holistically, to develop existing specialisations and place-based industries, both in urban and regional settings. The planned redevelopment of the thriving creative industries and small manufacturing precinct at Carrington Road in Marrickville, NSW (Table 5), for instance, has been strongly opposed. The development would likely result in the loss of affordable commercial tenancies for many creative producers. Without adequate affordable and public/social housing zoning targets, these commonplace ill-fill/densification strategies and mixed-use developments drive a lack of diversity and affordability in Australia's urban centres.

Box 1: Greater University Circle Anchor Initiative, Cleveland, Ohio. Community wealth building using anchoring and land-use financing

The Greater University Circle Anchor Initiative (GUCI) in Cleveland, Ohio (USA) was initiated in 2005 by the Cleveland Foundation. It aims to address significant challenges around disinvestment and disadvantage by leveraging the economic potential of local anchor institutions – Case Western Reserve University, the Cleveland Clinic and University Hospitals Health System. Prior to the initiative, the Greater University Circle area faced a significant economic divide. Despite a concentration of academic, research and cultural institutions, many residents were locked out of their employment and educational opportunities, and prospective students and employees from elsewhere were bypassing Cleveland. This meant the institutions were also suffering a downturn.

It was recognised that developments underway in the Greater University Circle area and seven surrounding neighbourhoods would drive greater productivity if mechanisms were added to enable local people to be valued and empowered. Partnerships between government, not-for-profits and private agencies catalysed the redevelopment of strategic areas. With targeted tools to attract residents and businesses, a critical mass of development was achieved that then encouraged private developers to return. This avoided the provision of costly regulatory incentives for private investment. The focus was on:

- Institutional partnerships – creating opportunities for diverse institutions to work together

- Physical development – catalysing transportation and real estate projects that reconnect neighbourhoods

- Economic inclusion – encouraging institutions to buy local and hire local, and empowering new and existing residents to live locally; and

- Community engagement – ensuring residents have authorship in the revitalisation of their neighbourhoods.

The GUCI sought to leverage the weight of the local anchor institutions to participate in a holistic strategy of community-wide renewal at a time when significant institutional development was planned. By seizing this moment to convene around shared goals and collaborate between institutions, government and partner organisations, Cleveland has been able to pioneer an approach to urban development that fosters opportunities for the economic inclusion of residents and businesses. By overlaying the future plans of anchor institutions and community groups on a single map, the transformative potential of a collaborative approach became clear. Four targets were outlined: 'buy local', 'hire local', 'live local' and 'connect'.

Over a decade since conception, the GUCI continues to evolve in response to the needs of people and place. Members have worked together to develop a US$3 billion local procurement program to funnel purchasing power to local businesses. Relatedly, three new 'green' employee-owned businesses were created to service this procurement, creating wealth for the local community through providing pathways for individual wealth growth, while also reflecting the Initiative's goal to integrate environmental sustainability into the development process. These new businesses hire more local people, retrain them and offer them pathways to a career. The GUCI has also increased the number of anchor institution employees who live in the local neighbourhoods and has improved the quality of life of residents.

Housing – Greater Circle Living

Greater Circle Living (GCL) is an employer-assisted housing program to encourage employees of anchor institutions and any non-profit in the Greater University Circle area to 'live local' - in the area's neighbourhoods. Participating employers offer financial incentives to rent (<US$1400), purchase (<US$30,000) or repair (<US$8,000) homes. Funds are provided by each participating organisation with additional support from the Cleveland Foundation (which coordinates GUCI). These 'forgivable loans' (that may not need to be repaid under certain conditions) are offered to improve access to affordable housing, assist individuals to build wealth through home ownership, and reduce commute times and costs, thereby improving community wellbeing and increasing productivity. Between 2008 and 2017, 459 employees benefitted from the program. Workers from fourteen non-profits have used the program along with workers from three anchor institutions.

Importantly, the success and uptake of the GCL program relies on the integration with GUCI's other streams, particularly 'hire local', highlighting the collaborative and interconnected nature of the GUCI approach. Productivity improvements have resulted from increasing numbers of locals among employees of anchor and other institutions. In line with the 'hire local' and 'live local' goals of GUCI, the City of Cleveland also granted developers a fifteen-year 100 per cent tax abatement offer for prospective residents.

The programs have attracted a mix of residents old and new, and reflecting an ethnically and financialy diverse population (Schnoke et al. 2018: 34). Cultural change has been supported by the accompanying Cleveland Neighbourhood Progress, that works with residents to accept newcomers and encourage diverse neighbourhoods. The need to maintain populations whose economic circumstances are being improved by the GUCI is the next step for the 'live local' target, with a recognised need to respond with a greater number of middle-income developments and affordable housing; for the latter, there remains a large number of older houses with potential for repair, suggesting potential for expansion of the GCL renovation loan program, and possible uptake by more local institutions and businesses.

In protecting the increasingly rare and productive existing industrial sites in Australia's cities, regional and peri-urban areas may provide more suitable opportunities for new innovation districts around existing and emerging hubs, particularly in agricultural and health technologies, aeronautics and defence and other existing areas of research and development. The UK model of Local Industrial Strategies, which builds on local strengths and economic opportunities for long-term nation-wide productivity, underscores the utility of such a people and place-based innovation-led employment strategy. The plan targets funding and collaborations through existing small businesses and organisations driving innovation, in areas such as artificial intelligence, clean growth, future transport and healthy aging (Department of Business, Energy and Industrial Strategy 2019)

2.2.2 Anchoring

Anchor institutions are useful ingredients in the success of innovations districts, particularly those in regional and suburban locations. They are those permanently embedded in place, such as hospitals, schools, universities, technical colleges, sporting facilities and public utilities as well as arts and cultural institutions such as art galleries and museums (Wright, Hexter et al. 2016). Unlike other types of organisations and private corporations, anchor institutions are unlikely to move to another locale based on a more favourable regulatory or taxation environment or more affordable rents, and they are less likely to outsource production. Several innovation economies, such as the MaRS Discovery District in Toronto (Canada), Paris-Saclay, Singapore's One North, and the Boston Waterfront Innovation District, benefit from proximity to, and research and governance collaborations with, anchor institutions. Benefits arise from the clustering of research and development opportunities, from the nurturing of startup and postgraduate research opportunities, and from the ability to leverage the economic weight of these anchors for community-wide benefits.

