From: Lisa Denny <lisa@lisadenny.com.au>
Sent: Monday, 1 June 2020 12:35 PM
To: Gutwein, Peter (DPaC) <Peter.Gutwein@dpac.tas.gov.au>
Cc: Gale, Jenny (DPaC) <Jenny.Gale@dpac.tas.gov.au>; Bowles, Mark <Mark.Bowles@treasury.tas.gov.au>
Subject: Premier's Economic and Social Recovery Advisory Council - contribution

Dear Premier Gutwein

I write to contribute to the economic and social recovery of Tasmania as the state progresses through the stages of the COVID-19 global pandemic to recovery.

As you and your Advisory Council consider the both the economic and social impact of COVID-19 for Tasmania and Tasmanians and formulate a plan for recovery, I ask that this plan is founded in evidence with a long-term objective to achieve economic and social sustainability for Tasmanians. While in the short term, stimulating economic activity

will be critical to ensure that the health crisis does not cause a deep, long lasting economic crisis, targeted short term stimulus can also set the foundations to achieve longer term economic and social outcomes.

I believe there are four key opportunities for Tasmania going forward, each linked to our existing structural challenges (see attached slide – Tasmanian Structural Challenges).

1) Use the opportunities attached to population ageing to address the challenges of ageing
2) Prioritise industry policy that aims to increase diversity across industries and markets
3) Approach the investment in the health care and social assistance industry as an economic and social opportunity
4) Aim to achieve a 'strong middle' educational attainment structure (EAS)

Given the current situation of the COVID-19 global pandemic, with the state and national borders effectively closed to immigration, it is likely that population growth will slow considerably in the short to medium term and that the rate of population ageing will intensify. Future economic and social policy development for Tasmania will need to be positioned in the context of a population with low or no population growth and ageing rapidly.

Use the opportunities attached to population ageing to address the challenges of ageing
It is likely that Tasmania will return to a situation of low or no population growth in the short to medium term which will result in rapid population ageing. Importantly, even when Tasmania was experiencing its strongest rate of population growth in a Century, the population was still ageing, and ageing at a faster rate than the rest of the country. Nearly half of Tasmania's Local Government Areas had already been experiencing population decline for a prolonged period prior to the pandemic. When and if Tasmania does return to relatively strong population growth, it will also continue to age. There will be more people who are older, both in terms of numbers and in terms of proportion of the total population.

The attached report, *Strategic policy responses to population decline: A synthesis of regional approaches and outcomes with policy recommendations for consideration from a Tasmanian context*, provided to the Department of State Growth in May 2020 outlines three key strategic, complementary, approaches to providing for the needs of an ageing population while creating economic activity and improving the well-being of communities, particularly in regional areas. A number of case studies are also included in the report.

1) Investing in the White Economy
2) The regeneration and repurposing of the built environment
3) Establishing Special Economic Zones (SEZs)

The White Economy will be briefly outlined below, SEZs fits within the diversifying the economy opportunity and is also explained in more detail in the attached report.

In terms of the **regeneration and repurposing of the built environment** and in response to your intended infrastructure and construction investment, consideration should be given to the revitalisation of regional centres and public spaces in both stimulating economic activity in regional areas but also in ensuring that the new infrastructure meets the needs of that community.

As regional populations age and/or decline, their town centres and public spaces also deteriorate, creating a fragmented and under-utilised spatial structure. The visible degradation (including vacant premises) of the built environment, for example houses, buildings and other public infrastructure can impact the perception of the place and detract people from living there. Policy initiatives that target the revitalisation of a town centre and its periphery in response to shrinkage have two main aims; to improve standards of living through urban renewal while maintaining cultural heritage and to improve social cohesion. This requires a shift from supply planning to demand planning. Regeneration encourages a focus on the existing built environment and includes the demolition or restoration of vacant, old or non-energy efficient buildings as well as historical landmarks; the revitalisation, repurposing and 'right-sizing' of public infrastructure and streetscapes; the development of brownfield and greenfield sites within urban zones; and, restrictions to curb suburbanisation and urban sprawl as well as appropriate scaling to ensure both improved service provision and liveability in the region.

A number of major towns could benefit from urban renewal projects which focus on the regeneration of the existing built environment and the revitalisation, repurposing and right-sizing of public and private infrastructure, services, amenities and housing to meet the needs of their changing populations. Appropriate towns to consider for fit-for-purpose urban renewal projects are those with transport corridors and access to other towns within their periphery, as well as to towns and major urban centres outside their immediate periphery which may provide larger-scale public services to their community. In Tasmania, towns like Smithton, St Marys and Queenstown could be considered.

Greater explanation is also provided in the attached document.

Prioritise industry policy that aims to increase diversity across industries and markets
To safe-guard against external shocks, Tasmania needs to improve the diversity of its industry structure and markets, particularly focussing on increasing the traded-market sector of the economy.

In 2019 the The BankWestCurtin Economic Centre developed a strategy for future-proofing the Western Australian economy. The research underpinning this strategy could be quickly and easily replicated for Tasmania.

The strategy is based on the framework of economic complexity developed by the Harvard University Kennedy Business School and smart specialisation. The report recommends the implementation of a 'smart specialisation' approach to regional diversification, to ensure that new development opportunities build on existing regional capabilities and capitalise on local conditions and networks. A fundamental element of smart specialisation is to support those industries that regions are leading in. But the smart specialisation policy is also useful to encourage diversification into new industries that build on existing advantages. Smart specialisation is policy framework designed to assist regional areas to boost their competitive advantage by prioritising innovation and research. A key feature of smart specialisation is its bottom-up approach, underpinned by partnerships between governments, businesses and research institutions. The framework encourages regions to focus on their strengths and to strive for "smart, sustainable and inclusive growth".

Research by the Harvard University Kennedy Business School identified that diversification and economic expansion results from moving into nearby and related products or into those that require similar knowhow to build on existing capabilities. The Atlas of Complexity identifies potential growth opportunities for all 133 countries, based on their export profile. These strategic new product opportunities aim to balance connectedness with existing capabilities, complexity and the opportunity for further diversification and are further diversified according to a realistic indicator of either; 'low-hanging fruit', balanced portfolio or a 'long jump'.

Tasmania needs to identify its low hanging fruit to start building the foundations of a more diversified economy which will be better positioned to withstand economic shocks and cyclical factors, and also from which to build a stronger economy over the longer term.

Approach the investment in the health care and social assistance industry as a valuable economic and social opportunity
Prior to the pandemic, the health care and social assistance sector contributed both the highest proportion to Gross State Product (GSP) and to employment than any other industry sector, yet its contribution is not valued as such in the community. Greater understanding of the Return on Investment (RoI) in the health care and social assistance sector would assist shift this negative perception and also inform greater investment in the provision of health care and social assistance in Tasmania.

The BankWestCurtin Economic Centre undertook an in-depth investigation of the WA health industry – a sector they recognise is of critical importance to the economy and the Western Australia people; To Health and Happiness. The report explores the economic and employment opportunity health care provides WA, including the sector's evolution over time, the current health funding model, trends in spending, and gaps in service delivery where more resources may be required – particularly in aged care. An assessment of the health workforce uncovers what sorts of jobs are being created for health professionals and health care and services workers, and whether the workforce is happy and healthy in their jobs. Given the era of digital transformation, the report also examines if the sector is poised to benefit from new technological advances and the spaces where digital health service delivery and innovation is already apparent in Western Australia.

The research underpinning this report could be quickly and easily replicated for Tasmania.

In addition to the above, consideration should be provided to the role of investing in the **white economy** in Tasmania. The white economy encompasses a new collective for economic growth based on the increasing demand for aged-focused needs; an eco-system of products and services for older people. More specifically, the white economy refers to 'products, services and activities related to healthcare and care including the dependent, disabled and elderly'. These products, services and activities include the meeting the existential needs of older people, needs of older consumers, needs of older employees and the needs of employers and organisations providing and servicing older people's needs.

White economy initiatives include investing in health care and its workforce including doctors, nurses and other health care specialists to adapt to the needs of an ageing population and related conditions, alongside new technologies and types of services which are fundamentally different to what is understood to be mainstream healthcare. The increasing demand for health care services resulting from ageing may include shifting the focus of health care from prevention and curing to one that emphasises management of symptoms and the variability of symptoms, as demands on the health sector increase.

Of critical importance, however, is that the white economy extends beyond just the provision of services, to transport and logistics, research and development, contemporary manufacturing, innovation and technological advancements, including the expansion of initiatives such as telemedicine, remote monitoring and rehabilitation as well as career upskilling.

Increasing the capacity of the health sector over the longer term; investing, identifying, prioritising and streamlining services around the state as well as providing logistics and transport services will provide much needed economic stimulus over the years to come as well as providing for the needs of an older population. So too will incentivising research and development for product and service innovation in the white economy as Tasmania recovers from the unprecedented, global scenario of COVID-19 and provides for the on-going unprecedented, global scenario of population ageing.

Aim to achieve a 'strong middle' educational attainment structure (EAS)
In addition to improving the participation in, and completion of, schooling and further education for individual Tasmanians, much greater consideration needs to be provided to the Educational Attainment Structure (EAS) of Tasmania's workforce and future workforce.

The International Labour Organisation (ILO) provides evidence that it is the type of EAS, rather than levels of educational attainment, that is the most significant determinant of the pattern of industrial development and growth. The type of EAS is explained by the share of the labour force based on educational attainment according to its shape along a bell curve.

The ILO argues that capabilities to innovate and develop new products are influenced by the particular mix of educational, vocational and technical competencies, which increase with the diversity and complexity of the knowledge sets embodied in the labour force.

'Strong middle' EAS are those with relatively higher shares of vocational and technical education and training. This EAS provides the widest range of options for developing and diversifying industry structures associated with a technological revolution.

'Missing-middle' EAS are polarised and present with relatively lower shares of vocational and technical education but higher shares of schooling and tertiary education, that is their workforces are polarised between high and low skill occupations. Missing middle EASs provide limited options for advancing technological revolutions as the labour force lacks the broad supply of complementary occupations required in addition to tertiary qualified managers and professionals.

Tasmania currently has a missing middle EAS and its workforce is skewed to both high and low skill occupations. See attached paper *Economic Restructuring and the polarisation of the workforce: A regional perspective* (Denny AJRS) for an analysis and explanation of Tasmania's polarised workforce.

See also *Heigh-ho, heigh-ho, it's off to work we go – the Fourth Industrial Revolution and thoughts on the future of work in Australia* (Denny AJLE Vol 22) for a further explanation of EAS and an evaluation of where Australia currently sits in progressing through the Fourth Industrial Revolution and where future jobs may be created under the current policy settings. This paper is also applicable to the Tasmanian economy and society.

Thank you for your stewardship through this time. I would be happy to discuss further and am also able to introduce you to the Directors of the BankWestCurtin Economics Centre, Professor Alan Duncan and Associate Professor Rebecca Cassells, if that is of interest to you.

Kind regards, Lisa

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Tasmania: Structural Challenges

Dr Lisa Denny
Institute for the Study of Social Change
University of Tasmania
December 2019

1) Economic structure: based on consumption sectors

Relies on disposable income, increasingly skewed to services sectors, loss of market/traded-sectors

o Threat is population low/no growth, low wage growth, un/under-employment, low labour force participation, low skill/low pay jobs

o Government response – population growth strategy, tourism

o Reality Check: population is growing and ageing – low/no population growth is inevitable

Recommendation: consider policy response to a no/low population growth scenario in which economic and social prosperity is aim

2) Workforce polarisation/Educational Attainment Structure (EAS)

The workforce is increasingly being skewed to high and low skill jobs, directly related to industry structure, and as such is experiencing a hollowing out of the type of jobs available

o Current trajectory is further technological change, decline in manufacturing/medium skill admin/services jobs, inability to innovate and improve productivity, skewed growth in low skill/low pay/precarious occupations such as those in the tourism and care sectors

o Implications: lack of entry level jobs, lack of career progression, increased risk to further migration losses in younger, working age groups

Recommendation: Rethink economic policy to recapture and grow contemporary manufacturing and associated industries/services, education and training policy to improve EAS to 'strong middle'

3) Population ageing and projected population decline

Reality check 1: even with population growth, population is still ageing and is experiencing hyper-ageing. It will continue to age as interstate migration contributes to the rate of ageing, even if migration is sufficient to keep population growing, the number and proportion of the population who are older will continue to grow.

Reality check 2: almost half of the LGAs are already in decline and projected to decline further, only four will be experiencing natural increase in 25 years – any future growth will need to be sourced from migration

Recommendation: In addition to population growth strategy, also develop policy to support an ageing population, regional disparities and capture opportunities related to population ageing such as in employment, new industries and ageing workforces requiring replacement labour

4) The health care and social assistance industry

The largest employing sector and greatest contributor to GSP, projected to grow given our ageing population and relative socio-economic status and disability levels.

Has diverse careers and pathways, more balanced EAS and also greater skill/education match than other industries.

In addition to the education and training sector, has the greatest capacity to improve the health and well-being of Tasmanians which will contribute to improved participation and employment outcomes

Recommendation: Find a way to use the health care and social assistance industry to assist address the above challenges

Strategic policy responses to population decline:

A synthesis of regional approaches and outcomes with policy recommendations for consideration from a Tasmanian context

A report for the Tasmanian Department of State Growth

prepared by the Institute for Social Change, University of Tasmania

Dr Lisa Denny

Ms Nyree Pisanu

May 2020

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Executive Summary

As part of the Population Research Project between the Tasmanian Department of State Growth and the Institute for Social Change at the University of Tasmania, an extensive review of the range of policies in response to population decline and their outcomes was undertaken. The objective of the review is to identify possible policy interventions appropriate for Tasmania, based on its demographic profile, welfare state and economy.

Key Recommendations

As a state, while Tasmania's population has been growing, it is also ageing; it is the oldest of all states and territories in Australia and is ageing at a faster rate than the national average. Within the state, there are already local government areas which have been experiencing population decline or are on the cusp of imminent decline. Over the past three years, Tasmania has slowed its rate of ageing associated with increased migration to the state, either from interstate or overseas, and the age profile of those migrants. This migration has contributed to Tasmania recording its highest population growth rates this Century. However, with migration contributing to over 80 per cent of this population growth, the current situation of the COVID-19 global pandemic, with the state and national borders effectively closed to migration, it is likely that population growth will slow considerably in the short to medium term and that the rate of population ageing will intensify.

Future economic and social policy development for Tasmania will therefore need to be positioned in the context of a population with low or no population growth and ageing rapidly.

This report provides the evidence base to capture opportunities associated with an ageing population, while also providing for the needs of the population; a combined countering and accepting policy approach

Three key policy themes are recommended for consideration, noting that while these themes could be considered in isolation, they are also complementary to each other. Importantly, these themes should also be considered through the lens of peripheralisation, whereby the inter-connected relationship between urban centres (cities or major towns) and their periphery (rural and regional social economy) are focal.

1) Embracing and investing in the White Economy
2) The regeneration and repurposing of the built environment
3) Establishing Special Economic Zones (SEZs)

Under-pinning the development and implementation a policy framework is the need for a clear place-based approach including governance, inter-regional co-operation, leadership and community engagement.

Overview

Population ageing and eventual decline (depopulation) is a reality facing all but a handful of developing countries. More diverse combinations of population change; ageing and migration, occur at the regional and urban level than observed at the state and national level. Moreover, the geographically larger the country, or in Tasmania's case, state, the greater the opportunity for inter-regional migration. As such, the potential for considerable variations in ageing profiles within the state is high. Given this, there are no 'off-the-shelf' or 'one-size-fits-all' policy solutions aimed at economic and social viability in the context of population ageing and decline, which are applicable to all cases; policy responses need to be tailored to the context.

As migration and population growth are increasingly concentrated in cities, depopulation usually occurs in regional communities first. However, the causes of depopulation are complex and vary considerably across regions, explained largely by the interrelationship between the local economy, socio-demographic profile, migration (including the stock, and flow, of human capital) and geography.

Managing population ageing and projected decline is an increasingly common policy challenge for governments, but it is also without precedent. The greatest challenge being the long-term economic viability of an area and the need to provide age-related health and social services care within the underlying fiscal position.

In Tasmania's case, while the state experienced its strongest rate of population growth in a decade, dominated by increased migration, this growth was concentrated in the south of the state, creating its own set of challenges. Despite this growth, Hobart and its surrounds continues to experience population ageing. During this time of strong growth, other regions in the state continued to experience economic and social challenges accompanying peripherialisation[1] including population ageing and decline, creating within state policy challenges associated with uneven economic and demographic change.

While the longer-term impact of the COVID-19 global pandemic is unknown, with the effective closure of Tasmania's, and Australia's, borders, it is unlikely that population growth in Tasmania will continue at the same rate in the foreseeable future. The population may even enter into decline, with the 29 Local Government Areas (LGAs) likely to experience varying degrees of population change.

For the decade until June 2019, twelve LGAs experienced annual population decline; twelve had been experiencing population growth above the state ten-year average of 1.0 per cent per annum. Three of the latter groups were experiencing hyper-ageing, whereby 20 per cent of the population is aged over 65 years, pointing to imminent natural decline. The remaining LGAs were teetering on the cusp of depopulation. Until ABS regional population data is released in 2021, the impact of the COVID-19 pandemic on the LGAs populations will be unknown but will likely be apparent to those in the respective communities.

The distinct and varied nature of population change within Tasmania has different implications at a local level, leaving policy and planning authorities facing diverse challenges. The issue is further complicated by demographic change within an area which is often caused by factors beyond its spatial and administrative boundaries. This means policy responses need to be coordinated and based on shared experiences beyond LGA boundaries.

There are three broad types of policy responses to population ageing and/or decline:

- strategic intervention to mitigate depopulation (known as countering strategies),
- acceptance strategies to manage decline and its consequences or,
- doing nothing (non-intervention).

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[1] Peripheralisation describes the mechanisms that drive periphery and centre relations; reflecting either a strong connection or the logical consequence of centralisation

On their own, countering and accepting strategies have limitations given populations that are experiencing depopulation, or are projected to decline, are likely to also be experiencing population ageing. For countering only strategies, the failure to acknowledge that population ageing occurs concurrently with population growth strategies, fails to address the needs of more older people in a society. For accepting only strategies, responding to the risk of depopulation with a focus on managing decline, contains the risk of becoming a self-fulfilling prophecy.

The positive for Tasmania exists in recognising and acting on the opportunities presented by an ageing society; a new customer profile, from older working-age people, to elderly, to older consumers, all of whose needs are different and require a different public or private response; the silver and/or white economy. Recreation, leisure and health complement each other as the end of the life cycle approaches. This offers potential for both the economy and society in the form of new business opportunities and changing occupations and careers, age-friendly places and urban spaces. These opportunities should be addressed in terms of governance, scale, pace and spatial differentiation.

For the purposes of this report as directed by the Department of State Growth, the synthesis of policy responses will focus on acceptance strategies as well as those countering strategies that incorporate accepting strategies, i.e. a combined approach.

Introduction

This report provides a detailed overview of Tasmania's demographic challenges and regional disparities, explains the causes of population ageing and population decline from an economic, demographic and spatial perspective. It then provides a synthesis of a range of policy initiatives implemented in regions worldwide to respond to the needs of an ageing and/or declining population from an accepting, or combined countering and accepting strategies, perspective. It concludes with a number of case studies.

To do this, an extensive scan of a diverse range of academic research, policy documents and grey literature pertaining to demographic change, population ageing, shrinking cities and regions, regional development, urban planning and migration was undertaken. The purpose was to identify the range of potential policy responses to the challenges of depopulation and, where possible, any outcomes and/or evaluation following policy implementation.

Apparent from this extensive scan, there is little evidence of a holistic approach in response to the challenges of population decline, from either a countering or accepting strategy perspective. Rather, policy initiatives tend to respond to one consequence relating to the challenges of population decline, or an opportunity, as opposed to a collective suite of policy responses by one region. While a few regions do present a suite of policy responses, these tend to focus on achieving population growth through countering strategies only[2].

An additional limitation throughout this extensive scan was that not all literature and policy documents were available in English, constraining the depth of information available regarding policy interventions. Best efforts have been applied to source as much information as reasonably possible.

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[2] See the countering strategy case studies in the Appendix of this report.

Tasmania's population

As at 30 June 2019, Tasmania's population was 534,281 persons and grew at a rate of 1.1% over the previous year, the highest growth rate since 2009.

The composition of Tasmania's population growth has shifted over the past five years to be dominated by migration, rather than natural increase (more births than deaths). Compared with 2014 when natural increase contributed more than half (53.0%) of the state's population growth, in 2019, more than four in five new Tasmanians (80.6%) were migrants (33.6% from net interstate migration and 47.1% from net overseas migration). Compared with 62.5% nationally, net migration provided the greatest contribution to population growth than any other state or territory.

While Tasmania's population has been growing, it is also ageing[3]. For the previous five years, the average annual growth rate of those aged 65 years and older was 3.3% compared with the annual population growth rate for Tasmania of 0.8%.

Tasmania's Vital Index[4], an indicator of demographic development, has been declining for four decades, with the gap widening further between Australia since the early 2000s[5].

One in five Tasmanians are aged 65 or over (20.1%), indicating what demographers refer to as 'hyper-ageing'[6], the point at which longer term population growth is not considered possible, leading to the likelihood of eventual population decline, following the onset of natural decline.

As a consequence of population ageing, Tasmania's population has been projected to enter decline by mid-21st Century in at least one series of the last three Australian Bureau of Statistics (ABS) population projections in 2008, 2013 and 2018 as well as the most recent Tasmanian Department of Treasury and Finance (Treasury) population projections[7].

Despite relatively strong population growth since 2016, the nature of aggregated state-wide data masks the true picture of how the population is changing within the State; the situation differs substantially between the 29 Local Government Areas (LGAs).

Prolonged economic restructuring has manifested in uneven patterns of regional development and thus demographic development – the size and structure of a population – leading to large-scale, differential population change within Tasmania.

Since 2015, and prior to the COVID-19 pandemic, of the 29 LGAs in Tasmania[8]:

- All are experiencing population ageing (except Brighton)

- 20 LGAs have a median age[9] older that the State's median age of 42.3 years.

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[3] Population ageing is defined as an increase in the median age of a population over time and whereby at least 10% of the population is aged over 65. See Demographic Snapshot – January 2020 for more details.

[4] The Vital Index is an indicator of demographic development and the ability of a population to replace itself into the future, in the absence of migration. The Vital Index is measured as the ratio of births to deaths.

[5] See Demographic Snapshot – December 2020 for further details

[6] when 20 per cent or more of the population is aged 65 or older.

[7] See Treasury's population projections

[8] See Institute Insight Six and Institute Insight Nine for more detailed analyses of Tasmania's population and regional disparities

[9] The median age is the age at which half the population is older and half the population is younger

- 12 are experiencing growth, 10 of them driven by migration from interstate or overseas.

- 8 are on the cusp of population decline.

- 6 are in population decline.

- 28 are increasing their median age.

- 16 of Tasmania's LGAs are experiencing hyper-ageing, indicating imminent natural decline.

    o 3 LGAs experiencing migration-led growth are also experiencing hyper-ageing.

- Over the next 25 years to 2042, it is projected that the populations for 14 LGAs will grow, while the remaining 15 LGAs will experience population decline[10].

    o Only four LGAs are projected to experience natural increase by 2042, all others are expected to experience ongoing natural decline.

It is important to note that this data reflects a period prior to the COVID-19 global pandemic and that the projections are based on assumptions informed by historical trends for five years prior to 2017.

It is not possible to predict the impact of COVID-19 on Tasmania's population over the medium to longer term at this stage. In the short term, it is likely that population will experience low or no population growth for the foreseeable future, due to the cessation of migration from interstate or overseas due to the effective closure of both state and national borders (however, less Tasmanians may also leave the state for the same reasons). The population will also age more rapidly than it has done for the past five years and the impact will be exacerbated in the State's regions.

Population decline and its causes

Population decline - depopulation - does not occur in a uniform manner and is the result of the complex interplay of several drivers at local, regional, national and international level. The spatial variation in population change also has profound implications at a regional and local level.

Population decline occurs first at a sub-state level (local government area or regional) before becoming a state issue, and then a national one.

The short-term drivers of demographic change include economic cycles or shocks, policy decisions and changing spatial patterns. Longer-term drivers are demographic trends and increasing globalisation, impacting an economy's industry structure. Over the past five decades, globalisation has been the key driver in the spatial redistribution of capital and people. When short-term drivers occur in parallel with longer terms structural causes of population decline, the ability to recover from population decline is diminished.[i]

Population decline can be further examined through three key lenses: demographic, economic and spatial.

Demographic

From a *demographic perspective*, population ageing, particularly hyper-ageing, is an indicator of the imminent onset of population decline, driven by lower fertility rates, increases in life expectancy and the age profile of inward and outward migrants of a region.

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[10] See Treasury's population projections

Population ageing

Population ageing causes a fundamental shift in the population, resulting in a trend towards an older age structure, as measured by the median age of a population. Population ageing usually precedes population decline, and, as such, it heralds the end of population growth.

Population ageing can be further defined and described as either numerical or structural ageing. Numerical ageing refers to the *absolute increase in the number* of elderly and is primarily caused by improvements in life expectancy. Additionally, the large number of baby boomers creating a bulge in the population age structure is contributing to numerical ageing (baby boomers, those born in the years post the Second World War, are now aged between 55 and 75 years). Structural ageing refers to the increase in the *proportion* of the population that is older and is primarily caused by declining fertility rates at a national level. However, in Tasmania's case, it is the age profile of interstate migration movements which decreases the size and proportion of the population that is young (and of reproductive age) which is the greatest contributor to structural ageing[ii]. Numerical ageing drives up the numbers of elderly and thus increases the demand for, and cost of, retirement income support, health, and aged care services, while structural ageing constrains governments in their ability to raise tax revenue to fund pension schemes and aged related services.

Both numerical and structural ageing are evident in Tasmania and its LGAs.

This has been predominantly caused by age selective migration, that is, the loss of younger people and gain of older people to an area, rather than declining fertility rates or increasing life expectancy[iii].

Economic

From an *economic perspective*, economic restructuring and changing labour market opportunities contribute to migration; the movement of people in and out of a region, the process of ageing and then eventual population decline.

Long-term economic drivers of population change include the effects of globalisation and economic restructuring, where political processes have changed the distribution of people and capital across the world. Specifically, population change has occurred where the economies of regions shift from industrial to post-industrial. Globalisation processes have driven concentrations of financial and human capital in globally competitive metropolitan and urban centres, while other smaller cities, towns and regions on the peripheral have suffered decline. In response to post-industrialisation, policies were implemented to deregulate the economy, reduce tariffs, and privatise government services which had the effect of slowing primary production and manufacturing, facilitating outward migration in response to an increasing lack of employment opportunities. While Australia as a whole became more competitive and urban centres were growing, the benefits of deregulation were experienced unevenly across regions. Conversely, the financialisation of the economy influenced growth in metropolitan and major urban areas and a services, information and knowledge based economy emerged, accompanied by wealth generation, gentrification and urban renewal and growth in consumption based industry sectors such as construction and retail.

Consequently, Australia's economy has been described as a patchwork economy, with much variation in economic performance between regions and cities.

The population impact on regions experiencing economic restructuring is caused by migration movements associated with a lack of economic, education and/or employment opportunities, changing spatial trends (i.e. urbanisation or suburbanisation), and/or lifestyle choices (i.e. retirement or seachange/treechange migration). Migration occurs at three levels; international, inter-regional, and intra-regional, however the consequences are usually most apparent at a sub-national or regional level.

Regional and rural areas often experience an out-migration of young people due to a lack of education and employment opportunities. A net loss of young migrants changes the age structure of a population and impacts on future reproduction. In some areas, natural decline is not only occurring simultaneously with net migration losses but is being driven by it. Conversely, some regions, particularly coastal areas in regional areas, may experience retirement in-migration which further contributes to the ageing effect. In urban areas, in-migration of overseas migrants has contributed to population growth, however in the long-term this will contribute to the ageing effect as immigrants grow older.

The key consequences of globalisation processes and economic restructuring is out-migration and the changing age-structure of the region, which drives the loss of human capital, under-utilisation of the available labour force, lower than average share of highly skilled labour force, competition over workers and skill shortages. This also means decreasing opportunity for businesses to invest in regional areas, which may result in stagnating economic growth and a lack of labour market mobility. Alongside this, ageing and declining populations place pressure on local governments with a declining tax base, a high age dependency ratio and increasing demand for high cost services. As such, economic restructuring leads to a self-perpetuating situation of population change, ageing and decline for many regions.

Spatial

While both demographic and economic factors influence population change, a *spatial perspective* considers how this change occurs unevenly between and within regions. The consequences of population change are not uniform as some areas experience growth, while other nearby areas experience decline.

Spatial differences in population change is explained by concepts such as shrinkage, urbanisation, suburbanisation, and peripheralisation.

Shrinkage

Shrinkage is a spatial consequence of depopulation, evident by the physical decline or degradation of built environments, in addition to statistical demographic evidence. Shrinkage is characterised by 'an interplay of different macro-processes at the local scale' which are often interdependent and self-reinforcing[iv]. The trajectory of shrinkage in both cities and regions is not linear, and this contributes to how decline occurs unevenly, in fact, 'there can be growing cities in shrinking regions, shrinking cities in growing regions and shrinking places right next to growing places'[v].

While shrinkage is a consequence of economic and demographic change, there are also specific outcomes which directly relate to spatial change, for example a mismatch between supply and demand in the housing market, empty lots and vacant housing, and underutilised infrastructure (sewerage, water supply, electricity, heating etc) which can lead to an increase in cost for public

services. There are also several perceived positives of shrinkage, including a relaxed housing market, more space available, less traffic, less pollution, less growth pressure, the ability to catch up with demands for new infrastructure and counter-development.

Localised shrinkage scenarios point to the need for place-based strategies and responses, as there is considerable variation depending on where decline occurs and also what economic and demographic factors are driving the change[vi].

Urbanisation, suburbanisation and counter-urbanisation

Three key mechanisms of population change from a spatial perspective are urbanisation, suburbanisation and counter-urbanisation, which describe population shifts to and from urban areas.

Urbanisation describes the movement of people into cities from rural areas or other smaller cities or towns. Reasons for urbanisation are mostly related to economic drivers, for example migration into cities for employment or to pursue education, alongside migration for lifestyle, cultural or social reasons.

Suburbanisation is the redistribution of people into areas within commuting distances of urban centres. Often, people will continue to work in urban areas and travel between their homes and employment. Counter-urbanisation is the migration of people away from urban centres to rural areas and small towns. However, it differs to suburbanisation as it leads to growth that is detached from urban cores. Counter-urbanisation can transform rural areas as population growth leads to the development of new housing estates, services and infrastructure.

Drivers of both suburbanisation and counter-urbanisation include changes in preferences (more attractive living environments, spacious houses in quiet settings, family formation etc.), transport and technological improvements, competitive housing prices, and changes in the economy and redistribution of employment. Dissatisfaction with urban areas for reasons such as pollution, traffic congestion, and poor-quality houses/ buildings are also significant push factors.

From a regional perspective, urbanisation, suburbanisation and counter-urbanisation all contribute to spatially uneven population trends as cities, suburbs or towns either grow or decline, often at the expense of other places in the region. As such, any future population growth potential is shaped by the changing age structure resulting from these migratory movements.

Peripheralisation

Peripheralisation describes the mechanisms that drive periphery and centre relations; reflecting either a strong connection[vii] or 'the logical consequence of centralisation'[viii]. While some cities and metropolitan areas which undergo economic restructuring also attract population growth, their periphery regions often experience decline and thus become both 'disconnected from, and dependent on' nearby urban centres[ix]. Whereas, for other multi-functional regions a strong periphery supports a strong urban or service centre[11]. The relationship between the centre and the periphery is often characterised by uneven economic, political, geographical, social and demographic development.

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[11] As is the case for Shepparton in Victoria, Australia – see Institute for Social Change case study

In the past, peripherals have been defined by their physical distance from urban centres. Peripheralisation, on the other hand, is a process-oriented concept which focus on the economic, social, demographic and political processes that either drive centre-periphery inequalities or multifunctionality, rather than the rigidities of distance[x]. Peripheralisation is therefore useful for exploring regional population change as it helps to unpack the interactions between these multi-dimensional processes and relationships.

As peripherals are not dictated by geographical boundaries, from a peripheralisation perspective, peripheries are socially and economically produced. How a particular region is portrayed and/or perceived influences for the decision-making process of individuals, households and organisations to leave the region or stay, whether to (dis-)invest and also whether to establish, maintain or abandon services. Often, perceptions of peripherals are embedded in discourses of deficit and negativity which can contribute to further population decline.

As peripheralisation can affect whole regions, specific areas or even individual people, it is considered a multi-level phenomenon that has the potential to link processes and developments at the macro level to their consequences at the micro level. A multi-level approach allows for an understanding of interactions between multiple domains. Thus, strategies and responses to population decline associated with peripheralisation can incorporate different perspectives at these levels.

Peripheralisation is underpinned by interactions between multi-dimensional drivers from economic, social, spatial, demographic and political domains which interdependently influence population change. Examples of economic drivers include centralisation processes such as economic productivity in urban centres disadvantaging other areas of the region, economic restructuring and lack of integration of peripheral areas in business networks and the global markets. From a social perspective, population change can bedriven by negative perceptions about the region which may influence decisions to migrate, invest or maintain services. Spatial drivers include geographical isolation and remoteness, poor transport links, and poor infrastructure. Political factors which influence population decline in peripheral regions include a dependency on the centre due to a lack of decision-making powers.

A combination of these drivers may result in the following outcomes: a restricted region with structural deficits (economic, demographic, social, cultural and political), a lack of opportunity for residents, selective out-migration (youth, females of reproductive age, brain drain), a disconnection from infrastructure, a lack of economic and social innovation including regional innovative capacities, little provision of higher education, a low skilled labour force, a reliance on funding from government, low fiscal revenue and high welfare dependence.

Types of depopulation

There are two types of depopulation. The old type is largely linked to short-term economic drivers, resulting from natural increase not being sufficient to offset a decline from net migration losses. This type of depopulation can be reversible, provided the demographic profile of the area is favourable. The new type of depopulation is underpinned by long-term demographic drivers resulting in natural decline. It can be demographic only (when natural decline is greater than migration gain) or absolute (when there is a combination of natural decline and net migration loss). It is unlikely that an area would be able to recover from this new type of depopulation.[xi]

The proposed tipping point for sustained population decline is when an area reaches the onset of natural decline. From this point, the area is unlikely to ever achieve long-term population growth[xii]. This is likely to occur once an area begins to experience 'hyper-ageing' – when more than 20 per cent of the population is 65 or older.[xiii] It is self-perpetuating, as natural decline tends to occur due to age-selective migration rather than low fertility rates. This situation, known as migration-accelerated ageing or migrant-driven natural decrease[xiv], has been occurring in almost all of Tasmania's non-urban LGAs.

This new type of population decline is already a reality for several LGAs in Tasmania and is an imminent likelihood for many others within the next decade which will also possibly be expediated by the impact of the COVID-19 global pandemic.

Types of policy approaches to population ageing and/or decline

Although population ageing and decline trajectories are difficult to reverse once hyper-ageing is evident, management of the consequences and opportunities associated with the demographic transition is possible. Smart policy intervention needs to respond to the unique interplay of the myriad of political, economic and social factors at different spatial scales. Addressing population change requires policy that runs both horizontally and vertically across different policy sectors and levels of government, alongside addressing both short and longer-term challenges[xv].

There are three broad types of policy responses to population ageing and/or decline:

- strategic intervention to mitigate depopulation (known as countering strategies),

- acceptance strategies to manage decline and its consequences or,

- doing nothing (non-intervention).[12]

On their own, countering and accepting strategies have limitations given populations that are experiencing depopulation, or are projected to decline, are likely to also be experiencing population ageing. For countering only strategies, the failure to acknowledge that population ageing occurs concurrently with population growth strategies, also fails to address the needs of more older people in a society. For accepting only strategies, responding to the risk of depopulation with a focus on managing decline, contains the risk of becoming a self-fulfilling prophecy.

Countering strategies

Countering strategies tend to focus on stimulating both economic and population growth, largely through proactive measures to attract or retain people and investment. They aim to increase spending in the area (e.g. tourism and international students) on the basis that this will lead to job creation and as an incentive to live in the area.

Countering strategies can be viewed from within the three different lenses of population decline. From a demographic perspective, policies designed to stimulate demographic growth may include in-migration policies, integration policies to retain immigrants, strategies to target skill shortages, increased accessibility of child-care, kindergartens and schools to attract young families, and place-

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[12] For a full explanation and assessment of types of policy responses to depopulation, see commissioned report by Rachel McMillan "Strategic Interventions to Population Decline" for the Local Government Shared Services, University of Waikato, Hamilton, New Zealand.

promotion strategies. From an economic perspective, strategies designed to increase economic growth and labour market opportunities may include investment into new businesses and industries, diversification of local economy, innovation (knowledge/technology) and entrepreneurship, and incentives for business to relocate to regions. From an urban planning perspective, strategies include those that support the development of the built environment e.g. building attractive houses, public spaces and facilities, and transport infrastructure for increased accessibility to attract people and economic growth.

Countering strategies have been found to slow population decline, but not reverse it, given underlying population age structures. The success of any intervention depends on the location and the economic and demographic profile of the area. However, employment alone is not enough to offset migration out of an area; the provision of social services and improved amenity has also been identified as having a greater impact than investment in infrastructure.

Examples of countering strategies at a regional scale are available in case studies in the Appendix of this report.

1) Poland – Katowice
2) New Zealand – Southland
3) Canada – Newfoundland and Labrador

Accepting strategies

Accepting strategies focus on maintaining the quality of life for the existing population by continuing, or strategically downsizing, services and infrastructure to meet the needs of a changing population. While demographic policies aim to maintain or increase the quality of lives of current residents and/or older people by investing in health and aged care or active ageing, economic policies tend to take a political or governance standpoint. These policies aim to restructure service provision to increase efficiency, such as closing or merging facilities, inter-municipal co-operation, changing governance procedures or collaborating with the private sector. Policy interventions include investment in social services and networks and changing governance structures to enable consolidation, economies of scale and greater flexibility of assets and services. However, these types of depopulation strategies have also been shown to become a self-fulfilling prophecy.

Non-intervention

The third type of policy response, non-intervention, may be the result of denial or ignorance, or it can involve an active decision to allow the free market to determine whether an area survives or not.

Whichever path is chosen, an ageing population and eventual depopulation is the most likely trajectory that will affect sub-state areas first. How an area responds to the challenges associated with population ageing will depend on local context, governance and the community and political will to respond.

Combined approach

A combined approach to population ageing and decline utilises policy initiatives that aim to encourage growth, both economic and demographic (countering strategies), but also respond to the needs of a changing, and likely, ageing, population (accepting strategies).

The key objective of a combined approach is to collectively grow the economy, slow the rate of population ageing (or decline) and meet the needs of an older population by identifying areas of economic opportunity associated with an older population.

More specifically, in a combined approach, new drivers of economic growth are identified and prioritised in terms of the demographic, economic and spatial profile of the region. Economic opportunities associated with an older population are often referred to as the silver and/or white economy. This involves reassessing, and resetting, the economic base of the region which may differ considerably from the traditional industry sectors of the region, reforming labour markets as well as maintaining the standard of living for the population on an age-related needs basis, including access to infrastructure, services and amenities.

Strategic policy responses: accepting and combined initiatives

This section provides examples of strategic initiatives according to type of policy response.

Accepting only strategies

Policy interventions accepting the process of ageing and the changing needs of a population either in decline, or projected to decline, aim to deliver appropriate services, amenities and infrastructure to meet the needs of the population as it changes. Interventions focus on maintaining the quality of life in the community, including older people, families and young people by providing access age-appropriate infrastructure, services and amenities, and encouraging social cohesion. To do this, restructuring of governance arrangements may also be required.

Populations that are declining or projected to decline are most likely also ageing. An ageing population will typically have different needs compared with a younger age structure, for example older people need increased access to aged and health care, transport, flexible employment opportunities and different types of community organisations i.e. senior clubs.

Positive ageing

Positive approaches to ageing include policies which support initiatives such as 'active ageing' and 'age-friendly cities'.

Active ageing policies are strategies that provide older people with the opportunity to engage with their community and access age-friendly facilities and services[xvi]. The primary aim of active ageing is to support people to age successfully and prevent social exclusion. Examples include providing subsides and discounts for facilities (such as gyms and swimming pools), access to community facilities (e.g. libraries), holding senior events, supporting seniors clubs and providing local transport options. However, regions which are spatially isolated and characterised by lower socio-economic status (SES), are less likely to implement active ageing policies due to lack of resources.

Fostering age-friendly cities also involves urban planning for ageing; ensuring that the urban environment is suitable for a growing older population in terms of community construction, public (and private) transport and living facilities.

Service provision restructuring

As populations change and age, demand for public services also change. Older populations require increased accessibility to services such as health and aged care, while other services such as primary

schools are in less demand. At the same time, revenue for public service providers is diminishing so efficiency of service provision is required while maintaining an appropriate level of service.

Responses to ensuring provision of services in an efficient manner include the clustering of services in multiple facility buildings, coordinating with other municipalities or nearby regions to deliver high quality services, relocating funding (e.g. from declining school to aged care),

A key aspect of service provision restructuring is place-based policy driven by flexible and agile governance structures. Consequently, local governments should be able to respond to challenges in contemporary or novel ways.

Table 1 - Examples of positive ageing

Region/Policy	Objective/Issue	Approach/Policy	Outcome	Comment/Evaluation
Beijing, China[xvii]	To provide services to assist older people to improve/maintain their quality of life.	The Measures of Preferential Treatment for the Beijing Aged People is a policy which provides free transport, entertainment and cultural activities, medical and healthcare to improve the quality of life for elderly people	1.7 million aged people above 65 were granted preferential cards	While the program would likely improve the quality of life for over 65s, it is likely to be expensive. Funding: local government
United States, Australia and Europe (~200 villages) Village model[xviii]	To provide the means and support for older people to stay in their homes.	An ageing-in-place model that offers services to assist older people to remain in their homes to retain independence alongside fostering social networks. The village model program provides a range of services, including transport, housekeeping, social support, referrals for other health and social services.	A survey of Village members in California (n=282) found that the model was successful for fostering social engagement (79% knew more people, 59% felt more socially connected) and 89% had used at least one village service in the previous year (social or educational events were the most used, followed by information and assistance, and driving and transportation services).	Good initiative to foster social cohesion amongst older people. Leadership and community engagement: grassroots groups Funding: annual memberships
Naturally Occurring Retirement Communities, (NORC)[xix]	The provision of ageing-in-place services for older people.	NORC provides health and social services to low income elderly	A survey of NORC employees (n=62) found that access to services was	As a significant proportion of participants needed help with personal care, the

		communities. Formed organically in senior-majority communities and provides services and activities for older people. Typically for low-income residents in apartment blocks, but also across low-rise housing. Organised by seniors alongside health care providers, home repairs and other services. Funding from government, community partners and charity donations	the most important goal, followed by strengthening social relationships. 25% of program participants needed help with personal care.	program has a significant relevance to vulnerable elderly adults. Leadership and funding: government grants, housing providers and charity organisations (public-private partnership).
Local Government Areas, NSW[xx]	To determine strategies that exist to assist older residents to age actively and participate in their community, and the differences between LGAs.	Developed strategies to encourage active ageing include subsides for council accommodation, hall hire, entry into facilities (gyms and pools), access to community facilities such as libraries, community centres and sport and recreational facilities, access to community transport for shopping and attending health care appointments etc.	Socio-economic status has a significant influence on the ability of LGAs to provide active ageing resources and infrastructure. Older, more rural LGAs with lower SES status will have more difficultly providing resources. For example, less community transport services exist outside of metropolitan areas, even though there is less public transport and larger distances in these areas.	Inequity of access is a significant problem for providing resources to older people to age actively and successfully. Thus, there needs to be an integrated response involving federal, state and local governments to provide necessary resources. Leadership and funding: local governments.
Opole, Poland[xxi]	To increase access to aged care services, promote	'Golden Autumn" strategies included senior events,	Local governments were surveyed to determine how	Findings show that active ageing strategies and digital

	active ageing and develop digital literacy for older people.	activities, training sessions, educational projects, job seeking techniques, and digital literacy.	Golden Autumn was implemented across municipalities (n=40). Holding events for seniors, activities that encouraged hobbies and training for computer use were the most popular strategies for active ageing and digital literacy. Others included senior clubs, courses and training for seniors and senior educational projects. Training for job seeking techniques and formal education qualifications were offered by only a few of the municipalities. Providing new aged care services or improving the quality of existing ones was also less likely to be implemented.	literacy were priorities, however less policies to provide services existed (most likely due to costs involved). Funding: regional government.
Brussels, Belgium[xxii]	To develop evidence-based policies to support age friendly cities.	The Belgian Ageing Studies project aimed to identify several domains of city life important for positive ageing (community safety, housing, mobility, social life, socio-economic	A seniors service for older city residents was one initiative which included social meeting places for older people, portal for volunteers with various activities, sports card with access to facilities and	Community engagement: older people held a key role in setting the agenda and making decisions for age friendly cities. Leadership: local government and other

		development, information, and health).	leisure activities. In 2017, 11,287 participated in the programs (68% women).	stakeholders (the Senior Advisory Council, local social services). Funding: local government.

Table 2 - Examples of service provision restructuring

Region/Policy	Objective	Approach	Outcome	Comment/Evaluation
Ostrava, Czech Republic[xxiii]	To address the oversupply of social infrastructure in a shrinking city and fiscal implications.	The project involved re-purposing closed kindergartens and primary schools for more appropriate use (e.g. tertiary education or aged care).	The allocation of vacant buildings to new university faculties, i.e. Faculty of Civil Engineering in Poruba. The number of university students in the city have tripled between 1990-2010. Aged care facilities and more diverse housing options for elderly people were constructed in response to increased demand for appropriate housing for seniors.	Secondary schools are also decreasing and may need to be downsized or re-allocated/purposed. Leadership and funding: State and local governments in collaboration with EU structural funds.
Südburgenland, Austria[xxiv]	Some public services were no longer cost effective as the number of inhabitants and GDP per capita were both decreasing in the shrinking region.	To adapt the provision of services to those needed in shrinking areas, including potential cessation of services.	Most kindergarten facilities and public transport lines closed (except for school bus routes). Local retail stores co-funded by municipalities and thus have lower rents, allowing them to remain open.	With the closure of public transport lines – this could create issues in equity, particularly for older, disabled or disadvantaged people. Leadership and funding: regional and local governments.

				Public-private partnership: between retail stores and local governments.
Northeast Scotland, UK[xxv]	As the region experienced population decline, the quality of services (such as schools) were also declining and infrastructure was becoming degraded.	The Reorganize, Renovate and Rebuild policy was implemented which aimed to retain and maintain a high quality of services for the existing population through a private/public partnership.	Multiple schools experiencing declining enrolments were merged into new schools with modern facilities to maintain quality of education services. Public buildings were repurposed to provide multiple services such as library, police station or social work services.	The 3Rs project was expected to cost £120 million, however £412 million in loans was still owed from the council to the private company 6 years after completion. This was partially due to the GFC and issues with the bank. However, it is argued that costs to maintain numerous older and degraded schools would have been much higher. Leadership and funding: private company and local government (public-private partnership)
Östergötland County, Sweden[xxvi]	To ensure quality of public services remains high despite shrinkage	Inter-municipal cooperation (IMC) agreements were implemented. These were formal agreements between municipalities aimed at avoiding the reduction in quality of services and adapting to a shrinking population.	Outcomes included lowered maintenance of streets, parks and facilities, and the reallocation of funding from declining schools to aged care as well as merging of schools.	In countries like Sweden (high tax, publicly funded services), delivering high quality services is a priority Leadership and funding: regional government. Governance: inter-municipal cooperation.

Combined Accepting and Countering Strategies

The key objectives of a combined approach are to collectively grow the economy, slow the rate of population ageing (or decline), meet the needs of an older population by identifying areas of economic opportunity, and to provide high quality services and infrastructure to the broader population.

Two policy frameworks which support a combined accepting and countering strategy approach to ageing populations are the silver economy and the white economy. Collectively, these can be broadly explained as the eco-system of products and services for older people and includes:

- existential needs of older people
- needs of older consumers
- needs of older employees
- needs of employers/organisations providing and servicing older people's needs

The Silver Economy

The development of a silver economy is an opportunity for increasing regional economic activity by an older population. Silver economy initiatives have two key aims, first, to foster economic growth by tapping into opportunities presented by an older population and second, to provide goods and services to address the growing needs of older consumers[xxvii].

Investment in the silver economy can assist in combating negative rhetoric and assumptions of economic downturn as a consequence of ageing. Previously, the silver economy has been perceived as a low profit and high-risk industry, with its value largely overlooked. Older people have generally been viewed as unproductive consumers of resources[xxviii], however the industry is now increasingly acknowledged for its market potential. The silver economy encourages older people to live a more meaningful and quality life in their later life stages, driven by consumption of leisure activities, participation in society and the economy, as well as the provision of products and services for an older population. The silver economy is based on providing goods and services for an older consumer and can range from recreation and leisure, entertainment and tourism, health-care products (crutches, glasses, hearing aids, adult diapers),[xxix] mobility scooters, transport, and accommodation and assisted living.

Employment initiatives for older people that are designed to increase participation in, and stimulate, the economy are also considered part of the silver economy, including education, training and skill development. Policies may include creating incentives for businesses to employ older people or encouraging workplaces to implement age management policies[xxx] such as flexible working hours, opportunities for older workers to update their skills and better health and safety.