In Australia, there is growing acknowledgement that stronger industry-university engagement will increase collaboration, and significant activity is underway to facilitate productivity through the leveraging of anchor institutions. Renewal SA's early securing of Flinders University and TAFE in the redevelopment of the former Mitsubishi Motors site into the Tonsley innovation - from 2009 - has been recognised as crucial to the site's success in attracting other firms and startups. This development represented a strategic shift from the State's manufacturing dominance towards a collaborative smart tech and knowledge economy. Using agglomeration principles focused through targeted sector and firm colocations, complementary firms and sectors were attracted by these anchors and a government focus on supportive infrastructure (see Section 2.2.4 below).

In One North (Singapore), departments within the National University of Singapore and other anchor institutions support clusters focusing on biomedical sciences, ICT, startups, media, and talent development. The business park is a more established example of how the agglomeration of firms around these institutions promotes a collaborative research and development environment, particularly when supported by suitable low-cost housing for young entrepreneurs and postgraduates. Innovate Albuquerque demonstrates that such agglomeration can be 'rightsized' for smaller cities and regional areas, promoting a strong and sustainable, place-based innovation culture. In a similar vein to One North, the significantly smaller 7-acre development in downtown Albuquerque consists of buildings focusing on biotech and materials, a startup and early growth lab, community makerspace, and the Rainforest building, where the University of New Mexico's Innovation Academy collaborates with private and government business and technology activities. The site's philosophy of intentional infrastructure allows walkability and technological connectivity to maximise the productivity of people and firms for job-creation and community-wide opportunity.

Innovate Albuquerque is also reflective of the imperative for innovation districts to include and bring along the existing population, particularly in such smaller cities and regional areas, and where there is a marked change in the local economic base. This has been a critical failure of many innovation-led employment strategies, leading to more widespread and costly societal problems, and declining productivity through participation challenges. While the presence of one or more anchor institutions can be a crucial ingredient in the success of regional and suburban innovation-led employment strategies, it does not guarantee success alone. Anchor-based models have been most successful where they have considered the wider community in planning through incorporating housing, transport and social infrastructure projects. In contrast, where anchor institutions isolate themselves from community, there have been significant productivity losses. For instance, in Cleveland, Ohio, prior to the Greater Circle Initiative (see Box 1) in 2005, employees of anchor institutions predominantly worked outside of the area, meaning long commute times. At the same time, neighbourhoods surrounding the anchor institutions faced significant blight and underemployment.

The anchor-based community wealth-building program that followed in Cleveland is outlined in detail in Box 1. Anchor institutions have spending power and a significant employment base that makes them heavily invested in the local community and its success – they can benefit directly and indirectly from improvements in the living conditions of their communities, as has been the case in Cleveland. Anchor institutions require access to a diverse employee and student base whose productivity (and in turn those of the wider innovation economy) may be hindered if people are displaced from or locked out of the local housing market. The utility of anchor institutions lies in their potential to leverage their significant resources for community-wide benefit. This leveraging can include local procurement strategies that inject huge sums into local economies, employment strategies, workforce training, and incubation of companies and social enterprises (see Box 1). In Cleveland, local procurement of anchor institutions has channelled billions of dollars into the local economy. Purpose-created 'green worker' cooperatives have been set up to service the needs of the anchor institutions and have created sustainable jobs and housing opportunities for the local population. Such models are crucial for employing an existing low-skilled or industry-transitioning workforce in regional and suburban areas.

When accompanied by innovative and sustainable financing models for housing (see Box 1), successful innovation districts are able create mutually advantageous entry-level employment opportunities for existing populations in struggling regional and peri-urban areas. The resulting combination of successful institutions and communities can help to attract investment, residents and visitors, as has occurred through the Cleveland Model. While existing models are based around anchor institutions and collaborative governance, benefits over time mean that firms will also see the benefits of investing locally as they become more grounded in place. This potential is evident in Chattangooga, where the development of an innovation district to leverage opportunities from the high-speed 'Gig' Internet saw the creation of an 'enterprise centre' as a new collaboratively-funded in-place anchor with community equity and inclusion programs (see Box 2). Cross-community collaborations and development in Chattanooga relied heavily on a number of well-established philanthropic foundations based in the city, which saw benefit from investing in its revitalisation.

2.2.3 Collaboration

For knowledge-intensive firms, productivity is improved through links between firms and labour markets, including housing and transport supply and availability. If done well, improved access to workers for firms (and vice versa) coincides with greater workforce participation. Such improvements in the overall functioning of cities (including regional cities) unleash greater productivity. While collaboration is a critical element in the planning and development of innovation districts, suburban and regional development zones can benefit from existing close-knit networks, community and industry leadership, proximity to (or potential avenues to) manufacturing processes, and a community mindset. Promoting local voices and leveraging these advantages through strong local collaborations benefits the 'unique regional culture, needs and aspirations' (Praharaj and Han 2019: 1) of these developing economies.

The international evidence points to greater success for suburban and regional innovation districts when there is a clear vision for the region that prioritises local issues, developed and planned for through structured public, private, and not-for-profit partnerships between local institutions. Leveraging place-based strengths through clustering and anchor institutions was identified as an important catalyst for collaboration. Successful collaborative governance models also have a place for citizen-participation and co-creation (see Boxes 1 and 2). New knowledge economies 'put' in place are likely to cause an abrupt disconnect between local workers and those employed in the new innovation sectors; this requires planned responses. As Pancholi, Yigitcanlar et al. (2018a: 706) found, innovation districts 'should not only aim for R&D [research and development], innovation and inclusiveness that lead to economic benefits, but also for approaches that lead to a democratic and cohesive society'.