Universities of the Third Age (U3As) is an international program that promotes lifelong learning for retired seniors[xxxi]. While there is an International Association of UTAs, there are many different approaches to the program. Since 1998, an online network called U3A Online has been established which has acted as an informal network between countries and regions. Some programs also have established links to traditional universities which often have access to university courses and offer open lectures and study groups.

Economic growth within the silver economy is contingent upon three factors: an increase in the proportion of elderly consumers, their relative wealth and related spending habits, and policy decisions which initiate and support growth within the silver economy.

However, the perception also that some goods and services are geared towards wealthy older people, may influence government decisions to facilitate and/or promote investment (or not) in this sector.[xxxii]

Table 3 - Examples of Silver Economy strategies

Region/Policy	Objective	Approach	Outcome	Comment/Evaluation
Europe[xxxiii]	To develop competitive tourism products and services for elderly people.	Developed a five-unit training program for tourism providers (e.g. travel agencies and tourist information offices).	The program provides a foundation for understanding the needs of silver tourists and how to design and market appropriate products and services.	Funding: European Commission
Canada[xxxiv]	To address high unemployment rates in older people and the need for older workers to remain in the workforce for longer.	A national policy, Targeted Initiative for Older Workers, designed to support older (55-64 years), unemployed workers to find employment, with a focus on regional communities. Programs include employment assistance training, skills training, peer mentoring and wage subsidies for employers.	An evaluation was conducted and 53% of respondents found employment during or immediately following the program. 75% of respondents found employment within two years following their participation in the program.	Upskilling and skills training are crucial to support an older workforce, alongside providing wage subsidies as an incentive for employers. Funding: national government.
Mid-East Region, Ireland[xxxv]	To support older people into entrepreneurship to keep them economically active and increase productivity and employment.	The Senior Enterprise Initiative provides training, workshops and networking opportunities to over 50s to assist with starting their own businesses or investing in existing businesses.	Between 2010-2012, over 600 people aged over 50 years participated in workshops and courses.	As entrepreneurship involves risks and uncertainties, greater awareness and engagement can provide incentives for business ambitions. Leadership: European Commission

				Funding: European Commission, regional government, private companies and charity organisation (public-private partnership).
United Kingdom[xxxvi]	To provide older, unemployed people with access to finance and services to become self-employed.	The Prince's Initiative for Mature Enterprise (PRIME) offers start-up finance and services for unemployed over 50s. Services include workshops, training, networking events, business advice and mentoring.	From a 2010 survey, 45% of respondents had started a business using PRIME resources. It is estimated that in 2010-2011 FY, 2250 PRIME participants started a business. In 2012, a forecast Gross Value Added of £43.4 million, saving a minimum of £3.7 million in Job Seekers Allowance.	Older people who are unemployed are less likely to start their own businesses and therefore require extra support.

PRIME also has a regional focus, with projects occurring in places which have experienced deindustrialisation and structural employment.

Leadership: charity organisation established by the Prince of Wales.

Funding: charity organisations and corporate donors. |
| **Germany**[xxxvii] | To increase employment of over 50s and find regional solutions to unemployment or gaps in labour market. | The Perspective 50plus: Employment Pacts for Older Workers in the Regions (50-64 years). supports employers of older workers with an integration subsidy | In 2011, more than 200,000 people participated in the program and over 70,000 entered employment following the program. | Incentives for employers to boost the employment of older people.

Leadership and funding: national government. |

		of 50% of wages with an agreement to employ workers for a mandatory period.		
United Kingdom[xxxviii]	The need for a policy to encourage the employment of older workers and improve their working conditions.	A large-scale supplier in the UK has implemented an Age Management Policy. An ageing awareness program has provided all employees with training and information about the ageing population and implications.	The company offers flexible or reduced working hours, pre-retirement leave, and carers leave for older people. Mentoring programs for older people to play a role in developing the skills of the younger workforce. Apprenticeship schemes and graduate programmes have no age limit.	Policies should be in place to encourage the employment of older people, with flexible working conditions. Education/awareness is also very important so that older employees are accepted in the workplace. Leadership and funding: private company
Nowy Sacz, Poland[xxxix]	To provide retirees with the opportunity to reskill and then volunteer.	The University of Third Age Initiative enabled retirees to undertake free diplomas to become medical assistants. Both theoretical and practical skills training in rehabilitation hospitals and social welfare houses.	After obtaining their medical assistant diplomas, three graduates became volunteers in a local hospice.	Retirees can contribute to productivity if provided with opportunities. Funding: Banking Education Association
Australia[xl] **UK**	To provide retirees with lifelong educational opportunities and/or to maintain mental stimulation in the third age.	In Australia and New Zealand, U3As started a grassroots movement in the 1980s but has progressively become more formal with time, and in 2008 won a $15 million grant from the Australian Government to provide Broadband for	In Australia: 250 U3As with approximately 85,000 students enrolled. In UK: 1000 U3As with 350,000 people enrolled, running 36,000 courses.	U3As are usually run by volunteers, and participants are mostly awarded certificates instead of formal qualifications. Some U3As collaborate with other educational providers to provide formal education.

		Seniors throughout the country. In Britain, UTAs follow a more flexible and independent model which has lower membership fees, flexible timetables and courses and limited academic requirements or constraints.		Leadership and funding: mostly run by volunteers supplemented by membership fees and donations (community engagement).
Sweden/Austria[xli]	Employment agencies specifically for older people.	The Seniorjobbarna initiative provides work in areas such as crafts, cleaning and gardening. The Austrian Senior Expert Pool provides consultancy services in highly specialised technical areas.		Targeted employment agencies can provide elderly people with the support and resources to find employment.

The White Economy

The white economy refers to 'products, services and activities related to healthcare and care including the dependent, disabled and elderly'[xlii]. White economy initiatives include investing in health care and its workforce including doctors, nurses and other health care specialists to adapt to the needs of an ageing population and related conditions, alongside new technologies and types of services which is fundamentally different to what is understood to be mainstream healthcare. The increasing demand for health care services resulting from ageing may include shifting the focus of health care from prevention and curing to one that emphasises management of symptoms and the variability of symptoms, as demands on the health sector increase.

The white economy extends beyond just the provision of health-related services, to transport and logistics, new product development and manufacturing, research and development and the expansion of such initiatives such as telemedicine, remote monitoring and rehabilitation as well as career upskilling.

Essential to the white economy are the innovative technologies that have emerged as creative solutions to address the needs of the elderly, including robotics[xliii], driverless cars[xliv], and ICT/smart living solutions.[xlv] More recently in response to the COVID-19 global pandemic, contemporary manufacturers have responded with the production of medical equipment such as ventilators, Personal Protective Equipment (PPE) and other innovative products.

See the Appendix for a Case Study on the North Denmark region which successfully imple telehealth initiatives.

Table 4 - Examples of White Economy policy initiatives

Region/Policy	Objective/Issue	Approach/Policy	Outcome	Comment/Evaluation
Saxony, Germany[xlvi]	To ensure that appropriate medical services are accessible to residents to provide medical services in a declining region.	The AGnES: mobile nursing program supports nurses to travel to the homes of older residents who cannot travel themselves and provides them with health and aged care services, such as medication management, blood samples, wound care and observation of symptoms, alongside liaising with doctors. Nurses are required to obtain an extra qualification to be employed under the program.	Has alleviated pressure on doctors and reduced waiting times in local GP clinics.	Program also had social implications as many elderly people suffer from loneliness and enjoyed the extra support. Leadership: The University of Greifswald initiated and supervised the project. Funding: the state government.
Aberdeen City, Northeast Scotland[xlvii]	To reform aged health and social care services and focus on delivering high quality services and promoting independence and wellbeing for ageing populations	Policy measures have included anticipatory care planning, centralised referral processes, development of preventative services, carers assessments for unpaid carers and addressing delayed discharges from hospital. Anticipatory care planning involves GPs working with elderly people to pre-plan for health and palliative care.	Decreased strain on health system as less elderly people are admitted to emergency.	Although progress was made with anticipatory care planning, care at home provision is a significant challenge and there is not sufficient staff to meet these growing demands. Funding: £11.8 million in funding from the national government to the city council.

North Denmark[xlviii] ***See case study in Appendix**	To ensure access to health services from remote locations.	The introduction of telehealth services to provide high quality, patient-centred healthcare in an ageing population using technological solutions. An example includes home monitoring to allow patients to self-measure indicators, such as blood pressure or pulse rate, while healthcare professionals monitor the data externally.	Home monitoring was used for 1,400 patients with a chronic disease. Patients reported improved quality of life and number and length of hospitalisations decreased.	Telehealth is a solution to improve efficiency in health care and provide good quality services, particularly in spatially isolated areas. Leadership: strong collaboration between national, regional and local governments with health care providers. Governance: cooperation between different levels of government.
Beijing, China[xlix]	To ensure that older populations have access to age-appropriate services in their homes.	A home-based care initiative provides elderly people with home-based care. Home-based care services include daily care, housekeeping, recovery care, mental health support and education.	Since 2010, all aged people above 80 years are provided with a monthly coupon to exchange for six types of services.	This service supports an ageing-in-place model. Leadership and funding: local government
China[l]	To address the growing demand for aged care.	National five-year plan to provide more aged care services and improve living environments in nursing homes.	80% of towns and villages and 50% of urban communities launched more aged care facilities over the 5 years, with a significant increase in number of beds (62% increase). In China, there is a total of 38,060 nursing homes providing a	Despite efforts, China continues to experience rapid ageing with large gaps between rural and urban areas. Leadership and funding: national government.

		total of 2.662 million beds for 2.109 million elderly people.	
Western Australia[li]	Increase the capacity and services of the aged care workforce in regional locations.	The Social Assistance and Allied Health Workforce Strategy outlines the need for funding for aged care workers (Certificate IV in Ageing and Certificate III in Individual Support), training programs for school-aged students and incentives for employers to upskill their workers Up to $300,000 is available for employers to upskill workers in the aged care sector.	Between July- November 2019, funding for more than 3,500 aged care training places was provided.	A good example of policy that anticipates an increasing need for aged care workers. As strategy was only released in 2018 outcomes are yet to be determined. Leadership and funding: state government
Australia[lii]	A need for more allied health workers in rural areas.	The Allied Health Rural Generalist Workforce and Education Scheme was designed to incentivise allied health professionals to take up employment in regional areas. Extensive training for rural practice was also provided.	An evaluation of a trial in QLD found that investing in high quality training and support for health workers was highly beneficial for recruitment and retention. This also increased service capacity and improved service quality in rural areas of QLD.	To incentivise health workers to take up employment in rural areas, high quality training programs are essential. Leadership and funding: $3.2 million from national government
Europe[liii]	To provide assistance for the elderly.	Under the CompanionAble project a robot was developed which provides	An evaluation of the robot found the robot to be useful for elderly with mild	Innovative technologies such as robots have the potential to generate

		assistive technologies for elderly people with mild cognitive impairment, including facilitating contact with family members, detecting accidents and falls, social assistance and greetings, cognitive stimulation and reminders for medication or events.	cognitive impairment or early dementia with high reliability, and low maintenance costs.	significant economic outcomes when designed properly. Funding: 7.8 million euros from the EU for the trial project.

Revitalisation and repurposing of the built environment

As regional populations age and/or decline, their town centres and public spaces also deteriorate, creating a fragmented and under-utilised spatial structure. This can result in a disconnect between the changing needs of the community and the provision of public infrastructure, services and amenities.

The visible degradation (including vacant premises) of the built environment, for example houses, buildings and other public infrastructure can impact the perception of the place and detract people from living there. Policy initiatives that target the revitalisation of a town centre and its periphery in response to shrinkage have two main aims; to improve standards of living through urban renewal while maintaining cultural heritage and to improve social cohesion. This requires a shift from supply planning to demand planning. Regeneration encourages a focus on the existing built environment and includes the demolition or restoration of vacant, old or non-energy efficient buildings as well as historical landmarks; the revitalisation, repurposing and 'right-sizing' of public infrastructure and streetscapes; the development of brownfield and greenfield sites within urban zones; and, restrictions to curb suburbanisation and urban sprawl as well as appropriate scaling to ensure both improved service provision and liveability in the region.

Another form of restoring built environments is within the context of ageing. For older populations and smaller household sizes, changes in infrastructure and services provision will be required, including urban design, transport and amenities which increasingly focus on quality of life, well-being and social cohesion issues. Larger numbers of older people now live alone, and these new household formations pose additional challenges in terms of access to health care and social assistance as well as recreation and leisure activities and community involvement.

See the Appendix for a Case Study on the Parkstad Limburg region in the Netherlands region which successfully revitalised and repurposed its built environment using a range of initiatives.

Special Economic Zones

Traditionally a countering only strategy used in Poland to address population ageing and decline, the concept of a special economic zone (SEZ) can be equally applied to a silver or white economy policy framework.

The key aims of SEZs are to attract foreign investment, create employment in regional areas, develop and maintain post-industrial infrastructure and provide non-financial support (i.e. information on regulatory frameworks and administration processes). Major aspects of SEZ policy include more liberal economic laws, providing state aid to investors through tax exemptions, and support with development of land (brownfield sites etc) and infrastructure.

See the Appendix for a Case Study on the Katowice region in Poland which successfully developed a Special Economic Zone.

Table 5 - Examples of revitalisation of the built environment initiatives

Region/Policy	Objective/Issue	Approach	Outcome	Comment/Evaluation
Parkstad Limburg, The Netherlands[liv] ***See Appendix for case study**	To improve the quality of life of current residents by addressing the degradation of neighbourhoods due to depopulation.	A Neighbourhood redevelopment Project involved demolishing old, vacant and non-energy efficient houses and buildings. A focus of the redevelopment was right-sizing; better quality, insulated and appropriate houses.	Between 6,000 and 14,000 houses needed to be demolished, and around 12,000 needed to be restructured. Improved neighbourhood liveability	Figures regarding actual number of houses demolished are not available. Leadership: regional authority Funding: It was estimated it would cost around €285 million to redevelop houses in the five neighbourhoods most affected by shrinkage, and around €2.6 billion to redevelop houses in the entire region.
The Netherlands[lv]	To restore town centres. In declining town centres, shop closures have left vacant properties adjacent to operating shops, resulting in fragmented spatial structures. Outdated business facades, public spaces, bad sewerage and parking issues are also significant issues.	An initiative based on urban land readjustment involved areas with high levels of vacancy and enabled private property owners to voluntarily exchange sections of their property with other owners to assist with redeveloping the area. This initiative is a collaboration between private developers, the municipality and landowners, where local government acts a broker.	Two towns experienced different outcomes. The approach was successful in Deventer as local retailers were active and engaged with the process. In Dordrecht, property owners could not come to an agreement.	Public-private partnership/community engagement: outcome is dependent on whether the collaboration between the public, government and private developers is successful. Leadership and funding: local government.

Leipzig, Germany[lvi]	To restore architecturally important but vacant and decaying houses in the inner-city.	Through a guardian houses program, through an organisation, renters signed a contract with the owner of the house they lived in and instead of paying rent they maintained or renovated the house.	An inner-city house that had been vacant for many years was converted into studio lofts for students at nearby Academy of Visual Arts.	Leadership/community engagement: A good example of a bottom-up program as it was initiated by a group of local architects and planners.
Leipzig, Germany[lvii]	To address prevalence of vacant land in a shrinking city.	Through an interim land use agreement, the facilitation of temporary activation of vacant land into green spaces was undertaken to revitalise neighbourhoods, enhance the attractiveness of inner-city areas and create spaces for public use.	Resulted in 130 agreements and 160,000 square metres of land transferred into green spaces for public use. For private owners, cost to clear derelict sites was subsidised.	Temporary measures can be successful policy responses to improve quality of life and neighbourhoods in the short-term. Leadership and funding: local government and private owners (public-private partnerships).
Leipzig/Halle-Saxony/Saxony-Anhalt, Germany[lviii]	To manage land sustainably under shrinkage conditions as the local land-use policy was not sufficient enough to address the challenges of a high prevalence of degraded land and brownfields. A high proportion of areas designated for development had not been used, which signalled the need for a reorganisation of land policy between the two states. A shift from supply planning to demand planning and	The KoReMi project was established as a sustainable land-use policy to specifically re-organise land use. Regional cooperation was needed to address spatial challenges.	Although land use targets were set, Saxony and Saxony-Anhalt failed to devise concrete land use management policies. Use of green fields continued to be encouraged. In the urban areas of Halle and Leipzig, re-urbanisation occurred, and the cities grew, taking advantage of cheap real estate. However, the sustainable development of both regions consecutively has not occurred as no	Governance: demonstrates that nearby regions may need to collaborate on policy if local solutions are not successful (inter-regional cooperation). Leadership and funding: regional governments.

	encouraging regeneration of existing land (as opposed to green field sites) was needed.		agreements were made between the states.	
Ventspils, Lativia[lix]	To improve accessibility for older people within the town as in 2012, 23% of the total population was over 65.	Developed a senior-citizen friendly town initiative to inform the development of infrastructure for aged citizens.	Infrastructure investment included wheelchair accessible public transport and public buildings, street infrastructure (traffic lights with audible signals, wheelchair accessible sidewalks, brightly marked road signs).	Leadership and funding: local government, $1 million - $5 million.
Potsdam, Germany[lx]	After WWII, the historic areas of Potsdam experienced depopulation as inhabitants moved from degraded buildings and into modern houses in city outskirts.	Established an urban revitalisation programme to restore historical monuments and cultural heritage in town squares and historical quarters. Basic rule for revitalisation of historical centres: mixed used of residential, employment, trade, services and tourism, with at least 50% residential. A focus on social and culture life: music and theatres, renovation of education and sports facilities, and restoration of churches.	Numerous revitalisation projects were undertaken. Between 1992-2004, around half of historical buildings were completely renovated and 70% of public spaces were redeveloped. Transport systems were also re-organised with focus on pedestrians and bicycles.	Revitalisation projects can help to reclaim a city's identity.

Funding: national government and EU funds. |
| **Czech Republic**[lxi] | Barriers to redeveloping brownfields for the private sector due to high costs involved. | A National Strategy of Brownfield Regeneration was developed whereby local governments were required to initiate and lead the regeneration of brownfield | As of 2017, 489 brownfield sites were registered within the data base with information for business and regeneration purposes. In 2016, 19 brownfield sites were | Leadership and funding: national and local governments and EU structural funds (vertical cooperation). |

		sites to improve the environment and create opportunities for businesses. The Government agency CzechInvest launched a database in 2008 which initially mapped over 2,000 brownfield sites (an estimated ¼ of all brownfields in the country) with basic characteristics of the sites (e.g. previous use, contamination etc) and approaches to regenerate.	offered to both foreign and domestic investors.	
Genoa, Italy[lxii]	To limit developments on urban fringe or on green fields.	An integrative neighbourhood agreement was developed that focused on urban renewal and social cohesion projects. These were carried out by municipal governments in conjunction with private landowners and NGOs.	Initiative resulted in improved quality of residential environment and renewal of building in inner city, public housing was built, and basic social services were offered in neighbourhood. These included regeneration of old buildings, historical housing stock, streets and public infrastructure alongside investment into social housing and services for women, a nursery and a health centre.	Funding: national and EU funding Leadership/public-private partnerships: local government worked with private landowners and NGOs
Broken Hill, NSW[lxiii]	NSW state government has a standard template for planning policy that does not acknowledge population decline.	Using discretion, local planners/policy makers are focusing on urban renewal and redeveloping within existing areas of the city,	While official planning documents are still growth-oriented, (e.g. Broken Hill 2030 with an emphasis on attracting new residents,	Shows that local governments use discretion to enact their planning policies.

| | | opposed to developing outskirts. Local council needs to be entrepreneurial to increase quality of life for existing residents (as opposed to focusing on growth strategies). | reflected by growth in NSW as a whole), local officials are more pragmatic about the town's state of decline. | |

Key factors contributing to successful policy outcomes

Throughout the extensive literature relating to the diversity of responses to the challenges of population decline (shrinkage) and/or population ageing, clearly evident are three key themes which facilitate successful outcomes.

1) Governance
2) Leadership
3) Community engagement

Underpinning each of these success factors however is a comprehensive 'place-based approach'. All regions, cities and towns have a uniqueness to them which defines their identify as a place and should be the focus policy responses value and preserve.

These place-based identities encompass the intersect of economic, social, cultural and political elements. Importantly, there is no 'one-size-fits-all' solution to the challenges associated with population decline and/or ageing; a place-based approach is required and must be informed by evidence-based research.

These success factors are evident in the Case Studies found in the Appendix of this report as well as highlighted in the various tables of examples throughout the relevant sections of this report.

Governance

To be able to develop and implement a place-based approach, an appropriate governance structure is required. The governance structure needs to have the ability to make decisions in relation to the 'place' it represents in both a regulatory and legislative manner as well as fiscally.

The unprecedented challenges associated with population decline and/or ageing often require an unprecedented approach and often involves different and difficult, yet informed, decisions.

To support a place-based approach, there needs to be flexibility and agility in establishing the best governance structure for the place. This may require the restructuring of governance and the decision-making responsibilities to be better able to respond effectively to the challenges being experienced by regions, cities and/or towns.

Although regional authorities usually work within frameworks dictated by central governments, they often have a unique insight into local problems, and through collaboration can incorporate broader policy agendas to address issues. To do this, regions need to have increasing political autonomy and access to financial resources to provide adequate policy responses.

A governance structure could be informal, or it could be formal and legislated.

Informal governance structures, described as 'soft spaces', challenge existing political-territorial boundaries and levels of government, often taking the form of co-operation and collaboration in response to issues such as shrinking tax bases, high maintenance costs of infrastructure and amenities, high services provision costs and inter-regional competition[lxiv].

Cooperation and collaboration strategies can involve changing governance procedures to collaborate on decision-making or the pooling of resources to deliver services across larger geographical areas. Effective strategies need to expand beyond geographical boundaries and be implemented at the most appropriate level.

Strategies may be horizontal, such as intra-regional cooperation (between local areas within a region), inter-regional (between regional areas within a country or between cross-border regions) or vertical cooperation (between different levels of government: local, regional, state and national).

Restructured governance arrangements could also include public-private partnerships (PPP) whereby government/s collaborate/s with the private sector to provide services, invest in infrastructure or shape policy.

See the Appendix for a Case Study on the Kainuu region in the Finland which successfully restructured its governance to improve the efficiency in the provision of a range of public services.

Leadership

Within a place-based approach to population decline and/or ageing, strong, local leadership is paramount. Policy approaches to this unprecedented scenario require a shift in the mindset of decision makers from a more administrative and compliance focused approach to one which is more innovative, and solution focussed, with an appetite for change, measured by outcomes.

To do this, leadership must be defined and have the confidence and authority to explore policy options to achieve a common goal informed by an agreed, clear and strategic objective. To achieve this, leadership will need to be flexible and able to negotiate.

Leadership may be in the form of a formal, governing body or institution, an individual, community organisation or a collective group of stakeholders. Regardless, the leadership must have the support of the public and community it represents.

Community Engagement

Success of policy responses to population decline and/or ageing is dependent on community engagement; either as leaders, by being involved or through a support role.

Involvement of the local community in policy development can lead to empowerment of the community so that they are not just passive receivers of policy decisions. Not only that, but the local community is likely to have the best knowledge and understanding of local concerns and issues and be better positioned to contribute unique or innovative ideas and alternative policy approaches to address the challenges for the community in less conventional ways.

Importantly, community engagement and empowerment are more likely to result in an acceptance, and understanding, of difficult decisions made for the community.

Table 6 - Examples of factors contributing to successful policy outcomes

Region/Policy	Objective	Approach	Outcome	Comment/Evaluation
Kainuu, Finland[lxv] ***See Appendix for case study**	To improve the efficiency of public service provision.	A regional self-government experiment involving Inter-municipal cooperation was undertaken to provide for decision making relating to investment and delivery of public services with the aim of increasing the efficiency of public services. Decision-making regarding provision of health care, social welfare and secondary education was rescaled from local and national levels to a regional level.	By rescaling local services into one regional organisation, public service costs were reduced by almost 50%, health care expenditure was below the national average and the quality and availability of services increased.	The regional council changed the way services were provided to respond to the changing needs of the ageing and declining population. Leadership and funding: funds and decision making was redirected from local and national levels to regional level
Parkstad Limburg, The Netherlands[lxvi] ***See Appendix for case study**	To improve public services, transport and housing.	Eight municipalities in the South Limburg region formed a voluntary inter-municipal arrangement called Parkstad Limburg, specifically to collaborate in the areas of housing, infrastructure, transport and urban development. The Pact of Parkstad, an informal regional authority, was formed to collaborate on spatial planning and housing policies in the	Between 6,000 and 14,000 houses needed to be demolished, and around 12,000 needed to be restructured. Improved neighbourhood liveability.	After the national government (and provincial government) identified and acknowledged that depopulation was occurring and needed to be addressed at a local level, managing/accepting policies were developed by local governments. This demonstrates the importance of leadership in higher levels of government

		region, leading to an agreement to demolish and redevelop housing to match demand and improve the quality of housing stock.		However, figures regarding actual number of houses demolished are not available.
Hesse, Germany[lxvii]	To provide public goods and services in shrinking rural areas.	The establishment of inter-municipal cooperation (IMC) agreements facilitated ways to address challenges with inter-regional competition and providing public goods and services in shrinking rural areas.	In a survey of 1,413 people from 59 rural municipalities, those who opposed IMC believed that they their political influence would be reduced as a result. However, the municipalities which were experiencing demographic and economic decline were more likely to support IMC.	IMC agreements are viewed as a less radical way to provide services compared with voluntary mergers or amalgamations/ reforms. Governments that establish IMC agreements must address issues relating to loss of citizen control over decisions.
Pirmasens, Germany[lxviii]	To actively steer development and address problems related to economic development.	As local government authorities were struggling to facilitate economic development on its own, a public-private partnership with a city marketing agency was established in the late 1990s which included policymakers, business representatives and other stakeholders (voluntary organisations and citizens), to address issues.	The partnership resulted in a targeted use of state subsidies which focused on creating and promoting established businesses (as opposed trying to attract external investors), which is still used to guide actions today. Business representatives mostly included local companies owned by local families who wanted to invest in their community.	Partnership between private and public actors working towards common goals at the local level can benefit policymaking. Success factor: public-private partnership

Heerlen, The Netherlands[lxix]	To address vacancy in the city centre by facilitating communication between government and other stakeholders in order to develop spatial policies.	A public-private partnership between Heerlen Mijn Stad (Heerlen My City; HMS) and URBACT Local Group (ULG) was developed to revitalise the shrinking urban centre of Heerlen between the municipality, retailers and other stakeholders such as citizens. Examples of policy included reducing retail and office spaces in the city centre with the aim to reduce vacancy.	Through collaboration between different stakeholders, around 40,000m2 of retail and office space was reduced, and 50% shop vacancy was removed.	While the municipality led the initiatives, for successful interventions to occur there needs to be involvement from all other stakeholders. Success factors: Community engagement; public-private partnership
See Appendix for case study				
Kyoto Prefecture, Japan[lxx]	To address local, social problems related to depopulation.	The CUANKA (Community and University Alliance for regeneration of Northern Kyoto Area) was established as a collaborative system of industries, governments, academia and citizens. Led by Universities, mutual partnerships between different sectors of the community are utilised to address the needs of communities that are facing significant depopulation, in particular by promoting urban-rural networking to solve local issues.	Community-based projects are undertaken such as the introduction of renewable energy projects to rural communities to support growth in green markets. An example is an eco-tourism project that developed motor driven bicycles powered by renewable energy, in collaboration with universities, industry, tourist offices. Students can gain knowledge and training to solve local issues and formulate local policy and	To address problems at the local level, partnerships with different sectors of the community such as universities and industry can revitalise shrinking communities. Funding: national government, local grants, local municipalities and private donations. Success factor: Community

			Universities can receive local and on the ground knowledge.	
Jaslo, Poland[lxxi]	To improve public service provision and disparities of access through a participatory approach.	A civil forum the 'Agora of Jaslo', Jaslo Public Service Zone was established in each local government area to determine differing levels of demand for services.	Initiatives have been undertaken in areas of local transport infrastructure, water and sewerage and education. Citizens and non-governmental actors were involved resulting in more holistic, bottom-up approach to governance.	A step towards a more advanced participatory approach to governance. Success factor: Community engagement
Parkstad Limburg, The Netherlands[lxxii] ***See Appendix for case study**	To collaborate on spatial policies for themes including renewable energy, re-use of sites and materials, and temporary land use.	Establishment of IBA (Internationale Bau Ausstellung) which was a bottom-up/citizen led projects- e.g. Superlocal which aims to reuse resources from three vacant ten story flats to construct new social houses and public spaces in the city of Kerkrade.	Three new houses made of 90% reused and remanufactured materials from the former flats were constructed as a pilot project, with financial and economic benefits reported.	Alternative policy approaches led by citizens have the potential to address the consequences of shrinkage in less conventional ways. Success factor: Community engagement

Recommendations

In response to the evidence base presented above, to capture opportunities associated with an ageing population, while also providing for the needs of the population; a combined countering and accepting policy approach is recommended.

Three key policy themes are identified as appropriate for Tasmania based on its demographic, economic and spatial profile. While these themes could be considered in isolation, they are also complementary to each other.

Importantly, these themes should be considered through the lens of peripheralisation, whereby the inter-connected relationship between urban centres (cities or major towns) and their periphery (the rural and regional social economy) are focal.

Peripheralisation is underpinned by interactions between multi-dimensional drivers from economic, social, spatial, demographic and political domains which interdependently influence economic activity, the community and population change.

The three themes are:

1) Embracing and investing in the White Economy
2) The regeneration and repurposing of the built environment
3) Establishing Special Economic Zones (SEZs)

Underpinning the development and implementation of a policy framework is the need for a clear place-based approach including governance, inter-regional co-operation, leadership and community engagement as outlined in the Success Factors section above.

Embracing and investing in the White Economy

Given that more than 1 in 5 Tasmanians are aged 65 or older, and that the proportion and number of elderly people in Tasmania is only going to increase over time, perhaps more so as the impact of the COVID-19 global pandemic on the population becomes more known, demand for aged and health related products and services will also only increase. This situation presents an economic opportunity to pursue.

The white economy encompasses a new collective for economic growth based on the increasing demand for aged-focused needs; an eco-system of products and services for older people. More specifically, the white economy refers to 'products, services and activities related to healthcare and care including the dependent, disabled and elderly'. These products, services and activities include the meeting the existential needs of older people, needs of older consumers, needs of older employees and the needs of employers and organisations providing and servicing older people's needs.

White economy initiatives include investing in health care and its workforce including doctors, nurses and other health care specialists to adapt to the needs of an ageing population and related conditions, alongside new technologies and types of services which are fundamentally different to what is understood to be mainstream healthcare. The increasing demand for health care services resulting from ageing may include shifting the focus of health care from prevention and curing to one that emphasises management of symptoms and the variability of symptoms, as demands on the health sector increase.

Of critical importance, however, is that the white economy extends beyond just the provision of services, to transport and logistics, research and development, contemporary manufacturing, innovation and technological advancements, including the expansion of initiatives such as telemedicine, remote monitoring and rehabilitation as well as career upskilling.

Increasing the capacity of the health sector over the longer term; investing, identifying, prioritising and streamlining services around the state as well as providing logistics and transport services will provide much needed economic stimulus over the years to come as well as providing for the needs of an older population. So too will incentivising research and development for product and service innovation in the white economy as Tasmania recovers from the unprecedented, global scenario of COVID-19 and provides for the on-going unprecedented, global scenario of population ageing.

The regeneration and repurposing of the built environment

Many of Tasmania's regional town centres are experiencing the degradation of their built environments, alongside economic restructuring, changing demographics, ageing and population decline. Local built environments with considerable heritage value are often disconnected, under-utilised and no longer fit-for-purpose for the communities they serve.

A number of major towns could benefit from urban renewal projects which focus on the regeneration of the existing built environment and the revitalisation, repurposing and right-sizing of public and private infrastructure, services, amenities and housing to meet the needs of their changing populations.

A focus on quality of life, well-being and social cohesion will also create economic activity, provide opportunities for the community, inform and improve service provision and provide for greater liveability in the region.

Appropriate towns to consider for fit-for-purpose urban renewal projects are those with transport corridors and access to other towns within their periphery, as well as to towns and major urban centres outside their immediate periphery which may provide larger-scale public services to their community. In Tasmania, towns like Smithton, St Marys and Queenstown could be considered.

Ensuring fit-for-purpose infrastructure, service delivery and connectedness within a community and within its periphery is key to successful regeneration and repurposing of the built environment in regions experiencing population ageing and/or decline.

Creating Special Economic Zones (SEZs)

The aim of a Special Economic Zone (SEZ) is to attract investment to a specific geographical area on the basis that the investment will create employment, provide infrastructure and attract people to that region. Investment is targeted and attracted using a range of levers such as liberal economic laws, providing financial assistance to investors through tax exemptions, and support with development of land (brownfield sites etc), infrastructure investment and the provision of non-financial support (i.e. information on regulatory frameworks and administration processes).

While Governments at all levels in Tasmania are active in attracting and facilitating investment in the state, these activities and specific sectors could be prioritised through the development of a SEZ, through the lens of peripheralization and also incorporate the white economy (as outlined above) as well as other sectors experiencing a comparative and/or competitive advantage.

Two approaches to complement and inform the establishment of SEZs are increasing Tasmania's economic complexity through smart specialisation and expanding the product and supply chain for existing products and services.

Smart specialisation

Smart specialisation is policy framework designed to assist regional areas to boost their competitive advantage by prioritising innovation and research[lxxiii]. A key feature of smart specialisation is its bottom-up approach, underpinned by partnerships between governments, businesses and research institutions. The framework encourages regions to focus on their strengths and to strive for "smart, sustainable and inclusive growth"[lxxiv].

The core elements of smart specialisation include:

- Entrepreneurial discovery: an interactive process between the private sector and the government and a more exploratory approach to producing knowledge and innovative solutions.
- Investment in activities (opposed to entire sectors): activities that are generally connected to specific technologies or natural assets/capabilities.
- Flexibility to diversify: unexpected pathways may emerge which can lead to innovative solutions.
- Evidence-based monitoring and evaluation: clear/measurable goals are needed as there is strong focus on policymakers and researchers evaluating progress. Flexibility in policymaking is required to adapt to the outcomes of this process and any successes/failures.

Economic Complexity

The Harvard University Kennedy Business School maps the economic progress and opportunities of the industrial and non-industrial world in a database of 133 economies; The Atlas of Economic Complexity[lxxv]. Economic growth, according to this model, is driven by a process of diversifying know-how to produce a broader, and increasingly more complex, set of goods and services which ultimately leads to increased wealth and income. Essentially, the ability of a region to achieve relatively strong growth is dependent on the productive knowledge that goes into making products (know-how or productive capabilities) and diversity, and the number and breadth of products the region is able to make. Over the longer-term, economic growth is driven by diversification into new products that are incrementally more complex.

Research by the Harvard University Kennedy Business School identified that diversification and economic expansion results from moving into nearby and related products or into those that require similar knowhow to build on existing capabilities. The Atlas of Complexity identifies potential growth opportunities for all 133 countries, based on their export profile. These strategic new product opportunities aim to balance connectedness with existing capabilities, complexity and the opportunity for further diversification and are further diversified according to a realistic indicator of either; 'low-hanging fruit', balanced portfolio or a 'long jump'.

Using the framework of economic complexity and smart specialisation, The BankWestCurtin Economic Centre developed a strategy for future-proofing the Western Australian economy[lxxvi]. The report recommends the implementation of a 'smart specialisation' approach to regional diversification, to ensure that new development opportunities build on existing regional capabilities and capitalise on local conditions and networks. A fundamental element of smart specialisation is to support those industries that regions are leading in. But the smart specialisation policy is also useful to encourage diversification into new industries that build on existing advantages.

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Appendix – Case Studies

Countering Strategies

Newfoundland and Labrador, Canada

Newfoundland and Labrador is the most easterly province of Canada, with a population of 528,817 in 2017 (Newfoundland & Labrador Statistics Agency 2017). St John's is the largest city in Newfoundland with a population of 108,860 in 2016. In the first three months of 2018, Newfoundland and Labrador was the only Canadian province to experience population decline, dropping to just under 526,000 (CBC News 2018). Newfoundland and Labrador started to experience a population decline between 2016 and 2017 (Newfoundland & Labrador Statistics Agency 2017). Estimates show that the population could decline to between 523,000 and 492,000 by 2036, with a large increase in median age (Roberts 2019).

In 2016, Newfoundland and Labrador had a total fertility rate of 1.42 (national rate was 1.60) (Roberts 2019). In 2014, the median age in Newfoundland was 44.6 years whereas Canada was 40.4 years. The average number of people per square kilometre is 1.4, compared to 4.0 for Canada as a whole so this creates unique challenges for employment recruitment and retention (Department of Health and Community Services 2015).

Newfoundland and Labrador Economic Profile

In 2017, the top five industries in Newfoundland and Labrador were:

1) Mining, Quarrying, and Oil and Gas Extraction (24% of GDP)

2) Construction (12% of GDP)

3) Real Estate and Rental and Leasing (10% of GDP)

4) Health Care and Social Assistance (8% of GDP)

5) Public Administration (8% of GDP)

A Population Growth Strategy

In 2015, Newfoundland and Labrador released a 10-year strategy to grow the population, alongside supporting the individuals and families who already live there. In 2020, the Government will release a review and an updated plan for the next 5 years.

Four key areas:

1) Workforce development 2) Families 3) Communities 4) Immigration

1) Workforce Development Action Plan

Aim: Reduce out-migration.

Supports job growth and assists people in finding jobs and utilising skills of the individuals in the labour market. Providing current information on in-demand occupations to facilitate securing employment in the province.

Example: Train Here (Government of Newfoundland and Labrador 2015)

- A renewed vision for apprenticeships

Actions/Outcomes:

- Harmonising training across provinces so individuals can gain the work experience required in other provinces but remain living in N&L
- Ensure apprentices can find employment opportunities in N&L when qualified
- The initiative began in 2007, with a 94% increase in number of registered apprentices. Following a renewed vision, it is expected this will continue to increase.

2) Families Action Plan

Aim: Create conditions favourable to an increased birth rate.

Breaking down barriers for families who want to, or already have, children. Putting families first (birth, foster and adoptive). Also seeking to support individuals who care for adult family members.

Example: Caring For Our Future: Quality and Affordable Child Care (Department of Child 2012)

- Quality and affordable childcare reduces barriers for parents to participate in the labour force.

  Actions/Outcomes:

- The Early Learning and Child Care Directory for parents to access information about child care.
- Between 2014-2016- over $20 million invested into childcare centres to help offset the costs for parents- particularly low-income parents.

3) Communities Action Plan

Aim: Foster economic growth and provide services to meet the needs of residents.

Strong emphasis on economic development. More activities, services and supports for all ages and types of families. A focus on immigration retention and diversity in the communities.

Example: Newfoundland and Labrador Strategic Health Workforce Plan 2015-2018 (Department of Health and Community Services 2015).

- An ageing population will see changes in the health workforce alongside increased demands on health services.

Actions/Outcomes:

- Expansion of places in University programs for health programs (e.g nursing).
- Ensure a sufficient supply of health workers are available in the region.
- Increase productivity to result in better patient care and satisfaction.
- Partnered with industry and increased the number of long-term beds (for the elderly) through the construction of several long-term bed facilities, and a new regional hospital in the West (Osborne 2018).
- These major health care infrastructure projects will generate more then 4,600 person years of employment and half a billion dollars in economic activity (Osborne 2018).

4) Immigration Action Plan

Aim: Increase number and retention of immigrants.

Increasing attraction and retention of immigration by promoting economic and lifestyle opportunities. Investments in immigrant settlement and retention services.

Example: Immigration Action Plan 2017-2022: Enhance Foreign Qualification Recognition Processes (Department of Advanced Education 2017a)

- Increase recognition of foreign qualification of occupations to allow more immigrants to work in the region.

Actions/Outcomes:

- Foreign education, experience, knowledge and skills recognised through a two-year agreement with Government.
- 11 projects were approved for funding in 2017-18 (Department of Advanced Education 2018).

Example 2: Survey Expatriate Newfoundlanders and Labradorians to Gain Insight on Ways to Entice Them to Return (Department of Advanced Education 2017b).

- Expatriate Newfoundlanders and Labradorians are a valuable resource for potential population and economic growth.
- Aim to better understand reasons for leaving and to gain insight on what would entice them to return.

Actions/ Outcomes:

- $22,800 funding for a survey with over 3,700 individuals and face-to-face interviews with 60 individuals.
- Data collected but yet to be analysed/released.

Take home messages:

- Focused on growth. Mostly countering or strategic intervention (McMillan 2015), but also some accepting.
- Addresses the ageing population through the Strategic Health Initiative.
- Addresses challenges for working mothers through child care initiatives.

What's missing?

- Some projects/ policies have only just been established, thus outcomes are too early to measure.
- Little mention of environmental impacts/ sustainability.

Despite the Population Growth Strategy, 2019 reports show that the demographic challenges in the region are worsening. 2018 saw a new low point for births, with 900 fewer births than deaths (Roberts 2019). In 2017-18, there was a net loss of people from Newfoundland and Labrador to nearby provinces (Ontario, Alberta and Nova Scotia). While statistics show that 1,035 new residents arrived in Newfoundland and Labrador in 2018, losses through outward migration and natural decline have resulted in a decline (Roberts 2019). Rob Greenwood, the executive director of Memorial University's Harris Centre, has argued 'we have to stop equating development with population growth. We have to start thinking about how do we make the most with the population we have' (Roberts 2019).

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Southland, New Zealand

Southland is New Zealand's most southern region, with a population of 93,339 in the 2013 census. Southland's largest city is Invercargill with a population of 51,696 people (Statistics New Zealand 2013). Population estimates for 2018 are 99,100 and 55,300 for Southland and Invercargill, respectively (Ministry for Business 2019a). Between 2006-2013, Southland grew by 2.7 percent (Statistics New Zealand 2013). Southland's peak population was 99,000 in 1996, however the region experienced a decline until 2007, at an average rate of -6.3%. Southland consists of 2.2% of New Zealand's total population (Statistics New Zealand 2013), however if the regional population remains static for the next 10 years, it would decrease to 1.8% of New Zealand's population (Southland Regional Development Strategy 2015).

In 2013, the median age in Southland was 39.6 years (an increase from 38 in 2006) and 15.7% of people are over 65 years (The median age of NZ was 38 years, 14.3% were 65 years and over) (Statistics New Zealand 2013). In 2019, in-migration exceeded out-migration (+400) and births exceeded deaths (+400), therefore the region is experiencing sustainable growth. However, with current trends, i.e. little population growth and the ageing effect, it is likely that Southland will face challenges associated with population decline. It is expected that the population of Southland will continue to rise until 2028 (100,600), before stagnating and then experiencing a decline in 2038 (Ministry for Business 2019a).

Economic Profile

In 2017, Southland's GDP per capita was $60,937 ($56,441 for NZ) (Ministry for Business 2019a). Although Southland consists of only 2.2% of New Zealand's population, 70% of Southland's GDP is exported and 15% of New Zealand's tradeable exports are produced in Southland (Southland Mayoral Forum 2015). Thus, Southland experiences strong economic development compared with other regions in New Zealand. The unemployment rate in 2018 was 4% (Ministry for Business 2019b).

 In 2016, the top five industries in Southland were:

1) Agriculture: Grain, sheep and beef cattle farming ($487M)

2) Meat and meat product manufacturing ($420M)

3) Forestry, fishing, mining, electricity, gas, water and waste services ($182M)

4) Transport, postal and warehousing ($149M)

5) GST on production, import duties and other taxes ($137M)

Drivers of population change

Southland experienced population decline between 1996-2007, due to an increased out-migration to other regions of New Zealand (predominately youth aged 15-24 years) (Roskruge & Pawar 2015). The region's population began to grow again in the late 2000s, mostly due to economic growth and increased employment in the dairy industry (Roskruge & Pawar 2015).

The drivers of population change in Southland are predominately economic. However, as Southland experiences strong economic growth relative to the national economy and a low unemployment rate, it is lack of diverse employment opportunities which drives out-migration, fuelled by a reliance on the primary sector.

In 2013, Southland's birth rate was slightly above the national average, however, it is decreasing at a faster rate than other regions in New Zealand. Thus, natural decline is likely to contribute to population change in the future.

Other contributing factors to population change include the geographical isolation of the region and its small urban centre.

Outcomes and implications

A lack of diverse employment opportunities and reliance on the primary sector has driven the out-migration of youth from the region. While youth out-migration has slowed since the overall population decline experienced in the early 2000s, the age group of 15-24 years continued to decline between 2008-2013 (Roskruge & Pawar 2015). A 2017 study found that most high school students from region planned to leave as job opportunities were largely limited to the farming industry (Cain et al. 2017). The implications of out-migration include loss of human capital, a shrinking workforce and smaller talent pool (Southland Regional Development Strategy 2015). Out-migration in Southland has contributed to a below average population growth on the trajectory for decline, and an increasingly ageing population (Southland Regional Development Strategy 2015). The implications for ageing in Southland is a declining tax base and higher age-dependency ratio.

A reliance on the primary sector also means that the region has economic vulnerability. Although the region is currently experiencing strong economic growth, future fluctuations in the industry may exacerbate future population change.

The geographical isolation of the region and its small urban centre impact on the opportunity for investors and new business. Even though the region experiences relatively strong economic growth,

it is limited by its small population. This further drives the lack of labour market opportunities and the out-migration of youth.

Policy response

Southland Action Plan

In 2015, in response to the social and economic concerns of an ageing and potential declining population, Southland produced the Regional Development Strategy (Southland Mayoral Forum 2015) and Action Plan for 2015-2025 (Southland Regional Development Strategy 2015).

The Action Plan focused on three key areas:

1) Grow population: 10,000 more people by 2025 (within 10 years)

2) Diversify the Regional Economy

3) Strengthen local business

Diversify the Regional Economy

a) Aquaculture

Aim: Invest in aquaculture and establish an internationally significant industry.

Southland's climate and water conditions are right for delivering a sustainable and efficient means of producing quality protein. Aquaculture is labour intensive, but a low emitter of greenhouse gases (Venture Southland 2012).

Example: Finfish aquaculture (Venture Southland 2012)

- Southland Aquaculture Strategy was developed in 2012 (Venture Southland 2012).
- A successful industry with high environmental standards could contribute economically to the region (Venture Southland 2012).

Actions/Outcomes:

- In 2018, received $2 million from the Provincial Growth Fund to study the feasibility of salmon hatchery and a research facility (Morris 2018).
- If successful, could deliver $400 million in export earnings and create 550 jobs in both primary production and research (Morris 2018).

b) Tourism

Aim: Develop Southland's tourism industry.

Southland has unique natural and cultural assets. Milford Sound is already a tourist attraction but seen as an extension of Queenstown, not Southland. Southland possesses a wild and natural landscape which is untapped (Venture Southland 2019).

Example: Destination Strategy

- Positions Southland as a destination to drive tourist numbers. In conjunction with Southland's story development.
- Works with businesses to develop their tourism products to attract tourists to the region (Venture Southland 2019).

Actions/Outcomes:

- 23.5% increase in the tourism sector between 2015 and 2018 (Brown 2018).
- A range of employment opportunities as the sector increases

c) International Students

Aim: Continue to increase number of International Students, with a clear focus on attracting working age population students with young families to complete post-graduate studies and then take up employment in the region.

Example: Southland Regional International Education Alliance (Southern Education Alliance 2016)

- Initiative to provide a collective regional response to the opportunities in international education.
- Bring in 3,850 more international students by 2025 and support them to stay in the region (with their families).

Actions/Outcomes:

- Each international student studying in Southland contributes an average of $39,290 to the regional economy.
- In 2015 there was a 20% increase in the enrolments of international students, it is expected over time this has continued to increase.
- International economic contribution to the region is around $60 million.

Key findings

- Southland is experiencing ageing and growth, projected to decline
- Experiences strong economic growth relative to national economy

- The region has identified the potential of future decline and its implications

- Countering policy strategies to stimulate economic and population growth

- One of these strategies is to diversify its economy, to provide different employment opportunities, reduce the out-migration of young people and attract young families.

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Katowice, Poland – special economic zone

The Katowice region is in Southern Poland, covering 3329 km² with a total population of 2.5 million in 2018 (Runge et al. 2018). Katowice's population was growing until 1991, where it reached its peak of 2.839 million (Spórna 2018). In 1993, out-migration exceeded in-migration, and in 1996, natural decline began to occur, and thus the region is in absolute decline (Runge et al. 2018). The Katowice region is Poland's most urbanised area, consisting of 33 cities and towns -described as having 'a distinct polycentric functional and spatial structure' (Spórna 2018, pp. 59-60). The density of the population was four times higher than the national average in the 1990s. The largest city is Katowice with 298,100 people in 2018, however there also are eight other cities with populations over 100,000 (Spórna 2018). Poland has three levels of government, voivodeships (similar to state/provinces), powiats (counties or districts) and gminas (municipalities/ local government areas).

The fertility rate in the Silesian Voivodeship in 2016 was 1.35 (Sojka 2016) and the median age is ??.

Economic profile of Silesian Voivodeship

In 2017, the GDP per capita was €21,600 which is the above the national average of €20,900. The unemployment rate is 4%, compared to 3.27% in Poland as a whole (2019).