Successful collaborative models such as Cleveland's (see Box 1) embed diversity and inclusion across visions and strategies. Local public, private and not-for-profit organisations are mobilised at a time of planned development to convene around shared goals. By overlaying organisational plans at the time of investment, community-wide benefits could be maximised. Continuing collaboration for over a decade has resulted in the development of a USD$3 billion local procurement program that has funnelled purchasing power locally, created new businesses, grows community wealth initiatives and enables local people to be valued and empowered by the area's transformation.

Such inclusive innovation-led employment strategies with measures to increase local workers and resident participation have strong potential to improve the productivity of lagging or disadvantaged regions and districts (Stanley, Glennie et al. 2018). These measures require a considered and collaborative approach with affordable and diverse housing a critical pillar, as is the case in Cleveland, where benefits to both residents and businesses have encouraged private investment to return to the area. In Chattanooga (see Box 2), the innovation district has grown with targeted public-private partnerships that focused on the needs of the city at large through a program of digital equity and housing affordability targets. These measures have prevented the negative impact on affordability that has occurred in places (in the US) such as Silicon Valley, San Francisco and Seattle. As in Cleveland, Chattanooga's collaborative governance model has targeted models to engage the existing employee base in the new economy. This has meant policies around digital equity, leveraging the city's high quality Internet by targeting low-income and minority groups though tech education, and programming events and creating places for everyone for an inclusive innovation district. Leveraging 'big' place-based strengths through such small-scale programs, and a community-led planning process facilitated by the Chattanooga Design Studio, gives an inclusive sense of ownership to the district and the innovation changes underway. Innovate Albuquerque (see Table 4) is a further example of a model to promote collaboration through inclusionary programming. Affordable classes and mentoring are provided in the FUSE Makerspace, and student housing is located within the University of New Mexico's 'Rainforest' Innovation Building, alongside other firms for strategic collaboration.

One North in Singapore also leverages community anchor institutions by collaborating with the university and businesses (see Table 4). In the state-led public-private partnership university departments act as horizontal catalysts within the ecosystem. Arrangements under the business park model allow profits to flow back into the state sector to maintain Singapore's large public housing system, infrastructure, education and the environment. Although Singapore's governance model is unique, and critically lacking in civic participation in state planning processes, the city/state-focused public-private model of collaboration is noteworthy for its public return on investment.

Box 2: Chattanooga, Tennessee. 'Gig' city: collaborative and smart

In 2015 Chattanooga, Tennessee became the first mid-sized city in the United States to have an innovation district. The district emerged from the recommendations of a task force set up by the Mayor to leverage opportunities from the 'Gig' – the first 1 gigabit-per-second fibre optic Internet network in the US, launched by the Electric Power Board (EPB) of Chattanooga in 2010. Spanning 56 hectares, the innovation district contains a mix of startups, venture capital firms, public organisations and not-for-profits, arts organisations and anchor institutions. One of those anchors is The Enterprise Center, which was chosen 'to establish Chattanooga as a hub of innovation, improving people's lives by leveraging the city's digital technology to create, demonstrate, test and apply solutions for the 21st century' (The Enterprise Center, cited in Morrison and Bevilacqua 2018: 8). The Center is a public-private partnership with three strategic areas:

- The innovation district

- Research and development

- Digital equity

The city's public-private partnerships involve six task forces to 'leverage the city's long history forging public and private partnerships and engaging citizens to help us reach our common goals' (City of Chattanooga, cited in Morrison and Bevilacqua 2018: 11). Indeed, since the 1990s, several foundations and donors have contributed over $200 million into Chattanooga's redevelopment, reflecting the mindset to promote local economic development and the knowledge economy.

One billion in private investment for redevelopment led to significant changes in the residential landscape. An increase in the proportion of wealthier households led Chattanooga's leaders to recognise the need to limit the negative externalities of the knowledge economy in the downtown area by focusing on equity and inclusion through the Technology, Gig and Entrepreneurship Task Force. Two types of strategies have been adopted, each facilitated by a range of public and not-for-profit organisations, and funded by place-based foundations, grants, and corporate sponsors:

- Promoting digital equity and fostering entrepreneurial opportunities for under-represented groups.

- To bridge the technological and digital divides between residents, collaborative efforts ensure that everyone can benefit from the city's technological advantages. Organisations such as Tech Goes Home, Launch Chattanooga, CO.LAB and others, provide opportunities through computer skills, coding lessons and startup acceleration programs to school children, low-income and unemployed residents, small businesses, women and minorities across the community, many run out of the Enterprise Center.

- Programming the downtown area as a place for everyone.

- Involving a wide range of organisations, public events include Tech Tune-up Tuesday, seminars, graduation ceremonies for skills courses, and other events aimed to be welcoming and interesting for all. A community-led planning process, facilitated by Chattanooga Design Studio and The River City Company has actively promoted placemaking in downtown Chattanooga and the innovation district through art installations, parks and other public places, as well as physically connecting the innovation district with diverse neighbourhoods and anchor institutions. Programs and community-led planning aim to give everyone a sense of ownership over the ever-changing district.

2.2.4 'Smart' thinking

'Smart' thinking incorporates two 'smart' elements as building blocks for successful innovation districts: smart society and smart technology. Innovation districts with the ingredients for sustainable success are those that leverage their technological advantages for inclusive planning. Crucially, the value of local communities and institutional actors should not be superfluous to smart city and innovation-led development (Praharaj and Han 2019).

Innovation districts mark a spatial shift from the business park model of the past. Proximity between workers, firms and industries, as well as research and education institutions, is a key element of the productivity of these new economies, with both workplaces and social spaces designed and located for collaboration. Through this proximity and collaboration, big data and smart technology can be linked into product design and application, and transformed into smart solutions to address societal challenges and needs. Digital connectivity is a critical underpinning. The Tonsley Innovation District (see Table 5), for instance, leveraged the South Australian Government's 'Gig city' initiative, which was based on the Chattanooga model (see Box 2). Tonsley has deployed high-speed Internet to attract knowledge-based industries and a research centre. Housing for workers is a part of widespread social infrastructure that has been central to enable Tonsley's productivity and connectivity.