In 2018, the top 5 industries in Silesia were:

1) Manufacturing (42.4 M €)

2. Motor vehicles (12.6 M €)

3. Mining and quarrying (5.8 M €)

4. Electricity, gas and steam (3.7 M €)

5. Transportation and storage (0.3 M €)

Drivers of population change

A key driver of population change in the region was Poland's transition from socialism to capitalism in the 1990s, which led to broad political and economic changes (Runge et al. 2018). Prior to this, national economic policy supported the development of heavy industry, and a large proportion of Poland's industrial production was situated in the Katowice region. Up until the end of the 1980s, Katowice experienced intensive industrialisation specifically in coal and iron mining, and metallurgy (Runge, Kłosowski & Runge 2003). Thus, due to growing opportunities in labour intensive industries such as manufacturing, most areas of the Katowice region experienced in-migration and population growth.

As a result of rapid growth and industrialisation, the region formed several distinct but connected urban cores within a 500km radius (Krzysztofik, Kantor-Pietraga & Kłosowski 2019). These urban centres in Katowice had highly specialised mining and industrial functions, and demographic growth was driven by employees of industry and their families. During the socialist era, heavy industry was under state ownership and urban centres were centrally organised (Krzysztofik, Kantor-Pietraga & Kłosowski 2019). While urban areas were growing, smaller towns were also growing as they offered employment in the industry and better housing conditions compared with cities (Runge, Kłosowski & Runge 2003).

However, the region was economically concentrated, with environmental degradation, low educational capital and chaotic spatial planning (Suchacek 2005). In the 1990s, transforming from a centrally planned to a market economy alongside globalisation processes and de-industrialisation resulted in the shrinking of traditional industry and subsequent economic restructuring. The liberalisation of the economy led to many Polish industries experiencing financial trouble as they were unable to compete in a global market (Schaefer 2018). For example, in the Katowice region, coal production decreased from 177.4 million tons in 1990 to 106 million tons in 1999 (Suchacek 2005). Thus, 1990-2000 saw the onset of negative demographic trends triggered by widespread structural unemployment (Runge et al. 2018).

Outcomes and implications

The economic crises and subsequent restructuring within the Katowice region had economic, demographic and spatial implications.

Economic

A key outcome of transitioning to a market economy and decline in industry was a high unemployment rate. Economic decline and restructuring led to an initial decrease of 15% in employment in traditional industry between 1989 and 1995 (Suchacek 2005) and a 10.2% decrease over the longer term (47.9% in 2000 to 37.7% in 2017) (Runge et al. 2018). Mining was the industry affected the most, with the number of employees falling from 280,000-300,000 in 1989-1990, to around 47,000 to 50,000 in 2018-2019. Average unemployment rate grew to around 15-20% in the 1990s and 2000s (Runge et al. 2018). The greatest unemployment rates were found in the mining towns (26.9%-25.7%) and the lowest rate was in Katowice city (7.1%), likely due to a rise in employment in services. However, similar trends were observed within Poland as a whole, and the region's unemployment rate never exceeded the national rate (Suchacek 2005).

However, there has been great spatial variation within the region and similar post-industrial towns have not followed a uniform pattern in terms of economic transformation and population change (Krzysztofik, Kantor-Pietraga & Kłosowski 2019). Krzysztofik, Kantor-Pietraga and Kłosowski (2019) argue there are five economic drivers within the Katowice region, including coal mining, industry, service, research and development, and residential functions. However, cities and towns within Katowice have followed nine different trajectories, or combinations of functions, none of which have achieved residential functions in conjunction with modern economic functions for example high-tech services or research and development (Krzysztofik, Kantor-Pietraga & Kłosowski 2019).

For example, two towns in the region, Ledziny and Razionkow were very similar in terms of economy and population before the 1990s, with mining and production plants as central features of both economies. In Ledziny, growth is still based on mining, with over 3000 people still employed in coal mining and 3500 people in a large industrial plant, producing around 11% of Polish's coal (Krzysztofik, Kantor-Pietraga & Kłosowski 2019). However, the Ledziny economy is still economically concentrated, with 75.6% of employment found in industry and only 24.2% in services.

Conversely, Razionkow has a more even share of employment, with 47.2% in industry and 52.6% in services. The closing of a mine in the 1990s drove economic decline, changes in the labour market and high unemployment rate. This led to economic restructuring, and in the 2000s, a fuel company, meat industry and lighting manufacturer were established on former mining brownfields. Other services the town has established more recently include museums, and the Silesian Botanical Garden and the Kanlux Tech Park Technological and Exhibition Centre (Krzysztofik, Kantor-Pietraga & Kłosowski 2019). Thus, while Ledziny has enjoyed continued economic development in the mining industry, Razionkow has diversified its economy and is working towards investment in more high-tech industries (Krzysztofik, Kantor-Pietraga & Kłosowski 2019).

Overall, Ledziny has experienced better demographic outcomes when compared with Radzionkow-with a larger proportion of working-age population (64.4% compared with 61.3%), a higher rate of natural increase (57 vs -16) and lower migration balance (-12 vs -33). This is likely due to a continued employment in the mining sector and buffer of economic security. However, this may not be sustainable over the longer term and towns that have diversified and serve different functions will likely experience better demographic and economic growth the future (Krzysztofik, Kantor-Pietraga & Kłosowski 2019).

Demographic and spatial

High rates of unemployment triggered an outmigration of the working-age population resulting in a changing age-structure of the population. In particular, urban centres depopulated and remaining population were mostly post-working age (Krzysztofik et al. 2017). Rapid urbanisation in the industrial era led to poor urban planning, and thus depopulation has resulted in one of the most degraded metro areas in Europe with rundown housing, public areas and transport infrastructure. Further, post-industrial areas are characterised by brownfields, polluted water ways and mining damage.

Overall, between 1991-2016 large urban centres decreased by a combined total of almost 400,000 people, and despite some growth in rural areas, the region overall has experienced depopulation. Between 1990 and 2016, Katowice city experienced a decline of 68,700 people (Spórna 2018). Since 1990, the rural areas surrounding urban areas experienced some growth due to suburbanisation and the construction of new housing developments (Spórna 2018). While other European cities experienced suburbanisation earlier (in the 19??), it occurred later in the Katowice region. This is largely due to rapid urbanisation prior to 1990, as multi-storey buildings and flats in block estates were built that expanded urban cores, for employees of the mining and metallurgy sector (Spórna 2018). Following de-industrialisation, these inner-city areas started to decline, and suburbanisation occurred in the Katowice region.

More recently, while urban cores are declining, areas close to urban centres described as 'inner city suburban zones' have experienced growth, characterised by good transport accessibility, access to green areas and competitive prices for real estate (Spórna, Kantor-Pietraga & Krzysztofik 2016).

Policy response: Special Economic Zone

In response to changes in its political economy, the Katowice region has undergone efforts to restructure and revitalise its economy through policy interventions which aim to diversify the economy (Magda-Żabińska 2014).

Economic restructuring was a relatively slow process in Katowice (Suchacek 2005). Lobbyism from industry and local institutions drove the slow pace of restructuring despite market declines, with strong regional actors, local institutions and also foreign investors playing a role (Suchacek 2005). In 1995, a contract was drawn between the region and the central government in attempt to transform the region in terms of industry, education, environment and infrastructure (Suchacek 2005). As the region was important for the Polish economy and was densely populated, the national government provided financial support for the transition (Suchacek 2005). Metallurgical and mining companies

received loans from central institutions to ease financial pressures. Alongside this, the region received EU funding through various programs such as the integrated regional development fund and the structural regional development programme (Suchacek 2005).

Poland's transition to a free market economy resulted in ad hoc measures and much of the state subsidies provided in the early 1990s were not connected to any long-term policy goals (Schaefer 2018). In 1994, Special Economic Zones (SEZs) were introduced as a long-term policy response in Poland, designed for areas that were economically concentrated in traditional industries with existing infrastructure and brownfields, and large numbers of unemployed workers. In the 1990s, these areas were affected by de-industrialisation, high unemployment rates, and out-migration, and subsequent population and economic decline. The key aims of SEZs are to attract foreign investment, create employment in regional areas, develop and maintain post-industrial infrastructure and provide non-financial support (i.e. information on regulatory frameworks and administration processes) The original SEZs were designed for 20 years (until 2014), however were recently extended until 2026.

The Katowice SEZ was the second in Poland, consisting of four sub-zones within the Silesian and Opolskie Voivodeships. Key aspects of SEZ policy include more liberal economic laws, providing state aid to investors through tax exemptions, and support with development of land (brownfields etc) and infrastructure.

Specific policies include:

- Corporate Income Tax Relief for investment costs (10% - 50% for large enterprises, 20% - 60% for medium enterprises, 30% - 70% for micro and small enterprises)
- Tax relief for two-year labour costs (up to 25%)
- A variety of investment plots, production and manufacturing warehouses, office buildings available for purchase or lease.

Initially, preference was given to investors in specific manufacturing industries, including precision engineering, electronics, car industry, food processing, medicine and medical instruments (Suchacek 2005). Recent investments in the Katowice SEZ have focused on the automotive industry and as a result, a car industry cluster has formed.

Key outcomes

- In 2017, the Ministry of Development has estimated that the 14 SEZs across Poland attracted €5 billion in investments and around 16,000 jobs that year (Schaefer 2018)
- Good public confidence and support for SEZs (Schaefer 2018).
- Internal stakeholders (regional government, local NGOs and communities) were not heavily involved in the development of the SEZ as the national government was required to create the legal environment for tax exemptions etc. The Polish Investment and Trade Agency (PAIH) which operated at a national level developed and promoted the zones (Schaefer 2018).
- SEZs are in competition with other zones in Poland and thus have an imperative to provide good services and business-friendly environments (Schaefer 2018)
- Additional investment incentives have been provided by the European Development Fund to encourage jobs and infrastructure in regional areas.
- A combination of both greenfields and brownfields

Katowice region:

- In 2019, Katowice SEZ rated 2nd most successful special economic zone in the world by Financial Times group.

- In 2018-19, 66 new projects and 1.14 billion in new investments (e.g. automotive, metallurgical, chemical, synthetic substances and food processing)

- In total, 350 new businesses, mostly in automotive industry (Krzysztofik, Kantor-Pietraga & Kłosowski 2019)

- Over 76,000 new jobs created in total (Krzysztofik, Kantor-Pietraga & Kłosowski 2019)

- Has good transport infrastructure- two highways (German-Poland-Ukraine connection and Poland-Czech Republic connection), a rail network and three international airports, an inland port and a reloading terminal.

As of June 2018, all of Poland became a single special economic zone which is likely to have implications for regional areas. The new law offers all regions of Poland an even playing field in terms of ability to attract investors and offer employment to their citizens but may reinforce regional inequalities. However, SEZs (like Katowice) which have been in place for over 20 years, with support systems already in place are likely to offer investors a competitive edge (Soful 2018).

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Accepting Strategies

Kainuu, Finland - governance and service provision restructure

Kainuu is north-eastern region of Finland, with a total population of 73,061 in 2018 (Statistics Finland 2019), Between 1990-2018, the population of Kainuu declined at an average annual rate of -0.80% (compared with a national population growth of +0.4%) (Statistics Finland 2019). Kainuu has eight municipalities and the capital, Kajaani's population was 36,973 in 2018 (declining at an average rate of -0.2 since 1990). Kainuu's median age is 46.4 (2017). Since 1998, the number of deaths has exceeded the number of births, and out-migration exceeded in-migration, thus the Kainuu region is experiencing absolute decline (OECD 2017). Kainuu is a landlocked region on the border of Russia and 83.2% of the land is forest. There are three levels of government in Finland: central, regional and local (municipalities). Finnish local government only has a single tier and they provide two thirds of public services.

Economic profile

In 2016, GDP per capita in Kainuu was € 28,596.30, compared with a national average of € 38,370.04 (Statistics Finland 2019). Kainuu's unemployment rate is around 10.8% (2017).

In 2017, the top 5 industries in Kainuu were: (Regional Council of Kainuu 2018)

In 2017, the top 5 industries in Kainuu were: (Regional Council of Kainuu 2018)

1) Bio-economy (renewable natural resources) (502M €)

2) Mining (300.7M €)

3) Energy (226.9M €)

4) Forestry (193.6 M €)

5) Metal (152.5M €)

Drivers of population change

After WWII, urbanisation and rapid changes in occupational structures led to migratory flows from the rural parts of Finland to towns and built up areas, particularly to Southern and South-Western Finland (Karjalainen 1989). While the 1970s saw some migration directed from centres towards urban margins, rural out-migration continued throughout the and subsequent decades (Heikkilä & Pikkarainen 2010; Karjalainen 1989).

The drivers of population change in Kainuu are predominately economic. Historically, Kainuu's economy has relied on the primary sector, in particular, mining, paper and pulp industries. Over

time, these traditional industries have experienced pressure due to international competition, lack of demand, declining prices and negative environmental impacts (OECD 2017). As primary production has slowed, a decline of the availability of employment for the working aged population has occurred. Thus, economic factors such as negative labour market forces and unemployment are most common reasons for out-migration from Kainuu (Heikkilä & Korhonen 1995; Karjalainen 1989).

Natural decline is also driving population change in Kainuu. Aside from a rise in babies born during the post-war boom, the birth rate in Kainuu has declined rapidly (Karjalainen 1989). Between 1995-2004, falling fertility rates and rising life expectancies contributed to striking change in the age structure of Finland as a whole (Heikkilä & Pikkarainen 2010). Further, the average death rate in Kainuu has been higher than the national Finnish average since the mid-1960s (Karjalainen 1989).

Other contributing factors to population change relate to the remoteness and low density of the region and its small urban centre (OECD 2017).

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Other contributing factors to population change relate to the remoteness and low density of the region and its small urban centre (OECD 2017).

Outcomes and implications

While natural decline has contributed to the altering of the age structure of Kainuu's population, out-migration has had the most profound effect on population change (Karjalainen 1989). Kainuu reached its maximum population in 1963 (108,036 people), before beginning to decline, even though Finland as a whole was growing (Karjalainen 1989). Aside from a slight population increase

between 1977-1984 due to major building project across the border in Russia, Kainuu has experienced a steadily decline (Karjalainen 1989).

Out-migration is mostly triggered by the decline in availability of employment due to a decreased demand in the primary sector. Kainuu has a high unemployment rate (10.8% in 2018) compared with the national rate (7.4% in 2018) (Statistics Finland 2019). In 1985, the unemployment rate in Kainuu was 12.7%, double that of the national average 6.3% (Karjalainen 1989). As such, the labour market in Kainuu is underperforming compared to Finland as whole (OECD 2010).

An underperforming labour market has led to a high proportion of young working aged people leaving Kainuu for work and further education (Heikkilä & Pikkarainen 2010). Additionally, the withdrawal of the University of Oulu campus in 2013 means there is no undergraduate education options in the region (OECD 2017). This has led to a lower than average share of highly skilled labour force, further contributing to population change (OECD 2017).

Limited road networks and large distances from other regions limit Kainuu's attractiveness for investors, labour mobility and ability to participate in other economic markets. Further, potential investors and businesses face barriers in Kainuu as the region does not have a large metropolitan centre, and lacks business knowledge and services (OECD 2010). These challenges have contributed to a cycle of loss of human capital and the under-utilisation of the labour force.

Intra-regional migration from the rural areas of Kainuu to the capital Kajaani is also common, creating uneven population shifts within the region itself (OECD 2010). National trends saw rural populations migrate away from Kainuu to urban centres in Southern and South-Western Finland. However, this also occurred within the region and between 1960-1980 Kajaani was the only municipality that recorded positive net migration in Kainuu (Karjalainen 1989). The population of Kajaani grew in the early 1990s, before experiencing a decline after 1994 (Statistics Finland 2019).

High levels of out-migration as a consequence of an underperforming labour market, combined with natural decline, has led to an ageing and declining population in Kainuu. The implications of these challenges include a declining tax base and a higher demand for high cost services, and thus a dependency on government funding for the public sector. Kainuu relies heavily on subsides from the national government to service its ageing population (OECD 2010). Further, due to uneven population change within Kainuu, demands for services often differ between municipalities.

Policy response

In response to the outcomes of uneven population change across Kainuu, a new regional government was established, in attempt to increase the efficiency of public service provision and to

develop the regional economy (Haveri, Airaksinen & Jäntti 2015). Described as a 'self-government experiment', (Haveri, Airaksinen & Jäntti 2015, p. 1), the region rescaled decision-making from the local and national levels to an elected council at the regional level from 2003-2012. Previously, to deliver services across the region cooperation strategies between municipalities in Kainuu were undertaken. Cooperation strategies also included local economic development strategies. However, this approach often resulted in 'slow and unreliable decision-making' (Haveri, Airaksinen & Jäntti 2015, p. 33). The self-government experiment sought to restructure this network approach into a hierarchical governance model with more efficient decision-making powers (Haveri, Airaksinen & Jäntti 2015). Several concerns led to the self-government experiment, including population decline (absolute decline), an ageing population and a financial crisis.

Under the experiment, the regional council made decisions about services including health care, social welfare and secondary education. The 'Happenings' programme, based upon a client perspective model, was designed to identify health care needs across the region (OECD 2010). Open forums were undertaken in all municipals with the regional health care team, service providers and residents. The regional council worked with the residents to identify the most important health concerns. Community-tailored solutions were developed to increase the quality, efficiency and availability of health care (OECD 2010).

To develop the regional economy, the council also made budget decisions regarding funding for economic development initiatives for new businesses and new jobs (Haveri, Airaksinen & Jäntti 2015).

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The experiment was successful for the increasing the quality and availability of social and health care services. As service costs differed between the municipalities, under the old model some areas

experienced problems in providing services, and this was predicted to become more severe as the population aged. By rescaling local services into one regional organisation and then distributing across the municipalities according to need, service costs were reduced by almost 50%. (Haveri, Airaksinen & Jäntti 2015). Before the experiment, health care expenditure was often higher than the national average. During the experiment, health care expenditure was below the national average. Further, within the new structure, local health care managers and workers were afforded more time to enhance the quality of their services. Overall, the regional council changed the way services were provided across the region to respond to the changing needs of the ageing population, and this model is still used in Kainuu today.

However, the experiment failed to boost the economy or support any regional economic growth over the eight years. It was found that despite the regional council gaining power to allocate economic resources for regional development, resources were allocated in much the same way as before the experiment. Decision-making powers were meant to be transferred from the central government to the regional council to aid regional development, however this was not properly implemented. Thus, no new or innovative economic initiatives were undertaken. Additionally, it was found that the allocation of resources was too heavily focused on the central areas, despite the regional council aiming to also develop rural areas. It was concluded that one model of regional governance was not suitable for both delivering services and promoting economic growth (Haveri, Airaksinen & Jäntti 2015).

Key findings

- The region is already experiencing ageing and decline
- Accepting policy strategy to manage the consequences
- Local governments can work together to provide more efficient services
- New initiatives must be backed up by actual changes (i.e. decision-making powers for regional development strategies).
- Regions like Kainuu which are declining due to ingrained economic structures (i.e. reliance on primary sector) can focus on accepting strategies to manage the effects of population change.

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Combined Strategies

North Denmark – white economy and telehealth

Denmark has three levels of government; central, regional and municipal. At the beginning of 2020, the population of North Denmark was 589,936 (an increase of 0.98% since 2008). In 2008, Denmark underwent a reform, reducing its number of municipalities and creating five distinct regions. North Denmark is Denmark's most northern and sparsely populated region, which has 11 municipalities and an area of 7,933 km². Aalborg, the largest city and municipality in the North Denmark region; had a total population of 217,075 in 2020, an increase of 0.89% since the restructuring of municipal areas in 2008 (Statistics Denmark 2020).

In 2018, population loss from North Denmark to other regions in Denmark exceeded in-migration (-463) however, the region as a whole was growing due to international migration (+1547). In 2018, the difference between deaths and births was 388, so North Demark is still experiencing natural increase. However, the region's growth is dominated by international migration. At the start of 2020, the median age in the region was 42.9 (Denmark's median age was 41.8) and the total fertility rate for women aged 15-49 years in 2019 was 1.75, which has decreased from 1.93 in 2008 (Statistics Denmark 2020).

Denmark enjoys a universal health system with free and equal access to public health and social care, funded by proportional income tax from national and local budgets (Forde et al. 2016). Denmark spends around 10.6% of its GDP on health care, which is one of the highest of OECD countries (the average is 9.0%) (Forde et al. 2016). In Denmark, the responsibility for the provision of health care and social services is shared between regions and municipalities. The responsibilities of the region include hospital and psychiatric treatment, primary health care and public health (GP, private practising specialists, adult dental etc), while the municipalities are responsible for social services, aged care and long-term care and rehabilitation (Forde et al. 2016). Denmark has a history of innovation in health care, with less hospital time and faster discharge times compared with other OECD countries, and close cooperation between health services and governments (Forde et al. 2016).

<u>Economic profile</u>

In 2020, North Denmark's GDP per capita was €44,300, compared with a national average of €52,000 (Eurostat 2020). In 2018, the unemployment rate in North Denmark was 4.4%, compared to a national rate of 3.9% (Jürgensen 2019).

In 2020, the top five industries in North Denmark: (Statistics Denmark 2020)

1. Public administration, education and health (551M €)

2. Trade and transport (396M €)

3. Manufacturing (323M €)

4. Dwellings (211M €)

5. Construction (197M €)

Drivers of population change

North Denmark is a spatially isolated peripheral region, and around one third of the population live in rural areas, i.e. towns with less than 1000 inhabitants (Vestergaard et al. 2011). North Denmark experiences spatially uneven population change across the region. While growth is occurring in the urban municipality of Aalborg, eight of the eleven municipalities have declined since 2008 (Statistics Denmark 2020). This is mostly due to youth out-migration to Aalborg and larger urban centres of Denmark for education and job opportunities (Vestergaard et al. 2011).

Another significant challenge for North Denmark is ageing. The total proportion of the population aged over 65 in the region has increased from 16.7% to 21.7% from 2008-2020 and those aged over 80 has increased from 4.4% to 5.2% (Statistics Denmark, 2020). The median age for the region of North Denmark is the third highest and higher than the national average (Statistics Denmark 2020). These figures are projected to grow, alongside increased life expectancy and a declining birth rate (Evans, Nistrup & Pfister 2018).

Outcomes and implications

A significant consequence of an ageing population and increased life expentancy is the growing prevalance of older people with chronic diseases and age-related illnesses, resulting in pressure on the health system (Evans, Nistrup & Pfister 2018). Specifically, a rise in noncommunicable diseases (diseases with a slow progression and long duration) which require long-term management will result in a signficant strain on resources (Healthcare Denmark 2018). As Denmark's healthcare system is predominately funded by the tax system, governments must find a way to support an ageing population with a shrinking tax base. Thus, current health care models in Denmark and the high quality of care may not be financially sustainable in the future.

The consqeuences of ageing also have spatial consequences, as rates of ageing is higher in spatially isolated areas. Thus, the rural areas of North Denmark will face significant challenges with maintaining their level of health care, particularly with a shrinking tax base fuelled by out-migration (Vestergaard et al. 2011).

Telehealth (telemedicine, ehealth, digital health) is considered a pertinent solution to address the challenges of ageing and declining populations, by offering smarter, more efficient services to relieve pressure on the system (The Danish Agency for Digitisation 2012).

Denmark is at the forefront of international efforts to use telehealth care. In 2012, Denmark established a national action plan on telemedicine and approximately 11 million euros was allocated for various initiatives (The Danish Agency for Digitisation 2012). In 2014, the national government established a database called the 'Telemedicinsk Landkort' (Telemedicine Map). The database contains information on Denmark's progress and specific telehealth initiatives across its five regions (Kierkegaard 2015). In 2018, the national government launched the Digital Health Strategy 2018-2022 which built upon the Denmark's internationally renowned progress for digital health solutions (Ministry of Health 2018). The Digital Health Strategy focuses on a holistic approach to health with the aim to form an integrated network between hospitals, GPs and other health services using IT solutions (Ministry of Health 2018).

Telehealth can include IT-based methods for communication between healthcare workers or with patients, via telephone or video calls, electronic monitoring equipment or online portals (Larsen et al. 2016). Telehealth has to potential to provide high quality, patient-centred healthcare, alongside reducing pressures on the healthcare system (Healthcare Denmark 2018). Telehealth care can increase the patients' knowledge of their condition, their capacity for self-care and potentially reduce their need for hospitalisation (Healthcare Denmark 2018). Telehealth is also useful for spatially dispersed areas, as health care professionals can communicate with patients remotely (Kierkegaard 2015). However, telehealth requires significant investment into IT, strong administrative frameworks, close coordination between hospitals, GPs and specialists, and collaboration between all levels of government (The Danish Agency for Digitisation 2012).

The Telehealth North project trial was established in North Denmark in 2011, with home monitoring project for COPD (chronic obstructive pulmonary disease) patients across the region. The participants in the program included the patients, the regional authority, the municipalities, GPs and four hospitals. The aim of the project was to trial the new integrated care model with the intention to expand to other types of diseases and patients (Healthcare Denmark 2018). As COPD is a progressive disease that worsens over time and a leading cause of death worldwide (Lilholt, Hæsum & Hejlesen 2015), telehealth and home monitoring can allow patients to track their symptoms more closely which may result in early intervention (Healthcare Denmark 2018).

The program provided patients with a Telekit (a tablet, a blood pressure monitor, a fingertip pulse oximeter and a health precision scale) to self-measure indicators while health professionals monitored the data externally (Healthcare Denmark 2018). The patient also responded to health questionnaires regarding their symptoms, which was sent to health professionals in real time. GPs or nurses also attended the home if needed, eliminating the need for hospital visits and reducing the strain on the system. The initiative also included video consultations and access to training to provide patients with information about their condition. A key feature of telehealth intiatives is the sharing of information between different health services. Home monitoring allows the data 'to follow the patient', which requires a well-functioning framework and strong collaboration between health care providers (Healthcare Denmark 2018, p. 9).

Between 2013 and 2018, telehealth home monitoring was used for approximately 1,400 COPD patients. An evaluation found that the patients experienced an improved quality of life over the course of the program, and the number and length of hospitalisations decreased by 11% and 20% (Healthcare Denmark 2018). A majority of patients reported they felt they had more control of their disease (61.7%), found the system easy to use (96.0%) and half of the patients felt they were proactive and had a better awareness of their symptoms (50.0%) (Healthcare Denmark 2018).

Based on the success of COPD home monitoring, the telehealth program has been expanded for use with heart patients across the North Denmark region. During the initial process of treatment and medication, the hospital is involved with monitoring data collected at home and can respond to deterioration of the patients condition. After the initial process, the self-monitoring continues but the responsbility for monitoring the data is transferred to health services at the municipal level (who are responsible for long-term care and rehabilitation) (Healthcare Denmark 2018). This helps to alleviate pressure on the hospital system, and provide long-term support with symptoms that would not exist without telehealth. However, this program is yet to be formally evaluated (Healthcare Denmark 2018).

Key findings

- Denmark has a high quality, publicly funded health-care system.
- This system was projected to become financially unviable as the population experiences ageing and was anticipated to be exacerbated given spatial implications.
- Telehealth care is offered as a solution to improve efficiency in health care and provide good quality services, particularly in spatially isolated areas.
- Telehealth initiatives were introduced and led by the national government, before becoming the responsibility of the regional bodies and local municipalities.

- The initiative requires strong collaboration between stakeholders: cooperation between national/regional and local governments, and between healthcare providers and services.

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Parkstad Limburg, The Netherlands – revitalisation and repurposing the built environment

Parkstad Limburg is a southern conurbation in the province of Limburg, the Netherlands with a total area of 211 km². Parkstad Limburg consists of eight municipalities, with a total population of 244,105 in 2018 (CBS 2019b). The population of Parkstad Limburg reached its peak around 1990 with 267,989 people, however started to decline in 1997 and is experiencing absolute decline (CBS 2019b). Heerlen is the largest city of Parkstad Limburg with a population of 86,832 in 2018 (Heerlen peaked at 95,149 people in 2000). In 2016, the median age within the eight municipalities ranged between 44.2 and 46.1 years.

The Netherlands has three levels of government, national, provincial and municipality. In 1999, Parkstad Limburg formed as an informal regional authority to work together to improve public services, transport and housing (OECD 2014).

Economic profile

In 2020, GDP per capita in South Limburg was €40,776, compared to a national average of €44,920 (CBS 2020). Unemployment in the province of Limburg was 4.7 in 2017, compared to a national average of 4.4% (CBS 2017).

In 2019, the top 5 industries in South Limburg were: (CBS 2019a)

1) Government and care (public administration and services, education, health and social work) (852M €)

2) Manufacturing (706M €)

3) Wholesale trade and retail, transport, accommodation and food (543M €)

4) Business services (331M €)

5) Information and communication (295M €)

Drivers of population change

Around 1900, the southern area of the Netherlands transitioned from an economy dominated by agriculture to a region driven by mining and the export of coal (Reijnders, Krishnamurthy & van Tetering 2017; Van Bon 2016). Over the next 50 years, the population in South Limburg grew from 282,000 to 728,000 and the region was one of the wealthiest areas in the country in the 1950s (Beunen, Meijer & De Vries 2020). As a result of industrialisation and strong economic and demographic growth, the municipalities of Parkstad Limburg were transformed from small, rural townships into a fragmented conurbation.

However, in 1965 after recognising the impact of international competition on the mining sector (the region's share of solid fuels fell from 51% to 16%), the national government closed its state mines within the region, and within 10 years private mines were also closed (Reijnders, Krishnamurthy & van Tetering 2017). (Reijnders, Krishnamurthy & van Tetering 2017). As a result, around 45,000 people became unemployed and the unemployment rate was twice as high as the national average (Van Bon 2016). Initially, some government services were redirected to South Limburg (such as Statistics Netherlands) in attempt to counteract unemployment, however there was a skill mismatch between blue collar (former mine workers) and white-collar employment (Westerink et al. 2017).

The mining industry collapse and economic decline resulted in high unemployment rates and economic decline, but initially, the population continued to grow. In 1997, Parkstad started to experience decline, mostly due to an out-migration of youth for education and employment reasons (Elzerman & Bontje 2015). Areas of Parkstad have some of the lowest wages in the Netherlands, with higher educated workers receiving between 10 and 25 percent less than the national average (Westerink et al. 2017), a significant incentive for youth out-migration.

Outcomes and implications

Depopulation in Parkstad Limburg has resulted in significant housing issues, including an overcapacity of houses and a mismatch between demand and supply, changes in type of housing needed, and the decay and degradation of buildings (Verwest & van Dam 2010). Housing prices are between 25 and 50 percent lower than the national average (Westerink et al. 2017), and properties stay on the housing market much longer. Between 1999 and 2007 the average length of time properties stayed on the market increased by 384% (compared with 112% in the Netherlands) (Verwest 2011). The proportion of rented social housing that remains vacant for more than three months is also higher in Parkstad (Verwest 2011). However, a relaxed housing market can have some positives for example for housing prices, first-home buyers and low rental prices (Verwest 2011).

Population decline (alongside economic factors such as e-commerce) has resulted in shrinking city centres in the region with high rates of vacancy, degraded buildings and public spaces, and excess infrastructure (Van Bon 2016). The urbanised nature of Parkstad Limburg means that there are overlapping catchment areas between cities/towns, which has led to an oversupply of retail and increased competition between municipalities (Van Bon 2016).

<u>Policy responses</u>

Parkstad Limburg is an example of a region that initially ignored population decline (non-intervention). In response to deindustrialisation, governments were focused on strategies to attract both economic and demographic growth. After national and provincial governments recognised the need for local and regional governments to address depopulation, the region then started to develop strategies to accept and manage the consequences of decline, in conjunction with countering strategies (a combination approach). Since, a series of fragmented but sometimes overlapping initiatives have been undertaken by various governmental and non-governmental actors within the region.

<u>1997-2006: Non-intervention and countering strategies</u>

Although depopulation began within the region in the 1997, in 1990s all levels of government ignored decline. In 1999, in response to ongoing economic decline, eight municipalities in the South Limburg region formed a voluntary inter-municipal arrangement called Parkstad Limburg, specifically to collaborate in the areas of housing, infrastructure, transport and urban development (OECD 2014). Initial policy responses were growth-focused and aimed at attracting new inhabitants through events and advertising, building attractive houses and shopping malls, and creating an attractive labour market (Westerink et al. 2017). One strategy consisted of increasing the capacity of housing stock under the assumption that new houses would attract more people (Verwest & van Dam 2010). However, increasing housing stock only increased the competition between municipalities within the region, opposed to attracting new residents as it intended (Verwest & van Dam 2010).

After 2005, governments began to acknowledge population decline was also occurring (Verwest 2011). However, tensions existed between the provincial/regional governments and municipal governments, as the latter wanted to continue to grow and attract people to their local areas. In 2006, the municipalities of Parkstad Limburg coordinated their housing plans in response to oversupply, however the strategy predominately argued that less new houses were needed (Verwest & van Dam 2010). It was also identified that housing stock and spatial environments needed to be improved and redeveloped to 'counter the exodos of existing residents and attract new people' (Verwest 2011). In particular, the strategy focused on developing new housing concepts to attract well educated and high-income earners. However, while overall the region did intend to reduce housing stock in response to less demand, in reality, individual municipalities did not adjust their plans to reflect depopulation trends (Verwest 2011).

In 2007, the province of Limburg identified that shrinkage within the housing market indicated that the focus of strategies should be on the qualitative growth and improvement of housing opposed to quantitative growth. In 2009, the national government developed an action plan 'shrinking with quality' which identified that depopulation needed to be addressed at the municipal level, in coordination with the region and province.

Also in 2009, a regional agreement called the Pact of Parkstad was formed to collaborate on spatial planning and housing policies in the region (Westerink et al. 2017). This included the demolition and redevelopment of housing to match demand and improve the quality of housing stock, an accepting policy response (Verwest & van Dam 2010). The agreement stated that between 2008 and 2020, between 6,000 and 14,000 houses should be demolished, and around 12,000 needed to be restructured (Verwest 2011). However, there are challenges associated with the private ownership of these properties (Elzerman & Bontje 2015) and it is unclear how many houses have been demolished or redeveloped in this time period. In a cost-benefit analysis, it was estimated to cost around €285 million to redevelop houses in the five neighbourhoods most affected by shrinkage, and around €2.6 billion to redevelop houses in the entire region (with the social housing and private housing sectors responsible for around 50% of costs each) (Elzerman & Bontje 2015). Elzerman and Bontje (2015) suggest that a restructuring program should be undertaken, and the provincial government is in the best position to manage a program of this scale. However, those with the weakest financial assets will have the least power to negotiate, e.g. the municipality and homeowners (Elzerman & Bontje 2015). Housing corporations and private developers are two other actors within the housing sector may hold significant negotiation power (Elzerman & Bontje 2015). As semi-public housing corporations own and manage most rentals within the region, local governments are required to collaborate with these entities on housing policy (Westerink et al. 2017). Thus, for successful interventions to occur, there needs to be support and involvement from all actors: governments at all levels, housing corporations, private developers and citizens.

Recent initiatives to address the consequences of shrinkage in the city centres of Parkstad include both government policies and collaborations between governmental and private actors. The 'Bidboek urban Heerlen' is a 2016 policy initiative led by the Heerlen municipal government (Eck 2019). The policy recognises that to revitalise city centres in the face of depopulation, the focus must be on adjusting land use policies and improving urban heritage. The policy aims to reduce retail floor space by 40% and transform vacant or degraded land for other uses such as housing, food facilities, multifunctional public areas, or greenspaces (Eck 2019; Urbact Local Group 2018). Further, owners

must report to municipality if their buildings are empty for 3 months or longer, and subsidies exist for companies who start a business in buildings that are vacant for longer than 6 months (Eck 2019). Further, as both shrinkage and e-commerce have changed the nature and function of city centres, customer demands have shifted from buying products to gaining experiences. Thus, strategies should focus on revitalising public and urban spaces to increasing quality of life for remaining citizens. Another way to transform urban centres is through policies that aim to regenerate and maintain cultural heritage. For example, a 'façade fund' of €700,000 was established in Heerlen where businesses receive a compensation of 50% of costs to improve their façades and shopfronts (Eck 2019). While these policy initiatives aim to manage the spatial consequences of shrinkage, there is still an emphasis on attracting visitors to the city centre to generate economic growth (Eck 2019).

Another policy intervention in Parkstad Limburg is governmental collaboration with stakeholders such as societal actors, private companies and citizens. For example, for projects related to the revitalisation of city centre of Heerlen, an organisation called Heerlen Mijn Stad (Heerlen My City; HMS) was formed, to facilitate communication between the municipality, retailers and other stakeholders. HMS brought together several stakeholders including public servants, representatives of the hospitality industry, entrepreneurs and business owners, and residents to form an URBACT Local Group (ULG), an initiative of The EU Regional Development Fund (Urbact Local Group 2018). Following the release of the 'Bidboek urban Heerlen', HMS and ULG alongside the municipal government have worked together to implement policy designed to revitalise the urban centre. Major changes are led by the municipality, while smaller projects are undertaken by ULG (Urbact Local Group 2018).

Some initiatives include:

- Removing 40% of retail and 40% of office spaces, and reducing vacancy in the city centre (as outlined in 'Bidboek urban Heerlen')

- Transforming a minimum of 5000m2 of vacant real estate into spaces for creative industries.

- Redesigning squares and public spaces (urban green spaces) e.g. Hotel Park Urban- a pop up park for summer season

- Restore 12 facades and restoring and converting prominent buildings

- Adding 400 homes to the city (100-150~ for students and young people)

- Sports, leisure and recreation: Urban sports areas, street artworks/murals, a cultural cinema

- Environmental: 5000 solar panels and asbestos-free and re-use usable material for recycling during demolition or renovation, bicycle parking facility.

The outcomes as of December 2017 include a reduction of -20,000m2 of retail and -20,000m2 of office space and over 50% reduction of shop vacancy in city centre (Urbact Local Group 2018). While the collaboration between the municipal government and relevant organisations and societal actors is recent and therefore outcomes are yet to be released, several of the other projects are on track for completion, including the transformation of vacant real estate for creative industries, restoration of twelve facades, and both the sports and recreation and environmental initiatives (Urbact Local Group 2018).

The IBA (Internationale Bau Ausstellung) is a collaborative organisation that hosts bottom-up projects and citizen-led strategies for Parkstad Limburg at a regional level (Westerink et al. 2017). Citizens and societal actors are invited to apply to the IBA and receive support in the form of access to resources and the IBA network, and subsidies. Themes include renewable energy, re-use of sites and materials, and temporary land use (Westerink et al. 2017). An example of an IBA project is called Superlocal, which aims to reuse resources from three vacant ten story flats to construct new social houses and public spaces in the city of Kerkrade (Reijnders, Krishnamurthy & van Tetering 2017). Three new houses made of 90% reused and remanufactured materials from the former flats have been constructed as a pilot project (Durmisevic 2019). While financial and economic benefits were reported, time efficiency was less certain (Durmisevic 2019). The IBA and Superlocal project demonstrate that alternative policy approaches have the potential to address the consequences of shrinkage in less conventional ways, led by citizens.

Key findings

- Regions will most likely go through different stages of policy response types, from non-intervention, to countering, and then accepting approaches, or a combination of both countering and accepting.
- Leadership is integral, national and state/provincial governments must acknowledge the reality of the situation and lead the way for decline to be managed at a municipal/local level.
- Policy responses may be fragmented and can involve many different actors, including all levels of government (national, state, local), private actors and citizens.
- Citizen-led approaches can be used as alternative/ less conventional policy responses

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Heigh-ho, heigh-ho, it's off to work we go – the Fourth Industrial Revolution and thoughts on the future of work in Australia

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Abstract

The Fourth Industrial Revolution (4IR) suggests significant transformation of the Australian economy with predictions of 'technological unemployment'. Combined with other significant economic, demographic and social shifts, it is inevitable that future of work will change. This paper applies industrial revolution scholarship to contribute new empirical insights into the transformation of Australia's economy between 2006 and 2016 and evaluate Australia's progress in the 4IR. The paper also introduces gender as a largely missing component in industrial revolution scholarship. Adapting the shift-share method of analysis to ABS Census data, the paper attributes the change in the share of employment and industry restructure over the decade to four factors: national economic growth, industry (re)structure, employment composition, and within industry employment composition. The paper finds that while job growth occurred in the decade to 2016, it was largely driven by a national growth effect associated with increasing consumption and the industry effect associated with the rise of the services sectors and the changing social organisation of care, rather than innovation and technological advancements. Job destruction, on the other hand, is evident in industry sectors associated with the 4IR; the replacement of jobs by automation and artificial intelligence to increase competitiveness and productivity. To transition to the phase of job creation in an industrial revolution, Australia needs socio-political intervention to address four key issues.

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Introduction

Current public discourse regarding the future of work and the Fourth Industrial Revolution (4IR) invites anxiety (Morgan 2019), implies determinism (Nübler 2016) and fails to acknowledge the socio-political role required in shaping the future of work (Perez 2012b). Instead, the collective framing of a future of 'technological unemployment' is at risk of becoming a self-fulfilling prophecy.

The 4IR suggests significant transformation of the Australian economy. Within that structural change some industries will decline, others will grow, and all will undergo some form of change. Combined with other significant economic, demographic and social shifts, it is inevitable that future of work will also change.

This paper reviews industrial revolution scholarship and applies Perez' three phases of shifting techno-economic paradigm (Perez 2004, 2010); the International Labour Organisation's (ILO) theories of capabilities for productive transformation (Nübler 2014b), and Nübler's framework for achieving a golden age of job creation (2016), to contribute new empirical insights into the transformation of Australia's economy between 2006 and 2016 and evaluate Australia's progress in the 4IR. The paper also introduces gender as a largely missing component in industrial revolution scholarship.

Adapting the shift-share method of analysis (Arcelus 1984) to ABS Census data, the paper attributes the change in the share of employment and industry restructure over the decade to four factors:

1. National economic growth
2. Industry (re)structure
3. Employment composition
4. Within industry employment composition

The paper finds that while the Australian economy grew and jobs were created over the decade, job destruction occurred in the industries associated with the 4IR, particularly for men, and particularly for those employed full-time in the manufacturing sector, consistent with the 'disappearing working man' phenomenon (Rozner 2017). Both the share of Gross Domestic Product (GDP) and employment increased in sectors not directly associated with the 4IR; over a quarter of the total growth in employment was in the health care and social assistance sector (27.6 per cent), followed by education and training (16.0 per cent), mostly women employed full-time or part-time. This growth is more likely to be explained by the rise of the services sector (Autor & Dorn 2013; Gallie 1991, 2017) and, more specifically, the care economy resulting from changes to the social organisation of care (Dwyer 2013).

In addition, the shift to part-time work for both men and women indicates further risk of job destruction and widening inequality. The findings also show that some industry sectors remain highly gendered, however, a positive within sector effect is evident for women in the construction, mining and utilities sectors, traditionally considered male-dominated industries.

The structure of this paper is as follows. begins with an overview of the transformational process of an industrial revolution, followed by details of the

empirical approach used to analyse Australia's progress in the 4IR and then presents the findings. The paper then discusses the findings in relation to the literature and public policy in Australia, before concluding with thoughts on the future of work in Australia should current trends continue.

The process of industrial revolution

In Australia, recent literature pertaining to the current 4IR, defined as an extension of the third (digital) revolution to the convergence of digital, biological, and physical spheres (Schwab 2016), is largely dominated by a plethora of grey literature from business consultancy groups[1] focused on the implications of digital disruption and the FIR at the micro level – jobs and skills[2] –, or the meso-level – business model innovation to increase productivity[3] –, rather than the wider, macro-level strategic process of potential socio-economic transformation that the FIR could enable (CEDA 2018; Dean & Spoehr 2018). There is however, extensive scholarship pertaining to the process of industrial revolution.

Like history, the process of an industrial revolution repeats itself; a long wave transformation which plays out over half a century, give or take a decade (Atkinson 2018; Perez 2004, 2010, 2012b; Soete 2018). The historical cycle of an industrial revolution is a three-phase process involving job destruction (Phase 1) and job creation (Phase 3) with a turning point, or adjustment phase, sandwiched between the two (Perez 2010). Perez describes an industrial revolution as 'the vast diffusion of what was once an invention into a socio-economic phenomenon' requiring a new 'techno-economic paradigm' (Perez 2010). To warrant revolutionary status, Perez and others (see for example Atkinson (2018); Hofheinz (2018); Nübler (2016); Soete (2018)) argue that new technologies in the market must have the capacity and capabilities to profoundly transform the rest of the economy and, eventually, society. This long wave transformation and ultimate diffusion consists of three phases culminating in a 'great surge of development'. Commencing with the installation period associated with the adoption of new technologies into business systems, led by finance and free markets, in the quest for increased productivity and competitiveness, this phase is also associated with job destruction. The third phase is the deployment period which is associated with job creation whereby the full benefits of the technological revolution are spread across the economy and society. Between these two phases sits an adjustment period which is accompanied by resistance to change, inertia, social dishevel, rising inequality, regional disparities and economic stagnation, eventually becoming a critical issue which requires socio-political intervention. Perez and others (listed above) argue that the adjustment period is not a passive process and cannot be left to the markets to determine. The period of this interval lasts as long as it takes to establish the institutional framework required to fully capture the potential of

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1   See for example Bankwest Curtin Economics Centre (2018); Deloitte (2019); Hajkowicz et al. (2016); Reeson et al. (2016); Seet et al. (2018).
2   See Morgan (2019) pages 12 to 15 for a critique of 'consultancies, think tanks and modellers' contribution to the literature and policy making relating to the Fourth Industrial Revolution.
3   See for example Australian Industry Group (2019); CEDA (2012); McKinsey & Company (2019); Prime Minister's Industry 4.0 Taskforce (2017)

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the new techno-economic realm; it needs to be shaped by government regulation and policies. The level of political consensus, conflict or confusion strongly influences the speed and the ease or difficulty with which the surge of development and growth is established. Given that changes in an economy usually happen at a much faster pace than institutional reform, according to Perez these adjustment phases have historically been long and difficult – two to three decades – and accompanied by considerable social costs.

While Schwab (2016) suggests the world is currently progressing through the Fourth Industrial Revolution (4IR), claiming 'We stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before', others disagree. Perez (2010) argues that advanced nations are currently experiencing the adjustment period of the fifth industrial revolution while Atkinson (2018) argues the world is on the cusp of the sixth industrial revolution, having not fully realised the potential of the fifth given the inability to achieve the socio-political transformation required. He suggests that the next industrial revolution will 'likely be grounded in AI, robotics and perhaps nanotechnology and biotechnology' similar to Schwab's (2016) definition of the 4IR; the convergence of digital, biological, and physical spheres. Both Perez and Atkinson agree that the first industrial revolution of mechanisation in the 1770s was followed by steam and railways in the 1830s, steel, electricity and heavy engineering from 1875, oil, the automobile and mass production from 1908 and then the fifth, the age of information and telecommunications, from 1971. Each of these transformations followed the same installation, adjustment and deployment process outlined above whereby a new socio-political paradigm was required to fully realise the growth potential associated with each new techno-economic opportunity.

While technological advancements have the potential to revolutionise the economy and society, the argument that this will result in persistent 'technological unemployment' is contested (Anderson 2009; Atkinson 2018; Barany & Siegal 2015; Montresor 2018). Predictions for the future of work suggest significant transformation of the type, and content, of jobs available in the labour market resulting from economic restructuring, as has occurred in previous revolutions, however the focus on technology as the determinant of the structural change in the wider employment market leads to a narrow explanation of change over time (Fernández-Macías 2012). Atkinson (2018) argues future job creation will be based on consumption patterns, largely related to greater expenditure associated with higher incomes resulting from increased productivity and wealth generation during the deployment phase of the industrial revolution process. Additional factors include, but are not limited to, higher levels of educational attainment and labour force participation, the age structure of the respective populations, the level and type of immigration and the type of welfare state (Baum 1997; Goos & Manning 2007; Hamnett 1996; Murphy & Oesch 2018; Oesch & Rodríguez Menés 2010). Another perspective is that of the rise of the services sector (Autor & Dorn 2013; Gallie 1991, 2017) and, more specifically, the care economy resulting from changes to the social organisation of care (Dwyer 2013), closely linked to changing household consumption. Howcroft and Rubery (2018) further argue that

the changing nature of work has gender-specific impacts and that emerging forms of work reinforce gender inequalities, however, they do note that these issues are not related to technological advancement per se but to institutional frameworks and associated regulatory environments and policies. They suggest that the 4IR presents a timely opportunity to propose a rethink of both the structures of employment and the forms of work as well as the division in both paid and unpaid work between men and women.

Perez suggests that most advanced nations are on the cusp of the deployment period, the turning point of the revolutionary process which will eventually lead to job creation and wider wealth generation. However, to progress to the job creation phase, the increasing mismatch between the economy and the regulatory systems created during the installation phase needs to be resolved. The installation phase is a market driven process which involves the often rapid and intense adoption of new technologies into business models and practices with the aim of increasing productivity and remaining competitive in a global market, usually with a short term focus (Dean & Spoehr 2018; Nübler 2016; Perez 2010). This often includes new production techniques, diversification, changes in the organisation of work, cost savings and labour-saving processes and, as such, is associated with job destruction. This period is characterised by unintended consequences such as increasing job and skill mismatches, obsoletion of qualifications and training, unemployment, income and wealth polarisation, jobless economic growth and within nation economic and social divergence (Perez 2010). This period is also referred to as incremental or process innovation, or the imitation or adoption of new innovations rather than new product innovation itself which is considered to be the primary mechanism driving initial structural change and an ensuing industrial revolution (Nübler 2016). While some argue that the current revolution is data driven and that the global economic base has shifted from one dominated by the production of physical capital, to one of servicisation and intangible products (Hofheinz 2018; Soete 2018), Nübler (2016) suggests that it is product innovation which is primary mechanism for structural change and eventual job creation and further argues that product innovation is dependent on a strong manufacturing base. She provides evidence that those nations with diverse and sophisticated manufacturing bases are more dynamic and better positioned than services-based economies to revolutionise their economy and society and that this potential is underpinned by a nation's Educational Attainment Structure (EAS) (Nübler 2014a, 2016).