Truly 'smart' cities, however, are those that take this productivity and connectivity a step further, engaging with the local realities and variants, to construct bespoke, place-based policies through collaboratively-defined visions that include and empower the local population. In Chattanooga, the benefits of smart technology have programmed the city's downtown as a place for everyone, with policies of digital equity focused citywide. The city's vision is 'to establish Chattanooga as a hub of innovation, improving people's lives by leveraging the city's digital technology to create, demonstrate, test and apply solutions for the 21st century' (The Enterprise Center, cited in Morrison and Bevilacqua 2018: 8). Through this vision, the city has fostered opportunities for computer skill sessions, coding lessons and startup acceleration programs for school children, low-income, unemployed and minority residents, and community-led planning has given all citizens a sense of ownership in the ever-changing district.

The policies of digital equity adopted in Chattanooga build from and maximise the benefits of smart technologies for sustainable, community-wide benefit. Other places, including Albuquerque (see Table 4) are learning from this model to maximise the potential of all citizens through opportunities to create and innovate. This inclusive model is crucial for developing the as yet largely unfulfilled potential of smart technology to provide planning and governance solutions to complex urban problems, linked by issues of affordability and productivity. This imperative extends to anchor institutions and their collaborative models, which have the potential to apply these tools locally and respond as required to people and place-based needs, as well as developing appropriate metrics to measure the success of complex, collaborative, community or city-wide projects. As Yigitcanlar, Han et al. (2019: 9) argue, places need 'the capability of developing their own technologies unique to their own developmental problems and needs'.

2.3 Summary

Innovation districts require a mix of research-oriented anchor institutions, startups and more established tech firms, and supportive social infrastructure, transportation and housing. The evidence presented here bolsters Praharaj and Han's (2019: 9) claim that truly smart cities should adopt a shared democratic approach 'by engaging leaderships from local institutions and by prioritising local issues'. Moreover, as Esmaeilpoorarabi, Yigitcanlar et al. (2020: 8) assert: 'In order to achieve desired community engagement outcomes, innovation districts need to ensure that the expectations of the broader community are delivered'. Table 6 (below) reviews the foundational elements of successful economies, highlighting how the international learnings outlined above intersect with each of the four strategies identified here. It is clear that housing affordability plays a difficult and important role in both emerging and developed innovation districts. Supporting diverse housing and the productivity it generates requires holistic approaches that address housing within a system of inclusion and affordability.

Table 6: Table 6: Foundations for successful innovation-led employment strategies

	Land-use	Anchoring	Collaboration	Smart
Building growth around existing firms by clustering innovative sectors around research strengths	●	●	●	
Melding disparate sectors and disciplines	●	●	●	●
Mix large and small, established and startup, public, private, academic and civic institutions	●	●	●	
Early identification and investment to address gaps in transit, Internet connectivity and housing	●	●	●	●
Focus large and small, long-term and immediate. Large investments in transit, high-speed Internet complement small strategies that boost productivity including reactivation of public spaces and community events	●		●	●
Programming – to strengthen skills, networks and firms and ensure the productivity benefits of the district spread to community/city-wide outputs			●	●
Supporting social interactions through identifying and nurturing 'hot spot' public/civic places	●		●	●
Embed values of diversity and inclusion in all visions, goals, and strategies	●	●	●	
Respond early through policy and planning to preserve affordability and diversity both within and outside of the innovation zone	●	●	●	●
Innovative and sustainable financing	●	●	●	
Collaborative governance. Successful models involve business, academic and civic institutions, as well as government, local workers and residents in a collective governance approach		●	●	●

Source: Compiled with evidence from Wagner, Andes et al. (2017) and the international review (above).

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- Large and small firms constitute the innovation ecosystem.

- For startup firms, affordable rental housing is just one factor of many that influence their ability to succeed. Other factors include proximity to work (including co-working spaces), ease of transport access, and agglomeration of business.

- Affordability was one element of housing considered to be important. Other housing elements were amenity, security, and ease of access.

- In outer metropolitan and regional locations, affordable housing was identified as less important than amenity, lifestyle and transport access.

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Both smart city and innovation-led ecosystems have technology-focused businesses at their core. As summarised in chapter one, large technology corporations such as IBM or Cisco have been explicit catalysts of smart city developments (Alizadeh 2017). Likewise, technologies developed by small-scale entrepreneurs underpin the implementation of smart-city initiatives, such as transport apps. Both large and small firms constitute the innovation ecosystem. The success of innovation-led employment policies is dependent on their ability to reflect and shape the actions of firms. This chapter examines the perspectives of the small firms on affordable rental housing, typically described as startups. Startups are defined by umbrella organisation Startup Muster as 'an early stage business that has a large addressable market that utilises technology to capture that market quickly' (Startup Muster 2018: 4). There are a number of reasons for this focus on small firms. First, as described above, they are critical to functioning innovation ecosystems. Second, such firms have been the focus of innovation-led employment strategies, especially in outer metropolitan and regional locations. In NSW and Victoria, for example, in addition to startup incubators or accelerators associated with universities, we can identify over 25 startup accelerators in these states (see Alexander 2018).

Due to their small-size, geographical dispersion and ephemerality, comprehensive data on the startup sector is rare. However, for the purposes of this report, an annual survey undertaken by Startup Muster provides instructive background information. Startup Muster used an innovative methodology to estimate that are there are 1500 startups in Australia, down slightly from the previous year but almost double the estimated 2015 number (Startup Muster 2018: 5). There is significant churn in the sector: between 2017 and 2018 there were an additional 712 startups, and an estimated 1000 that either become too large to be classified as a startup or folded as a business.

Founders of startups are most likely to be aged between 35–40 (20%) or 30–35 (19%). Though housing was not collated as a 'hindrance' to founding a startup in the Startup Muster surveys, factors such as 'life circumstances that require a stable income', financial commitments including a mortgage (not surprising since 65% of startups relied on cash contributions from the founder), were significant for many (Startup Muster 2018: 11). Interestingly, of the types of location worked from, the top two were home office or co-working space.

The research included interviews with startup businesses and accelerators as a means to ascertain the role of housing affordability in starup operations, and specifically whether, and if so how, it was a barrier or opportunity. Interviews were drawn from a variety of small businesses and umbrella organisations from across four case study areas: Wollongong NSW, Central Sydney, Western Sydney, and Geelong, Victoria. These were supplemented with interviews with local and state government strategic planners, local economic development officers and senior state government bureaucrats. It is worth noting that interviews with startup and digital businesses proved difficult to acquire. Reflections with those interviewed suggested that these difficulties were largely due to the time and financial pressures of running such businesses, which meant that contributing to research projects was not given high priority. Interviews ranged from 30 – 75 minutes and were conducted either over-the-phone or face-to-face by one to two research leads or a research assistant. Interviews were recorded and audio files were anonymised and transcribed by an external transcription agency. A research assistant then coded transcripts thematically with guidance from research leads based on the key research questions. The following analysis divides the discussion in terms of the locations of firms.

3.1   Housing perspectives of firms in inner-metropolitan areas

In both Sydney and Melbourne, innovation-led employment is principally located in districts around CBDs, major hospitals or universities. Interviews identified several housing-related factors amid barriers and opportunities to innovation sector growth in these metropolitan locations; these are outlined in Table 7 and expanded upon below.

Table 7: Barriers and opportunities for innovation sector employees across inner-city locations

Barriers	Opportunities
• Poor public transport integration	• Agglomeration of other businesses in the sector/networking opportunities
• Loss of working hours and difficulty travelling to multiple locations	• Proximity and access to city centre for business and social meetings
• High cost-of-living	
• Accommodation-sharing impacting sleep	• Access to co-working spaces for improved productivity and workforce/collaboration sourcing
• Poor building maintenance meaning money, time and stress spent on getting accommodation to liveable standard, or getting real estate agent to do so	• Greater concentration of accelerator programs and funding opportunities;
• Low-quality Internet connectivity – lost hours working waiting for Internet	• Leveraging industry/anchor partnerships and spaces
	• Lifestyle amenities e.g. restaurants/arts/etc.
• Lack of affordable and flexible housing options amenable to startup/mobile workforce lifestyle (e.g. all-inclusive options)	• Proximity and access to medical services, schools and day-care
• Small and unproductive home office spaces	• Innovative and flexible in-fill and high-density housing options, capsule hotels, granny flats
• Over-regulated nightlife	
• Lack of industry diversity/banking and finance dominance	

Source: author interviews

The first was the importance of housing close to employment in order to minimise commuting time and maximise work time. For example, an interviewee noted the importance of location in relation to employment goals when choosing to locate in the inner city:

> We chose that [location] because we knew that my husband had a job here at the university and at least that would make it easy for us, or rather for him, to get to work. A lot of the good places for user experience design are around the city.

Or another, who also stressed the importance of having important services such as childcare close to work:

> People say that you need a separation between work and home life, but just the reduction in commute times made such an impact on our lifestyle… We also have our kids at the day care here. That also ties us down to the area…

One entrepreneur recognised that their decision around where to live was tied to their co-working space and funding arrangements; the agglomeration of businesses and co-working spaces in the Sydney CBD often influenced decisions around housing for entrepreneurs moving to the city from interstate or overseas. However, proximity to the CBD was also cited as an important factor:

> [My] seed funding including co-working at Ultimo, which made decisions around my accommodation and housing. Well, yeah, and some of the meetings to do with the business were also just in the CBD generally.

Overlaying these housing perceptions were additional factors relating to productivity. As suggested by Pancholi, Yigitcanlar et al. (2017) high rents for startups are more likely to be a factor in shaping the location of these businesses. Having access to free or cheap office space was found to be a key contributor to entrepreneur productivity and improving chances of business success. For example:

> Office cost is one of the largest costs in a business when you start and so most startups work out of their homes… When you're an entrepreneur in a struggling startup your productivity is the number one thing that you need to focus on getting good at. So if you're working on your bed… it massively reduces your potential to succeed…

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Another factor for productivity is the type of housing preferred. Younger or more mobile entrepreneurs noted that access to adequate and comfortable housing were important factors in decisions around housing, often overriding affordability. One factor of significance was ability to get enough sleep. Privacy in dwelling type was a related key factor. While interviewees stressed the advantages of co-working spaces, co-living was not similarly favoured. As one interviewee noted:

> Being able to sleep is massive for productivity, and like at that period… I was turning up at the co-working space seven days a week for six weeks straight or something… So, you do need the sleep part. So therefore, yeah, share-houses, Airbnb, hostels, that all can all be a cost to you. You might save money but you're actually losing physical values like productivity.

> Relatedly, interviewees noted particular needs for housing design to best accommodate entrepreneurs' activities – 'Fully furnished, fully inclusive options [are] always good for… I would call them mobile workers, just like you have students that are fairly…mobile'. 'Someone build a capsule hotel, please'.

Interviewees also noted that a key impediment to productivity and business development was the lack of access to efficient transport connections across the city. One effect of this was loss of workable hours due to long commuting times:

> The public transport in Sydney is really shocking at the moment. I mean we also have to carry around big heavy kits like a wheeled case and a backpack… The public transport tends to add a lot of extra time to get anywhere.

Access to reliable, high-speed Internet was noted as a key factor in increasing productivity across the interviews. Many commented on the lack of digital connectivity as a hindrance to productivity. Even in inner-city areas, slow Internet connection can result in loss of workable hours, for example:

> Personally, my house has absolutely shocking Internet in Glebe and that is a massive hit to productivity. When you're trying to do sales and a lot of your sales requires market research online and it takes you an extra minute or two to load a website it's just that stacks up over the day, and you end up losing potential hours a week just waiting for websites to load.

This need to maximise productivity, particularly in the early stages of a business was frequently cited as key to the ability to succeed. Reflecting the Startup Muster statistics above, interviewees noted that given the significant personal and financial investment founders often make in these initial stages, access to housing that was affordable was a key sticking point. For example, one founder notes the difficulty of balancing the intensive work required in the early stages with the second job he needed to pay rent:

> If you're working on a startup part time [it] massively reduces your chances of success because you really need those full-time hours to be able to focus enough time and effort into getting those sales and working on the business model and developing a product or service that you can actually sell for money. If you can't do that full-time… it is tricky… When I started, I was doing seven days a week, 12-hour days, just to try and get off the ground because I had to pay rent, which is expensive, and try and start a business out of my own pocket… A lot of people go through that.