Despite widespread process innovation globally, productivity has not yet increased at the level expected to shift the transformation into the deployment phase whereby productivity gains are distributed more widely in society and job creation ensues (Gordon 2016; OECD 2015; Productivity Commission 2016). This is somewhat explained by the increasingly networked and expanded global market, and the speed at which new technology, largely digital rather than traditional manufacturing innovation, is applied and exploited, keeping downward pressures on costs to maintain competitiveness (Soete 2018), thus preventing product innovation.

Nübler (2016) expands on Perez' (2004, 2010) techno-economic paradigm for achieving economic and societal prosperity associated with industrial revolutions to

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develop a framework for achieving a 'golden age of job creation'. This framework is underpinned by the International Labour Organisation's Theory of Capabilities for Productive Transformation (Nübler 2014b) arguing that the theory contributes to a better understanding of the link between education, training and technological learning on the one hand and economic growth on the other; facilitating the revolutionary opportunities attached to technological advancements.

Essentially, Nübler argues that revolutionary opportunities are endowed within a nation's productive capabilities. These include the physical capacities; production factors and infrastructure, and the social capabilities; the collective knowledge base and the institutional framework, which enable transformation. While some nations may share similar physical capacities, it is the intangible capabilities, which differ among nations, that facilitate the level of innovation and economic diversification possible. It is these capabilities which also shape future structural change. Nübler (2014b, 2016) argues that it is the combination of productive capabilities which are the major determinants of the job creation adjustment process. In particular, she argues that it is the competence of the labour force; the nature and knowledge base, combined with the institutional framework of the society; the rules, regulations and policies, which determine the performance and progress of an economy and society during an industrial revolution. ILO research into the difference in competence of labour forces identified that different knowledge bases, measured by the educational attainment structure (EAS), explains differences in industry structures and therefore economic performance, and that it holds for both developing and developed countries. Nübler (2014a) argues that the EAS, rather than educational levels, is the most significant determinant of the pattern of industrial development and growth. As such, the EAS represents an important carrier of capabilities to diversify, develop and achieve growth. Defined as the share of the labour force based on educational attainment, EAS, can be further defined according to its shape along a bell curve. Capabilities to innovate and develop new products are therefore influenced by the particular mix of educational, vocational and technical competencies, which increase with the diversity and complexity of the knowledge sets embodied in the labour force.

'Strong middle' EAS are those with relatively higher shares of vocational and technical education and training. This EAS provides the widest range of options for developing and diversifying industry structures associated with a technological revolution.

'Missing-middle' EAS are polarised and present with relatively lower shares of vocational and technical education but higher shares of schooling and tertiary education. According to Nübler, missing middle EASs provide limited options for advancing technological revolutions as the labour force lacks the broad supply of complementary occupations required in addition to tertiary qualified managers and professionals. Rather, the relatively higher tertiary education share provides options to develop advanced services such as research and development, finance, tourism, ICT enabled services, and administrative services.

The ILOs comparison of the strong and missing middle EAS shows that these two EAS' result in different patterns of industrial development. According to the ILO, the missing middle countries are limited in expanding their manufacturing base,

and industrialise by expanding sophistication in services, however, the ILO suggests that even the highest performing missing middle countries cannot achieve the levels of sophistication within manufacturing than can be achieved by the strong middle nations. Further, EAS tends to reflect income and wealth distribution in society, and missing middle EAS are often found in countries with high inequalities (Nübler 2014a). These findings are also consistent with the literature on over-qualification associated with the expansion of higher education (see for example Figueiredo et al. 2015; Holmes & Mayhew 2015, 2016; Lloyd & Payne 2016), skill utilisation (see for example Felstead, Gallie & Green 2017; Keep 2017; Livingstone 2017; McGuinness, Pouliakas & Redmond 2017; Quintini 2011; Smith 2017) and job polarisation (see for example, Barany & Siegal 2015; Cirillo 2018; Coelli & Borland 2016; Denny 2019; Goos & Manning 2007; Montresor 2018; Salvatori 2015) .

The other element for achieving a 'golden age of job creation' is the process of collective learning, including trust in the institutional framework (Morgan 2019; Nübler 2016; Perez 2004, 2012b). The premise of collective learning is that it incorporates not just education from schooling and higher education, but is accumulative, including tacit learning of concepts, rules, procedures and expectations in organisational, social, cultural and economic contexts, not just at an individual level but also at the collective level such as within enterprises, organisation and societal groups. This process of collective learning develops a knowledge structure within society which, according to Nübler (2014b), determines the feasible patterns of productive transformation. In the context of industrial revolution, Perez argues that this process of collective learning also requires unlearning, learning and relearning processes, new rules and regulations and undertaking new training and skill development. Morgan (2019) extends the understanding of the revolutionary process, stating that the diffusion of new technology is subject to the values, principles and mechanisms of society so much so that the extent of diffusion is subject to the response by institutions, rules, laws, behavioural responses, rights and obligations associated with new technology and how society uses it, or rejects it.

The institutional framework which governs the rules and regulations of both the economy and society, forms a critical component of the process to job creation during an industrial revolution. Nübler (2016) argues that institutions are integral in the pace of change, driving the adjustment phase and mobilising support for change whereby the institutional framework generates a sense of justice in society, that the distribution of gains and losses; the unintended consequences of technological advancements associated with the revolution, are considered fair. This has already been recognised in Australia by CEDA (2018), pointing out that 'while businesses adapt to the disruption that new technologies create, governments need to be identifying new regulations to be institutionalised to keep economies transparent and effective'. This includes maintaining trust in the institutional framework. Trust that institutions will respond accordingly in times of systemic failings provides people and society with the confidence and security they need to continue on with their lives, highlighting the importance of institutions being adaptable and flexible to achieve long-term advances in prosperity. Perez (2004) sums up the challenges of the adjustment phase as a process whereby the existing institutional framework becomes obsolete as it was designed

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around a previous techno-economic paradigm, arguing that the persistent application of obsolete practices can actually aggravate society and the economy contributing to a collapse, often in the form of a recession or financial market failure.

Given the long wave creative destruction process (Schumpeter 1942) to widespread prosperity of an industrial revolution, Hofheinz (2018) suggests that the pressing issue now is how do nations prepare for and legislate for an economy where society faces a different set of challenges, problems that will need to be mitigated with a different set of policies, proclaiming "We stand on the cusp of an important decision: will we find and develop the social innovation needed to make the digital revolution a win-win for all?"

The following section outlines the empirical approach to analysing Australia's progress in industry restructuring and socio-economic transformation within the revolutionary process of the 4IR.

Method

In order to better understand the restructuring of the Australian industry base over the decade between 2006 and 2016 and how it may align with the phases of an industrial revolution, this paper adapts the shift-share analysis method first used in regional economics to study the components of regional growth and development (Dunn 1960). Shift-share analysis is an effective method used to isolate structural and compositional characteristics within aggregate change over a period of time (Danko III & Hanink 2018). It has been used extensively to identify sector-level employment change in regions which could be attributable to national, regional or industry factors while controlling for national, aggregate, effects.

This paper uses shift-share analysis to attribute changes in employment in the Australian economy to economic performance, industry structural change, employment composition (labour force participation by men and women), and, adapting Arcelus' (1984) extended shift-share analysis method to disaggregate the industry effect; compositional labour force change within an industry sector. Using ABS Census data for 2006 and 2016, changes in employment in Australia over the decade are attributable to four different effects:

1. National economic growth
2. Industry structure
3. Employment composition
4. Within industry employment composition

The change in employment between two periods is simply the difference in employment levels between period 1 E_1 and period 2; E_2 so that:

$$\Delta E = E_{2-}\,E_1$$

In its simplest form, the shift-share analysis method enables the statistical separation of the main national and industrial forces affecting the change in

employment; ΔE_s^e– the number of men and women employed full-time or part-time (e) for industry (s).

This change in employment can be decomposed to national, industrial and employment composition effects and expressed as follows:

$$\Delta E = NG_s^e + LM_s^e + IS_s^e$$

Whereby, NG_s^e represents the national growth component which is the expected change in employment composition (e) for industry (s) if it grew at the same rate as the total national employment rate. LM_s^e represents the employment composition component – the mix of men and women employed full-time or part-time – which is the portion of the employment change attributed to the difference in employment composition (e) of industry (s) and that of the nation. IS_s^e represents the industry share component. That is, the share of the change in employment attributed to differences in the change in employment composition at industry and national level due to the particular circumstances of the industry. In regional studies, this component is referred to as the 'competitive effect' (Danko III & Hanink 2018) as it illustrates whether a region possesses a competitive advantage in that industry over other regions on a national scale.

In this adaptation, the competitive effect can be equally applied to an industry's competitive advantage in terms of employment opportunities in times of economic restructuring, as in the case of the 4IR. That is, the competitive advantage that an industry sector may offer men or women full-time or part-time employment opportunities.

$$NG_s^e = E_s^e * e^n$$

$$LM_s^e = E_s^e * (e_e^n - e^n)$$

$$IS_s^e = E_s^e * (e_s^e - e_s^n)$$

Where E_s^e is the number employed by employment composition (e) for industry (s) and where e^n is the percentage change in the national employment level, e_s^n, is the percentage change in employment in industry (s) at the national level, e_e^n, is the percentage change in employment composition (e) at the national level and e_s^e is the percentage change in employment composition (e) for industry (s).

Arcelus argues that the competitive effect in its simplest form does not account for regional effects as it is restricted to employment change analysis based on national performance. As such he extends the simple form to disaggregate the competitive advantage effect to include *a regional growth effect* – the part of ΔE attributable to growth of the region – and *the regional industry mix effect* – the part of ΔE attributable to combined regional and industry factors, that is, a within region competitive advantage.

For this study, these regional effects are translated as industry structure effects (I_s^e) and within industry employment composition effects (IM_s^e). The industry structure

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effect identifies the industry share of employment change due to the overall change in employment in the industry and the within industry employment composition effect identifies the share of employment change that is particularly due to the change in employment composition for the industry. Based on this, the industry share component can be redefined as follows:

$$IS_s^e = I_s^e + IM_s^e$$

Arcelus also argues this can be equally applied to the national growth component and the employment composition component; providing a competitive advantage sub-component and a degree of differentiation component.

Arcelus further argued that this simple form of shift-share analysis does not account for the degree of differentiation within sectors and with respect to both the national and employment composition components either. Using Arcelus' extended method each shift-share analysis component is disaggregated into an 'expected' or 'differential' effect (1984, p. 6). The expected effect is the share of employment change that would have been expected that is due to overall change in employment for industry (s) if the industry had the same employment composition as the nation. The differentiation effect is the share of employment change that is attributed to the extent of deviation from the nation for industry (s) and employment composition (e). These effects are calculated based on the concept of 'homothetic employment' (HE_s^e), that is, the employment composition (e) for industry (s) if the structure of the employment in the industry was equal to the national employment structure.

Homothetic employment is expressed as follows:

$$HE_s^e = E_s * \frac{E_e^n}{E^s}$$

Where, E^s is the total employment in the industry sector, E_e^n is the national employment composition and E^n is the total national employment, all for the first period.

Given these extensions, the three shift-share components in equation 2 are calculated as follows:

$$NG_s^e = HE_s^e * E^n + (E_s^e - HE_s^e) * e^n$$

$$LM_s^e = HE_s^e (e_e^n - e^n) + (E_s^e - HE_s^e) * (e_e^n - e^n)$$

$$IS_s^e = HE_s^e (e_s^e - e_s^n) + (E_s^e - HE_s^e) * (e_s^e - e_s^n)$$

IS_s^e is also calculated to account for the disaggregation of the industry effect and the within industry employment composition effect, so that

$$I_s^e = HE_s^e (e^s - e^n) + (E_e^s - HE_s^e) * (e^s - e^n)$$

$$LM_s^e = HE_s^e * [(e_s^e - e^s) - (e_e^n - e^n)] + (E_e^s - HE_s^e) * [(e_s^e - e^s) - (e_e^n - e^n)]$$

Thus, NG_s^e can identify the extent to which employment composition (e) in industry (s) is impacted by national economic performance and the degree of differentiation, or lack thereof, in employment composition (e). LM_s^e can identify whether an industry experienced a shift (positive or negative) ('competitive advantage' in regional studies)compared with other industries in terms of employment composition opportunities as well as the extent to which an industry may be gendered or the workforce standardised (whereby 'standardised' is full-time employment).

Data used for this analysis is drawn from the 2006 and 2016 ABS Census' of Population and Housing (Census). These collections were selected as they represent similar, relatively stronger periods of economic performance compared with 2011. The dataset includes all those Australian men and women employed full-time or part-time by the industry in which they worked[4], as defined by the Australia New Zealand Standard Industry Classification (ANZSIC), at the Division level.

Findings

Over the decade to 2016, an additional 1,385,142 Australians were employed, either full-time or part-time, a growth rate of 16.6 per cent. Part-time employment grew 28.1 per cent, while full-time employment increased by 11.3 per cent, so that the share in full-time employment reduced to 65.4 per cent of the workforce from 68.5 per cent in 2006. Over half of the increase (56.9 per cent) was experienced by women, where employed women increased by 20.4 per cent, compared to a 13.2 per cent increase for men. Part-time employment increased substantially for both men and women, 35.8 per cent and 24.6 per cent respectively. See Table 1.

Table 1. Change in employment composition, Australia, 2006 to 2016

	Percentage change (%)	Share of total employment change (%)
Women	20.4	56.9
Men	13.2	43.1
Part-time	28.1	53.3
Full-time	11.3	46.7
Men, full-time	8.3	22.0
Women, full-time	16.7	24.6
Men, part-time	35.8	21.1
Women, part-time	24.6	32.2

Source: ABS Census of Population and Housing, 2006 and 2016, author calculations.

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4   Those employed, but away from work, are excluded from the dataset as their level of attachment to the labour force (full or part-time) cannot be determined.

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When employment change is considered by industry, substantial restructuring of the economy is evident. While the number of people employed increased for all but three industries (Agriculture, Forestry and Fishing, Manufacturing and Wholesale Trade) the share of employment growth by industry shifted considerably from the traditional industrial sectors to the services sectors. Over a quarter of the total growth in employment was in the Health Care and Social Assistance sector (27.6 per cent), followed by Education and Training (16.0 per cent). Construction (14.9 per cent), Professional, Scientific, Technical Services (12.5 per cent) and Accommodation and Food Services (12.0 per cent) shared the majority of the remaining employment growth, supressed by Manufacturing (-17.5 per cent) and Wholesale Trade (-5.8 per cent).

Figure 1. Percentage change in employment and in employment share', ANZSIC Division 1, Australia, 2006 to 2016
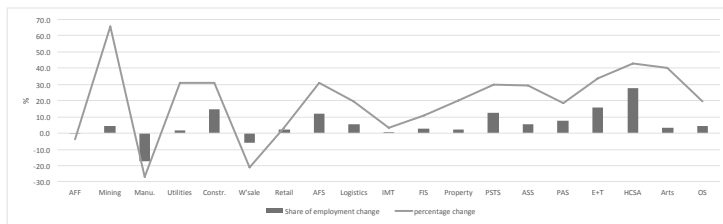
Source: ABS Census of Population and Housing, 2006 and 2016, author calculations

Applying the extended shift-share analysis outlined in the method section, a greater understanding of the factors associated with the changes in employment is possible.

At an industry only level, the change in the share of employment is attributable to either the national growth effect or the industry effect, with the employment composition effects offsetting the other. As expected, given a larger population, growing economy and associated increasing consumption, the national growth effect contributed positively to each industry's change in employment over the decade, however, at varying degrees. See Figure 2. The national growth effect was the greatest contributor to change in employment for Public Administration and Safety, as well as the consumption services sectors such as Other Services, Property[5], Financial and Insurance Services and Logistics[6] supporting the thesis of the rise of services associated with changing consumption patterns of the population (Atkinson 2018; Dwyer 2013; Gallie 2017). Whereas the industry effect was the greatest contributor to change in employment for those sectors with exposure to opportunities based on changing demographics (Health Care and Social Assistance), policy priorities (the

5   Rental, Hiring and Real Estate Services
6   Transport, Postal and Warehousing Services

NDIS, education and training, arts and recreation) and the resource boom (Mining). Industries such as Utilities[7], Construction, Accommodation and Food Services and Administration and Support Services shared their growth between national and industry effects. The industry effect placed downward pressure on industries exposed to automation and globalisation (Manufacturing and Agriculture, Forestry and Fishing), technological advancements (Wholesale Trade and Retail Trade) and artificial intelligence (Information, Media and Telecommunications and Financial and Insurance Services).

Figure 2. Drivers of employment change by ANZSIC Division 1, Australia, 2006 to 2016
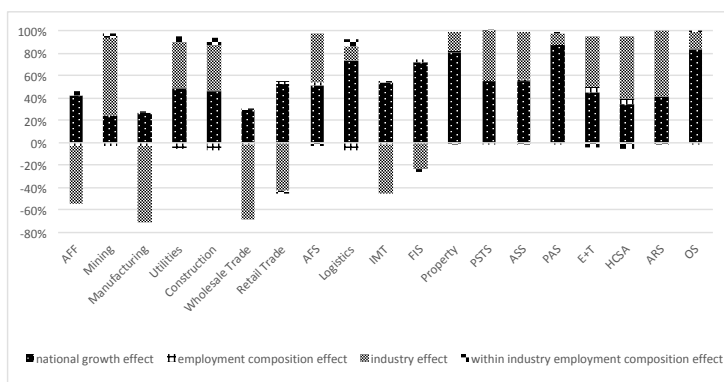
Source: ABS Census of Population and Housing, 2006 and 2016, author calculations

Figure 3 illustrates the four shift-share analysis effects on employment change for men and women employed full-time or part-time for each industry sector. For all employment composition combinations, the national growth effect is positive, and the industry effect is consistent within the industry sector, that is either positive or negative, however, the extent of the effect differs. Where the employment composition effect is positive, the industry sector experienced a positive shift compared with other industries for that combination of sex and labour force attachment. The converse is true when the employment composition effect is negative. That is, the employment composition, and its extent, indicates whether an industry's workforce is gendered or standardised, compared with other industries. Where the within industry employment composition effect is positive, the industry sector experienced a positive shift for that employment composition combination within the sector. The converse is true if the within industry employment composition effect is negative. Also see Table 2.

For the Agriculture, Forestry and Fishing, Manufacturing and Wholesale Trade sectors, all associated with the implications of technology advancements, job

7   Electricity, Gas, Water and Waste Services

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destruction is evident. Employment decline was driven by a strong, negative industry effect, slightly offset by a weaker national growth effect. For each there is also a strong shift away from full-time employment for men, with the shift for employment composition negative for full-time work, and strong and positive for part-time work for men. Within wholesale trade, men and women also experienced a strong negative effect for part-time work (-16.1 and -17.4 per cent respectively).

National growth strongly effected the utilities, Construction, Professional, Scientific and Technical Services, Administration and Support Services and Accommodation and Food Services sectors. All were also accompanied by a strong industry effect, particularly so for women in the utilities, construction and professional services sectors, traditionally considered male-dominated sectors. All sectors show a negative shift for full-time employment for men, and a shift to part-time employment, particularly for the professional services (33.1%), Administrative and Support Services (39.2%) and Construction (36.0%) sectors. Within industry competitive advantage differs for each sector, however, part-time work within the industry has a negative effect for women in all sectors except for Administration and Support Services (17.5%), and particularly for those in Construction (-39.9%). Full-time work for women shows a strong negative effect for Accommodation and Food Services (-39.3%) and Administration and Support Services (-33.0%), yet a strong positive effect for Construction (15.8%) and utilities (29.6%), while slightly negative for professional services (-13.0%).

While Retail Trade, Information, Media and Telecommunications (IMT) and Financial and Insurance Services experienced a positive national growth effect within its overall employment growth, each was also offset by a negative industry effect, more so for the Retail sector (associated with digital disruption and the 4IR). Each sector also shows a positive effect for part-time employment, particularly for men, while within industry employment composition effects favour men working full-time, particularly for the Financial and Insurance Services (36.7%) and IMT (26.3%) sectors, with a corresponding negative effect within industry effect for women working full-time in Financial and Insurance Services (-16.9%), providing evidence of gendered industries and the impact of the internet of things and artificial intelligence.

Employment growth for the Logistics, Property, Public Administration and Safety and Other Services sectors was driven by strong, positive national growth effects, particularly for women. Each sector also experienced a positive, yet weak, industry effect. Like all other sectors, the shift for men was strongly positive for part-time employment, and to a lesser degree for women employed part-time. Within sector employment composition effects differed considerably. Property favoured full-time work for men and women (19.5% and 24.2% respectively) while the converse was true for other services (-8.9% and -28.8% respectively). Administration and Support Services provided a stronger negative shift for full-time employment for women (-33.0%) while Logistics showed a strong negative shift for part-time employment for women (-26.7%).

The industry effect was stronger than the national growth effect for the Mining, Education and Training, Health Care and Social Assistance, and Arts and Recreation Services sectors, particularly the Mining sector, reflecting the resource boom over the

period of analysis. The industry effect was also relatively stronger for women than men, excepting the Arts and Recreation sector. All sectors showed a strong shift to part-time work for men. Mining showed a positive within sector employment composition shift for women employed full-time (12.2%), while the Arts and Recreation Services sector showed a strong, negative within industry employment composition effect for women employed full-time (-20.2%). Men employed full-time in the Education and Training sector shows both a negative employment composition shift (-17.4%) as well as a negative within sector shift (-12.3%), as did men employed part-time (-10.1%). Women employed in the Health Care and Social Assistance sector show a negative within sector shift, despite a positive shift for the overall employment composition effect. Conversely, men employed in the Health Care and Social Assistance sector enjoyed a positive employment composition shift within the sector.

These findings largely reflect the gendered reality of the labour market. Most of the job change for men and for women depends on what is happening in male-dominated and female-dominated occupations; men are particularly vulnerable to changes in manufacturing and construction and women particularly vulnerable to changes in the public sector and private services (Howcroft & Rubery 2018; Rozner 2017). Further, women are disproportionately represented in non-standard forms of work (i.e. part-time), however this situation is also increasing for men. The findings also show that while some industry sectors remain highly gendered, a positive within sector comparative effect is evident for women in the Construction, Mining and Utilities sectors, traditionally considered male-dominated industries.

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Table 2. Employment composition effect and within industry employment composition effect, men and women, full time and part time, by industry

	Employment composition				Within industry employment composition			
	Men		Women		Men		Women	
	Full time	Part time	Full time	Part time	Full time	Part time	Full time	Part time
Agriculture, Forestry and Fishing	-	+	+				-	
Mining	-	+					+	-
Manufacturing	-	+	+					
Utilities	-	+	+		+	-	+	+
Construction	-	+	+		+		+	-
Wholesale Trade	-	+	+		+	-		-
Retail Trade	-	+	+				-	-
Accommodation and Foods Services	-	+	+			+	-	-
Logistics	-	+	+			+		-
Information, Media and Telecommunications	-	+	+		+	-	-	-
Finance and Insurance Services	-	+	+		+	-	-	-
Property	-	+	+		+	-	+	-
Professional, Scientific and Technical Services	-	+	+		+	-	-	-
Administration and Support Services	-	+	+				-	+
Public Administration and Safety		+	+			-	+	+
Education and Training	-	+	+		-	-		
Healthcare and Social Assistance	-	+	+					-
Arts and Recreation Services	-	+	+				-	
Other Services	-	+	+		-	+	-	+

Source: ABS Census of Population and Housing, 2006 and 2016, author calculations

Figure 3. Drivers of employment change by ANZSIC Division 1, by employment composition, Australia, 2006 to 2016
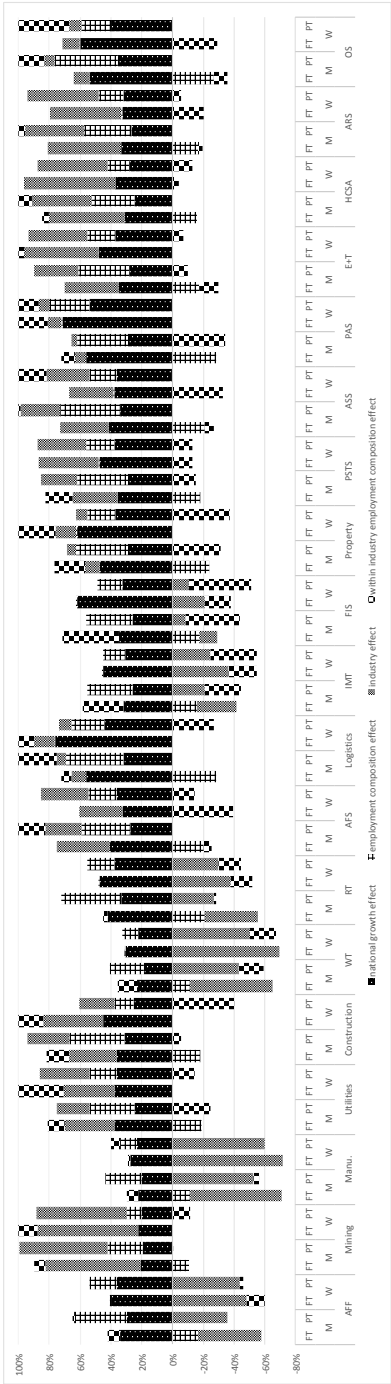
Source: ABS Census of Population and Housing, 2006 and 2016, author calculations

Notes: FT = full-time employment, PF = Part-time employment, M = men, W = Women, AFF = Agriculture, Forestry and Fishing, Manu. = Manufacturing, WT = Wholesale Trade, RT = Retail Trade, AFS = Accommodation and Food Services, FIS = Financial and Insurance Services, PSTS = Professional, Scientific and Technical Services, ASS = Administrative and Support Services, PAS = Public Administration and Safety, E+T = Education and Training,

HCSA = Healthcare and Social Assistance, ARS = Arts and Recreation Services, OS = Other Services

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Discussion

At an aggregated data level, over the decade to 2016, the Australian economy grew, both in terms of Gross Domestic Product (GDP) and employment. However, aggregated data can mask the transformation of economies and societies impacting on the ability to identify the need to undertake regulatory reform. As this paper shows, a portion of employment growth is attributable to overall national economic growth, but within economy structural change is also evident in Australia over the decade. These changes warrant more detailed attention.