> Relatedly, lack of time to find housing was identified as a key barrier. As one interviewee recalled, 'I was working seven days a week… so…except like an hour here and there [and maybe] a few hours here and there on the weekend [I didn't have time] to look at accommodation'. Another associated time spent on housing decisions with negating their entrepreneurial productivity, stating:

[For] an entrepreneur that's already doing something new [and] growing their business… there's already a lot of new decisions every day…the last thing you want to do is [look for accommodation]…Having three months accommodation straight up would have been great because that would have removed a decision process [and] basically you save then more productivity or more impactful decision-making.

This sentiment was associated with the need for balance with the intensity of the work environment: 'I think the kind of intensity of a startup environment and a new business environment… doesn't need the intensity around the work period'. For startups, cost of living was frequently identified as a factor interfering with the ability to balance this work/life intensity. As one entrepreneur commented, 'It's more than just the affordability [of accommodation]… People in the industry are always interested in cost of living'. This perspective was echoed in the experiences of entrepreneurs, for instance:

> You have to be so careful that you don't go into debt…you're living week to week… you're sacrificing take-aways, you're sacrificing eating out… hobbies… Basically you're down to the bare basics to…grow [your] business, and I had already been doing that for over 14 months… I probably spent $105 a night [on] accommodation that wasn't too divey… because I was already struggling… without having [the] stress [of] noisy accommodation or accommodation that made me sad because it was dirty or whatever.

> The decision of where to live was seen to have a significant impact on balancing cost of living with income, and could be seen as a deterrent. As one interviewee regretted:

> I went to Sydney because I had competed and won seed funding of $30,000 to spend on the startup at the time… I could have chased funding in Brisbane, and the most funding at the time was $20,000 and I thought, 'Well, I've got $10,000 more. Awesome'. What I realised quite quickly is Sydney,.. cost of living…did suck up that… which is a shame… I could have not made that giant move and just stayed in Brisbane.

> Just as innovation ecosystems are comprised of complex and overlapping networks of aspirations, lifestyles, business relationships and amenity, so too is the relationship of startup firms to housing affordability. Housing that is affordable in proportion to income frees up capital and time to allow the entrepreneur to focus on their economic activities. Where housing is either not affordable or not appropriate, detrimental effects on business success are perceived. A number of creative responses to these impediments are in evidence, including living with others or using resources from family or from previous employment:

> We had purchased [our] house before I started [the startup] …Honestly, that was only possible through my previous occupation and the salaries that we were earning and the savings that we had. We were lucky that we had the benefits of… a good profession and a good job, steady income…

> And another:

> It has been more challenging… since we started [the startup] because essentially, we cut our income in half… We're fortunate that my wife still has enough - earns enough that it can support both of us.

For many, affordability issues were managed through the use of informal networks – parents, partners, friends, co-workers – that provided access to less expensive housing in these areas where affordable rental housing was in limited supply. Many of the entrepreneurs interviewed were still living in the family home, suggesting that the 'bank of Mum and Dad' may be supporting more than the home ownership aspirations of their children.

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Interviews confirmed the complex relationships between affordable rental housing, startup cultures and innovation clusters in inner metropolitan locations. As summarised by one economic development officer:

> So affordability, then really becomes about affordability of your - not only where you live but also becomes affordability of the office space, the employees, what you have to pay them to retain them in those areas and so forth. When you start totalling it up for a business across all their costs that they need to think about, housing is - certainly would be in there but it's maybe not the most - not the biggest driver for a business.

An entrepreneurial ethos, and focus on creating a successful business meant that the key attractors of proximity to work and other businesses were seen as priorities enmeshed with housing affordability.

3.2 Barriers and opportunities for innovation sector firms in regional and outer-metropolitan locations

As outlined in chapter one, Australian and international innovation-led employment strategies are increasingly focused on the productivity opportunities in outer metropolitan and regional locations. Through interviews with firms, startup accelerators, and state and local government economic development officers, this research identified the critical barriers and opportunities for increased innovation-led employment beyond the inner urban locations that were the focus of the previous section. These are summarised in Table 8 and detailed further below.

Table 8: Barriers and opportunities for innovation sector employees across regional and outer-metro housing locations

Barriers	Opportunities
• Poor transport infrastructure and car-reliance	• Major infrastructure developments e.g. Aerotropolis, Sydney Science Park
• Poor digital and telecommunications infrastructure	• Existence or development of 'eds and meds' anchor institutions
• Lack of funding relative to population/ potential workforce	• Context specific innovation foci
• Wage differentials cf. cost-of-living	• Diversification of national economic base
• Problems with student retention	• Low-cost and green housing options e.g. prefabricated, modular housing
• Corporate-minded governance inflexible for startups and non-community-minded	• - Environmental or natural amenity

Source: author interviews

For firms in the digital innovation and startup sector in outer Western Sydney, Wollongong and Geelong, there was a different ensemble of elements that constituted the innovation ecosystem.

Firstly, the availability of a large pool of skilled labour was important. As one Wollongong interviewee commented:

> Okay, well, yeah, that is an ongoing challenge. Some businesses have chosen to relocate to Wollongong because they see some advantages. We've got, if you look at our workforce, we've got in Illawarra more than 20,000 people travelling to Sydney each day for employment and half of that would be people in professional and management roles. So, we've got a very skilled workforce leaving the city each day. We tend to have a bit more stability in our employment here, so if businesses relocate here, they're less likely to have as high turnover of staff, which again in certain sectors would be a good thing. There's just a range of reasons why some businesses would consider Wollongong as an option for relocating.

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Second, lifestyle and amenity were also crucial:

> There's some phenomenal growth with office space in Wollongong over the last five years and more to come. Part of that is getting some of those tech-savvy kinds of businesses that don't really matter where they're located. They want lifestyle, they want accessibility to cheap housing, they want amazing coastal lifestyle that this region offers and they're actually trying to package all of that up. It's been quite good with getting some businesses to relocate.

One interviewee associated with a startup accelerator in Wollongong, drawing on his extensive international experience, notes:

> I think for a lot of people, they want to be around other people doing some cool stuff. I think this ongoing attraction means that you can have more of a revolving door sense, but that people will come back at some point and contribute again. If we can build a centre that becomes more and more active that that really is a draw…You've got to give them the opportunity to be around other people who are in that same frame of mind.

Anchor institutions, such as universities or hospitals ('eds and meds') were another key factor driving a regional innovation ecosystem. For example, a startup accelerator in Wollongong notes the importance of situating the accelerator in a university:

> It was really thought of as, this is something to actually help develop jobs in the community and the university seemed to be a good place for that to happen given the commercialisation efforts that already go on in a university.

Regional areas, due to their geography and population, also offered unique opportunities for innovation outside the dominant focus of inner-city innovation districts on financial services, such as in 'deep technology', agricultural and health technology, advanced manufacturing, defence, and aeronautical technologies. For example, in Western Sydney:

> The beauty of what we have out here, it's all deep tech focused. So if you go to Westmead, you know, you're talking about the highest level biomedical engineering and scientific level technology development happening. If you go to Liverpool Health Innovation Precinct at the hospital, it's robotics and automation in healthcare is the focus. You've got the Ingham Institute sitting there next to the hospital doing amazing work in 3D printing and all sorts of other - everywhere you look…

Or in Wollongong:

> There's some phenomenal growth with office space in Wollongong over the last five years and more to come. Part of that is getting some of those tech-savvy kinds of businesses that don't really matter where they're located. They want lifestyle, they want accessibility to cheap housing, they want amazing coastal lifestyle that this region offers and they're actually trying to package all of that up. It's been quite good with getting some businesses to relocate.

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However, interviewees in regional and outer-metropolitan areas saw a mismatch between policies encouraging innovation strategies in regional areas and the relatively more significant funding continually focused on inner-city developments. In Western Sydney:

> So you know, why we're developing the next app to find the best smashed avocado in the CBD when we've actually got a deep tech region sitting there waiting to be harvested. It's so dumb. It's so dumb that they… The problem for us is we're doing all this; I've got a staff of three people. We've got over 100 companies. We've got three sites and we've got three people. Just government won't give us any money. But you look at the economic potential opportunity that sits out here in the west with all this stuff, and no matter how much you tell them, you can tell them all that until you're blue in the face and then they'll just go and bury another $30 million in the city.

And in Wollongong:

> I think it's much too slow and too little. I think there's - from most of the activity that we see seems to still be always coming back to urban areas and in New South Wales certainly to Sydney. There was no problem spending $28 million getting a hub in Wynyard, and yet when it was time to look at trying to fund regional hubs it was like $2 million for everyone.

Interviewees also saw this mismatch as a threat to the development of emerging sectors in regional areas:

> That's something we get a little frustrated by - I get fed up of it - because you hear a lot about fin-tech and getting high-tech and all these things about tech that predefines that innovation can only come from these areas. That really ignores the development of a lot of - now we're starting to talk about ag-tech and we're talking about different aspects of that, but it's still a small slice of the overall pie. Also, for investors it's not a place where they tend to want to focus because they don't see the big unicorn opportunities there. Some of these are longer - have longer gestation periods.

Some of the issues facing startups and entrepreneurs in inner-city areas – namely, transport and Internet connectivity – were also experienced in regional/outer-metropolitan areas, but at a greater degree. A startup accelerator/incubator located in Western Sydney, for example, notes how the lack of efficient transport connections hinder the growth and development of new businesses trying to connect with clients:

> The problem is that - the cross Western Sydney connections are the problem. So, if you've got to get from Werrington to Bankstown, right? It's basically at least a one-hour train ride… Yeah, if you've got to get from Campbelltown to Werrington and you don't have a car, it's a nightmare. A complete nightmare. So, the intra Western Sydney travel times are just ridiculous… You've got 80 new businesses registered every month. But they're now not going to connect that LGA and Campbelltown, which is smaller but similar in terms of growth, to the airport. They're going to do that later.

In the Illawarra region, mobility issues made it difficult to have a successful innovation sector:

> The other thing is to understand the mobility is important. I think we have to bring it back to transport issues and getting people an easier way of moving around so that they actually have flexibility of where they may be able to also - to live, versus where they work. For us in the Illawarra we have some pretty significant issue with train service…

Lack of public transport connections and reliance on car-based transport in Western Sydney was also seen as a deterrent for entrepreneurs/knowledge-sector workers when presented with the option of relocating to Western Sydney. One startup worker notes:

> We also have to think about the fact that we don't have a car. So we are pretty much reliant on public transport. Sure we could go out to places like Parramatta and Penrith, but it's still widespread. Everything is spread out. You still need a car.

Knowledge- and innovation-sector workers living in the inner city and central areas were less likely to move to Western Sydney or regional areas that did not have strong digital infrastructure:

> Yeah, the Internet here sucks. Internet connection is really important for our industry. So making sure that we have the right infrastructure to support that is - it's a given. The infrastructure isn't there yet and unless it's already there, we wouldn't think of going out there.

Finally, in terms of housing, it was difficult in regional areas to attract and retain staff due to wage differentials. As one commented:

> I've heard people say, look I can go to Wollongong and I'll take a cut in pay but that cut in pay won't be compensated by a cut in rental. … It's not necessarily so. You will take a cut in pay but that may not be offset by a cut in your costs, especially not costs of living.

3.3 Summary

Key barriers to regional and outer metropolitan innovation sector growth include improvements to transport, medical, education and childcare infrastructure. More specifically, funding for innovation sector growth in regional areas was also identified as a key sticking point. Regional and outer metropolitan areas also have unique opportunities to leverage potential innovation in green and flexible housing and to nurture diverse and place-based innovation economies through anchor-based agglomeration; the latter is also an opportunity to continue to diversify the national economic base.

Regardless of the opportunities present for innovation sector growth in regional and outer metropolitan areas, many firms and startups will choose to remain in inner metropolitan areas for a number of reasons. The interview data demonstrates that, at present, the productivity of those businesses and entrepreneurs is being negatively impacted most particularly by housing affordability and income/cost of living disparities, factors with policy levers across government that will also benefit – and indeed are crucial to – innovation sector growth in regional and outer metropolitan areas.

The key findings from interviews with firms related to the startup and digital economies is that for young entrepreneurs, affordable rental housing is important, as one of many factors that influence their ability to successfully engage in the sector. Proximity to co-working spaces and agglomerations of businesses (e.g. a CBD) were very important in helping facilitate the networking opportunities useful to develop a business and client base. In addition to proximity, amenable or comfortable housing was important to sustain the high-intensity work culture of the industry and ensure maximum productivity. Lack of affordable rental housing also saw younger entrepreneurs engaging in coping strategies to sustain their livelihoods, including working second jobs, living in the parental home, or share housing. While these coping strategies were seen to be crucial for these entrepreneurs, they are also seen to have hindered the potential productivity of them and their emerging businesses. Enabling ecosystems of greater affordability that maximise opportunities and address barriers across inner and outer urban and regional areas would facilitate productivity in the startup sector.

4. Policy development implications

This research was a first pass assessment of the relationships between housing affordability and digital innovation, focusing specifically on the importance of affordable rental housing to support innovation-led employment strategies. Overall, a key finding is that innovation-led strategies are largely housing 'blind'. That is – across the research and policy documents we reviewed we found little evidence that housing is systematically considered as part of the enabling infrastructure needed to support innovation-led economic development. However, in practice we found that affordable housing had been embedded as an implicit or explicit ingredient across the international case studies. The key policy implication is that innovation-led employment strategies should explicitly consider their housing foundations and the consequences for housing at formulation stage.

Considering 'inclusive innovation' as a guiding principle a number of implications follow. Innovation districts focused on supporting high-growth digital technology, hardware and e-commerce firms, such as in South Lake Union, are highlighted here as problematic use of public funds, with inequitable outcomes. The displacement of previous land uses for such purposes adds to these concerns, underscoring the need to consider these uses when development is planned. Although this restraint on investment may present a challenge for governments trying to attract high-growth innovation firms, successful international cases, such as Barcelona (Katz and Wagner 2014), Cleveland or Chattanooga (see chapter three) demonstrate the importance of ensuring a focus on equity, to support a sustainable innovation economy. These cases demonstrate that catering to diverse housing, including through the provision of affordable housing, facilitates the varied skill-sets that will allow innovation economies to continue in these places. Two sets of policy implications follow: the first relating to innovation-led employment strategies, and the second to the specific housing elements of those.

In relation to innovation-led employment strategies, new innovation sector entrepreneurs are supported by lower housing costs in establishing and expanding startups, suggesting that live-work innovation districts and development models might enable new knowledge sector firms in high-amenity, satellite city locations. Policy initiatives linking housing and smart city initiatives are not yet embedded in Australian metropolitan planning. However, models emerging internationally provide a starting point for emulation. Variations in place and scale among these models, as well as a lack of data made any meaningful systematic evaluation of the cost of the international cases unachievable within the remit of this report. Future work should address this lack of data and need for more meaningful comparative evaluation.

- Our review of emerging Australian practice shows that innovation districts can mobilise significant and new economic opportunities, but strategies take time to bed down and depend on:

- Strong locational advantages, such as proximity to key existing knowledge clusters, for instance universities and/or hospitals;

- Access to attractive natural amenities and cultural facilities; and

- Digital and physical connectivity, suggesting the need for digital equity strategies.

Moreover, land-use planning frameworks may support the development of innovation districts, through models such as live-work zones, while strategic place-based funding interventions could prioritise connectivity (physical and digital) to enable new firms to operate beyond established central city areas. These place-based funding approaches could also focus on amenity qualities (local cycle/pedestrian networks, distinctive and sustainable urban design), known to attract digital entrepreneurs and their staff.

In relation to affordable housing specifically:

- Renegotiating regulations and developmental incentives—such as flexible floor space index or relaxation in height controls—can help as potential strategic tool to encourage the growth of diverse housing options at the site.

Targeting early-career knowledge workers through particular housing typologies, with flexible tenures, accessible locations, and high-quality amenities is often a key success factor. However, maintaining affordability requires added interventions:

- Preserving and providing affordable rental housing is a key challenge, depending on strong up-front strategies to embed affordability before districts 'take off' and requiring ongoing adaptation as they develop.

Specific affordability strategies are required for emerging innovation districts, particularly those around transformative infrastructure projects:

- Adapting of zoning and taxation should be readily considered in emerging innovation districts as mechanisms to preserve affordability. Policy settings should be flexible to ensure infrastructure, housing and service capacity meets need. This flexibility includes taking seriously innovative models for financing diverse housing types.

- Smart innovation could be leveraged to improve urban planning systems and productivity losses, including addressing affordable housing provision and availability. Using 'big data' effectively could help to improve urban systems modelling and intergovernmental processes for more inclusive growth. While there has been extensive work on smart houses, smart housing has been a tangential (at best) focus. The Australian Government's *Smart Cities and Suburbs Program* could be more effectively targeted to address housing affordability. Pending outcomes, the funded Maroondah City's Council project could provide a model for work in other locales.

Innovation-led employment and smart city strategies are increasingly important for regional economic development as digital ICTs reshape economies and cities. At the same time, while housing affordability is a key issue for many workers in the innovation sectors, there is a clear disconnect between the provision of affordable housing, innovation and smart cities in both research and policy. The findings of our study highlight the potential value in inclusively planning for innovation-led employment and affordable housing, particularly in cities with high housing affordability pressures. Furthermore, the higher rate of affordable housing in regional and non-metropolitan areas suggests that such areas could play a stronger role in growing innovation economies.

In particular, we identify the potential opportunities to reshape the spatial geography of this development by investing in the enabling infrastructure that supports digital firms to relocate to regional areas where housing costs are lower; as well as the ongoing importance of supporting, enabling, or providing affordable rental housing in accessible areas already favoured by digital innovation firms, to support further growth in this dynamic sector. Innovation economy and smart city policy is still evolving. Further research is required as policy and practice respond to industry changes and in turn shapes industry.

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