Over the period, job destruction occurred. Consistent with Perez' Phase 1 of an industrial revolution and the Routine-Biased Technological Change (RBTC) thesis of Goos, Manning and Salomons (2014), this loss occurred predominantly in sectors associated with technological advancements; Manufacturing, Agriculture, Forestry and Fishing, Wholesale Trade and IMT, evident from the negative industry effect in the shift-share analysis. While the Manufacturing sector also realised a reduction in GDP, the latter three sectors increased their economic contribution, indicating improvements in productivity (measured as the relationship between inputs (hours worked) and economic output (GDP)), which is also consistent with the process of an industrial revolution. Considerable improvements in productivity are also evident for most other sectors (except Accommodation and Food Services), with the increase in GDP greater than the increase in the number of hours worked, particularly for Retail Trade, Finance and Insurance Services and Property, again consistent with technological advancements, but less so for the Arts and Recreation Services, Education and Training and Health Care and Social Assistance sectors. See Figure 4.

Job creation also occurred. Aside from the Construction sector being driven by a national growth effect, sectors which experienced the greatest growth in jobs were in the services sectors; Health Care and Social Assistance and Education and Training, mostly women employed full-time or part-time. Driven by a positive industry effect, this growth is more likely to be explained by changing demographics, consumption patterns (Atkinson 2018; Autor & Dorn 2013; Gallie 1991, 2017) and the social organisation of care (Dwyer 2013), rather than the job creation phase of an industrial revolution. That said, relatively strong job creation in Professional, Scientific and Technical Services, is consistent with the imitation phase of an industrial revolution and Goos, Manning and Salomons (2014) Skill-Biased Technological Change (SBTC) hypothesis as well as the industrial profile of Nübler's missing middle EAS nations.
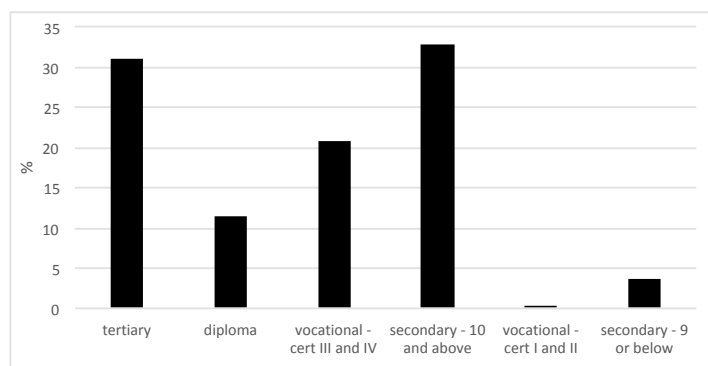
Figure 4. Economic restructuring, ANZSIC Division 1, change in hours worked, GDP and productivity, Australia, 2006 to 2016
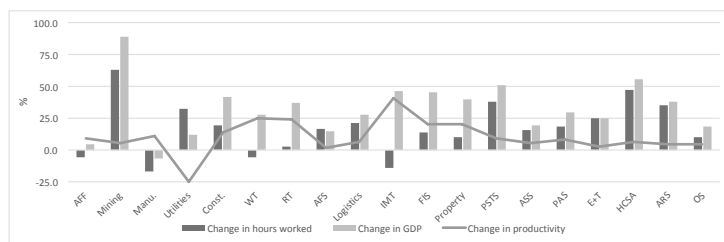
Source: ABS, Australian National Accounts: National Income, Expenditure and Product, Jun 2019, Cat. No. 5206.0; Labour Force, Australia, Detailed, Quarterly, Aug 2019, Cat. No. 6291.0.55.003; Australian National Accounts, Jun 2016, Cat. No. 5204.0.

Australia's educational attainment structure can be defined as a 'missing middle' EAS according to Nübler's (2014a, 2016) classification. Around a third of Australia's labour force highest level of educational attainment is a tertiary qualification (30.1%) or secondary school education – year 10 or higher (32.8%), while only 20.1% have a vocational or technical qualification at the certificate III or IV level. See Figure 5. This missing middle EAS constrains Australia's ability to innovate and diversify its industry base beyond a services-based economy. As Nübler explains the EAS represents an important carrier of capabilities to expand, innovate and develop the manufacturing of inventions and other technological advancements, rather than just adopting other nation's innovations within a business model, as appears to be the case in Australia.

Figure 5. Educational Attainment Structure (EAS), Australian labour force, 2016

Source: ABS Census of Population and Housing, 2016 NB. data not available for 2006

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Nübler asserts that manufacturing is a "leading sector" in the process of productive transformation with strong linkages between industries and services sectors in progressing technological advancement. While the services sectors have replaced manufacturing in nations with a missing middle EAS, Kucera and Roncolato (2013) argue that advanced services can also be a lagging or leading complement to manufacturing and therefore shouldn't be considered in isolation of each other in industrial policy.

In Australia, Dean and Spoehr (2018) assert that Australia's manufacturing policy is situated in Phase 1 of the industrial revolution being limited to short term objectives using process innovation aimed at increasing productivity. Alternative approaches to manufacturing policy should incorporate longer-term objectives of industrial transformation and the development of new markets, jobs and economic sectors based in digitally connected supply and value chains. In the absence of a longer term view, Dean and Spoehr (2018) suggest the consequences will be dire for the labour market, resulting in widespread job destruction. This is fear is affirmed in a report to the Prime Minister's Industry 4.0 Taskforce (Prime Minister's Industry 4.0 Taskforce 2017) which states the aim of adopting and deploying new technologies associated with the 4IR is to digitise the entire manufacturing process to increase competitiveness so that 'the interconnection of products, machines, networks and systems independently communicating and cooperating with each other over the entire manufacturing process results in minimal or no human intervention'. Even so, according to Grodach and Gibson (2019) while broader government agendas position the manufacturing sector in 'inevitable decline', it also attempts to rebrand manufacturing within the narrative of a high-tech, innovation-driven advanced manufacturing economy. The confused rhetoric regarding manufacturing and its future role in the economy demonstrates a false dichotomy between manufacturing and the knowledge and creative spheres, suggesting that the latter needs to replace the former in the period of economic transformation (Gibson & Warren 2013). There has been a failure to shift the understanding of manufacturing from traditional to contemporary resulting in manufacturing policy being situated between entrenched visions of deindustrialisation and emerging notions of a renewed, advanced manufacturing sector.

The Harvard University Kennedy Business School's Atlas of Economic Complexity (Hausmann 2019) confirms that Australia lacks the economic diversity and productive capabilities to enable it to grow strongly relative to other countries into the future. Similar to Nübler and Perez, Hausmann states that the ability of a country to achieve relatively strong growth is dependent on the productive knowledge that goes into making products (know-how or productive capabilities) and diversity, the number and breadth of products a country is able to make. Hausmann (2019) argues that a country's total diversity can also be expressed by the collective know-how held within that country, what Nübler would refer to as the EAS and social capabilities. Of 133 countries in the Atlas, Australia ranks as the 93rd most complex. Compared to a decade prior, Australia's economy has become less complex, worsening 22 positions in the ECI ranking[8] due to its dependence on commodities. It concludes that Australia's

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8   A measure of the knowledge in a society as expressed in the products it makes. The economic complexity of a country is calculated based on the diversity of exports a country produces and their ubiquity, or the number of the countries able to produce them (and those countries' complexity).

worsening complexity has been driven by a lack of diversification of exports and that in the future Australia is positioned to take advantage of only a moderate number of opportunities to diversify its production using its existing productive capabilities.

According to (Hausmann 2019) economic growth is driven by a process of diversifying know-how (productive capabilities) to produce a broader, and increasingly more complex, set of goods and services. In Australia, export growth over the past five years has been driven by expanding its global market share of services, however, globally, long term economic growth is driven by diversification into new products that are incrementally more complex. Based on Australia's export profile, Hausmann (2019) concludes that Australia has diversified into too few products to substantially increase income growth into the future.

Conclusion

Based on Perez' (2010) three phases of techno-economic paradigm, the ILO's Theory of Productive Capabilities (Nübler 2014b) and Nübler's (2016) framework for achieving a 'golden age of job creation', this paper finds that Australia's industrial structure and knowledge sphere is well positioned to develop advanced and sophisticated professional services as well as the adoption of innovation into business models. However, the nation will be constrained in its ability to lead product innovation and transition to the job creation phase of an industrial revolution to achieve a 'great surge of development' due to its educational attainment structure (EAS) and proportionately smaller, and declining, manufacturing sector.

While job growth occurred in the decade to 2016, this was largely driven by a national growth effect associated with increasing consumption and the industry effect associated with the rise of the services sectors and the changing social organisation of care, rather than innovation and technological advancements. Job destruction, on the other hand, is evident in industry sectors associated with the 4IR; the replacement of jobs by automation and artificial intelligence to increase competitiveness and productivity.

Public discourse relating to the Fourth Industrial Revolution is currently stuck in the job destruction phase rather than job creation and widespread prosperity, the risk being a failure of public policy and institutional frameworks to prevent the former becoming a self-fulfilling prophecy.

The ability of a country to transition its economy from job destruction to job creation requires extension beyond relying on market forces to encompassing socio-political intervention. This potential socio-economic transformation is dependent upon a country's productive and social endowments whereby productive capacities are embodied in the physical sphere of production factors and infrastructure and the social capabilities are embodied in the intangible sphere; the educational attainment structure (EAS), the collective knowledge base of a society and its institutional framework (Nübler 2014a, 2014b, 2016).

In order to transition to the third phase of industrial revolution to achieve longer term growth and social prosperity, Australia needs socio-political intervention to address four issues:

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1. The transformation of the institutional framework to facilitate both economic and social prosperity through increasing trust and safe-guarding;
2. The repositioning of education, skill and training policy to shift its educational attainment structure to one of 'strong middle' and enhancing collective learning and the knowledge structure;
3. The prioritisation of gender equality in rethinking both the structure of employment and the forms of work for both men and women; and
4. Redesigning economic development policy to embrace contemporary manufacturing as a growing, important industry.

Perez likens the current global economic and social challenges to the period prior to the Great Depression of the 1930s and resistance to then US President Franklin Roosevelt's New Deal for prolonged economic stagnation (Perez 2012a). However, despite declaring that he may not succeed but that he would try and try again; "The country needs and, unless I mistake its temper, the country demands, bold, persistent experimentation. It is common sense to take a method and try it. If it fails, admit it frankly and try another. But above all, try something.", through political leadership and government and industry collaboration, Roosevelt facilitated institutional reform that created the greatest 'surge of development' in history.

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ECONOMIC RESTRUCTURING AND THE POLARISATION OF THE WORKFORCE: A REGIONAL PERSPECTIVE

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ABSTRACT: Closely associated with rising non-standard forms of work, under-employment and a lack of opportunity for young and new labour market entrants, workforce polarisation is an increasingly pervasive feature of economically restructuring regions. Recent scholarship regarding the causes of workforce polarisation has diverged, particularly since the global financial crisis (GFC). While most explanations for job polarisation rest with technological advancements, growing interregional economic divergence within nations suggests that the extent of job polarisation is pre-determined by historical socio-economic and industry structures. Other perspectives include the rise of the services sector and changes to the social organisation of care. Efforts to understand and project changes to the occupational distribution need a localised, regional lens. This article presents the evidence and discusses the implications of heightened job polarisation for Tasmania, Australia, pre and post GFC. Marked within skill level and occupation group changes, including increased spare capacity within the workforce, present considerable challenges for policy-makers.

KEY WORDS: Job polarisation; economic restructuring; technological change; globalisation; regional divergence.

1. INTRODUCTION

Polarisation of the workforce is an increasingly pervasive feature of advanced economies (Fernández-Macías, 2012; Goos *et al*., 2014; McIntosh, 2013; Montresor, 2018; Salvatori, 2015). It is defined as a pattern of change within the labour market whereby the share of employment in high skill jobs and low skill jobs increases relative to the share of employment in middle (intermediate) skill jobs over time. Research into the causes and implications of job polarisation is gaining prominence, particularly in the UK, Europe and the US (Autor *et al*., 2006; Cirillo, 2018; Goos *et al*., 2009; Fernández-Macías, 2012; Montresor, 2018; Murphy and Oesch, 2018; Oesch and Rodríguez Menés, 2010; Salvatori, 2015). Critically, the emergence of polarisation in the labour market is in contrast to the historical trend of linear upskilling, or

professionalisation, of the populations of advanced economies (Maselli, 2012).

Scholarship on divergence in the experience of job polarisation at a sub-national level is only recently emerging alongside Storper's (2018) evidence that interregional economic divergence within nations is greater in many developed nations than it has been for decades. Increasing evidence suggests that the extent of job polarisation is pre-determined by the industry structure of a region and the share of routine intensive industries such as manufacturing (Autor and Dorn, 2013; Barany and Siegal, 2015; Cirillo, 2018; Consoli and Sánchez-Barrioluengo, 2019; Montresor, 2018; Rubæk Holm and Richter Østergaard, 2018). While substantial differences in the experience of polarisation by jurisdictions suggest there is no single factor to explain the diversity, that de-industrialisation and job polarisation are related in the process of regional diversification (Rubæk Holm and Richter Østergaard, 2018), future job polarisation may be predictable. As such, efforts to understand changes to the labour market and occupational distribution need a localised, regional lens.

Polarisation of the workforce is concerning for several reasons. Primarily, job polarisation threatens productivity improvement, social mobility and inclusive growth, providing income redistribution challenges for governments. These issues are evident in the increase in non-standard forms of work, differences in hours of work between skill levels, increasing levels of under-employment, impact on the quality of work, reduced opportunities for young graduates to enter the labour force, increasing levels of over-qualification, increasing job insecurity, limited opportunities for upward progression and career development from lower-skill level jobs, low wage growth, widening inequality, impact on retirement savings and overall health and well-being (Peat, 2016; Gallie, 2017; Greve, 2017).

This research identifies the existence of workforce polarisation in Tasmania, Australia, by analysing the change in the number and share of jobs by skill level over time using Australian Bureau of Statistics (ABS) Census of Population and Housing data for 2006 (pre GFC) and 2016 (post GFC), similar economic periods in Tasmania. To examine the existence of over- or under-qualification, analysis of job polarisation is extended to include the highest level of educational attainment of workers as an indication of workers skills to identify whether the relationship between the supply of skills (educational attainment) and demand for skills (occupations) has an impact on the composition of the workforce, noting that educational attainment is not the only proxy for skill (Quintini, 2011a).

The structure of the article is as follows. First, an overview of the evolution of job polarisation and its various causes. To provide a regional context and incorporate divergence within a nation, the article then outlines a number of Australian studies of labour market change before introducing the methodological approach. The findings are then presented and discussed. The article concludes by explaining that job polarisation has both heightened in Tasmania since the GFC and that the characteristics within skill and occupational groups have also changed, reflecting industry diversification rather than professionalisation, resulting in considerable economic and social implications for policy makers.

2. EXPLAINING JOB POLARISATION

Economic restructuring affects the level and distribution of the skills of the working population. As early as the 1950s, the expansion of the higher education sector, changing composition of the workforce and the transition from manufacturing-based industry sectors to service oriented ones initiated the shift towards professionalisation of the workforce (Hamnett, 1996; McIntosh, 2013; Montresor, 2015). This shift resulted in a decline in demand for, and share of, intermediate skilled jobs. That is, an increasing share of the population with higher education qualifications contributed to the initial, substantial reallocation of employment from intermediate-skilled jobs to higher-skilled jobs, referred to as professionalisation. Based on the emergence of a knowledge intensive economic framework, the upskilling of the population was expected to lead to improving productivity, increasing competitiveness and demand for higher level skills, ultimately expanding employment opportunities, the availability of work and social cohesion (Gallie, 2017). However, this century the professionalisation of the workforce has shifted further to that of polarisation whereby the composition of the workforce shifts to an increase in the share of employment in both high and low skilled occupations offset by a decrease in the share of intermediate skilled occupations (Coelli and Borland, 2016; Goos and Manning, 2007). These changes are not necessarily equal in the redistribution of high and low skill jobs (Coelli and Borland, 2016), nor is the experience consistent across or within jurisdictions (Autor, 2015; Goos *et al*., 2014; Montresor, 2018; Cirillo, 2018).

While most explanations as to the cause of job polarisation rest with either technological change or changes within the labour market institutional framework (Autor *et al*., 2006; Goos and Manning, 2007; Goos *et al*., 2009; Goos *et al*., 2014; Holmes and Mayhew, 2010a), more

recent scholarship refutes these findings and suggests alternate causes (Barany and Siegal, 2015; Montresor, 2018; Rubæk Holm and Richter Østergaard, 2018). Fernández-Macías (2012) argues that the focus on technology as the determinant of structural change in employment leads to a narrow explanation of change over time. Cirillo (2018) found no single pattern of change in the employment structure across Europe and concluded that the emergence of polarised workforces is underpinned by sectoral and technological heterogeneity. Another perspective is that of the rise of the services sector (Gallie, 2017; Autor and Dorn, 2013) and, more specifically, the care economy resulting from changes to the social organisation of care (Dwyer, 2013), particularly in regions experiencing population ageing. Further, the historical industry structure of a region, the share of traditional industries and the process of economic diversification is increasingly associated with the extent of job polarisation (Autor and Dorn, 2013; Barany and Siegal, 2015; Rubæk Holm and Richter Østergaard, 2018). That said, advancements in technology are considered largely responsible for the restructuring of the employment market. This extends to globalisation and the pressures to improve productivity, increase competitiveness and the resultant 'offshoring'. However, changes in household consumption and consumer preferences, the age structure of the respective populations, the level and type of immigration and the type of welfare state are also influencing factors (Baum, 1997; Goos and Manning, 2007; Hamnett, 1996; Murphy and Oesch, 2018; Oesch and Rodríguez Menés, 2010).

Since the Global Financial Crisis (GFC), a further defining characteristic of workforce polarisation is an increase in the share of lower skilled jobs, particularly in the services sector. More recently, as polarisation accelerated, an additional key feature of the composition of job polarisation is the increasing proportion of higher educated persons employed in lower-skilled jobs and a shift toward less than full-time employment, resulting in scenarios of over-qualification (Gallie, 2017; Goos *et al*., 2014; Goos and Manning, 2007; Greve, 2017). Montresor (2018) suggests that this results from a decline in routinisation and increasing job competition due to rapid educational catch-up and, thus, an increasing supply of graduates. Together, these indicate an over-supply and/or lack of demand for higher educated workers (Autor, 2015; Greve, 2017; Salvatori, 2015). This is consistent with the declining trend of the relative supply of lower-skilled persons, even though overall employment growth is largely driven by high-skill occupations.

Technology can either substitute (replace) or complement workers based on the level of routinisation of an occupation and the cognitive requirements of the work (Autor, 2015; Goos *et al*., 2014; Peng *et al*., 2018). Where jobs, regardless of industry sector, have high levels of routine, repeatable and predictable processes requiring precision; automation or artificial intelligence (AI) has, and will, replace these jobs (referred to as routine-biased technological change (RBTC)). These jobs tend to fall in the intermediate-skill occupations requiring vocational qualifications. Technology complements jobs which require cognitive, yet non-routine, input. In these jobs, again regardless of industry sector, technology amplifies the human comparative advantages of problem-solving, creativity, adaptability, flexibility, physical dexterity, and interpersonal and communication skills, increasing the productivity of workers (referred to as skill-biased technological change (SBTC)). Growth in these non-routine, cognitive jobs may also increase the demand for higher educated workers, both within and across industry sectors (Autor, 2015).

Low skilled jobs are the least affected by technological advancements as they are generally non-routine and difficult to automate (Autor and Dorn, 2013; McIntosh, 2013; Peng *et al*., 2018). These jobs usually require a response to a non-routine task more efficiently and effectively provided by human input and are less predictable. They usually rely on direct physical proximity and interpersonal skills. Lower skill jobs, particularly those in the services sector, tend to be non-storable nor tradeable and therefore suppliers and users of services must co-locate (Autor and Dorn, 2013). That is, these jobs are not 'off-shoreable' (yet). Increasingly, displaced intermediate-skilled and qualified workers are reallocating to lower skilled jobs.

It is growth in these non-routine jobs not substitutable by automation or artificial intelligence, which exist at opposite ends of the skill spectrum, associated with the polarisation of the workforce.

Job Polarisation in Australia

Storper (2018) argues that the magnitude of economic divergence between regions and the contribution of different causes vary according to the national context. For this reason, an overview of the Australian perspective is provided within the methods section. At the time of writing, no studies of job polarisation at a regional level in Australia had been identified.

In Australia there are a few disparate investigations into the changing composition of the labour market (see for example Baum (1997); Coelli and Borland (2016); Cully (1999); Esposto (2011); Healy (2016); Wilkins and Wooden (2014); Wooden (2000)). Each reports conflicting outcomes, largely explained by differing methodologies and periods of analysis. Most empirical approaches to identifying compositional change in the occupational distribution of the labour market use the aggregate number employed which Wooden (2000) suggests is misleading given the approach fails to account for those employed less than full-time and that the hours employed vary substantially across occupations. He suggests that recorded levels of employment are not a true indication of labour demand. In his analysis, Wooden (2000) concluded that workforce polarisation and the growth in the share of low skilled occupations was the result of an increase in the share of part-time and casualised jobs.

The most comprehensive analysis of changes in the composition of the Australian labour market was undertaken by Esposto (2011). Esposto (2011) investigated the presence of upskilling, down-skilling and polarisation of the workforce using both the number employed and hours of work by occupation groups and skill level as well as by the type of employment (full-time, part-time, permanent, casual) for both men and women. Incorporating the methodologies of Cully (1999) and Wooden (2000), Esposto (2011) concluded that the patterns of upskilling are mixed dependent on the combination of job type, terms of employment, hours worked and sex. Despite not actually analysing workers' skills nor educational attainment, only the occupations workers were employed in, Esposto (2011) further concluded that workers who do not possess high level skills will experience increasing levels of uncertainty in the labour market.

3. METHODS AND DATA

Consensus on the conceptualisation and measurement of job polarisation is yet to be reached given both the dearth of good data over time and methodological constraints as well as localised context (Autor, 2015; Coelli and Borland, 2016; Gallie, 2017). Initial scholarship of job polarisation used wages as a proxy for skill. However, the lack of polarisation in wages didn't reflect the changing labour market structure and indicated alternative approaches to identifying job polarisation were required (McIntosh, 2013; Salvatori, 2015). More recent investigations have used occupational classification systems, skill levels, educational

attainment, hours of work or labour force status by occupation. The greatest critique of these approaches is that the results are difficult to compare in different economic climes (Wooden, 2000). Given that economic disparities also exist within a nation (Storper, 2018), a regional perspective is undertaken using Tasmania, Australia, as a case study.

Using a cluster approach to polarisation rather than inequality measures (Esteban and Ray, 1994; Fernández-Macías, 2012), the unit of analysis for this research is shifted to jobs—labour demand—rather than the individual (labour supply). Esteban and Ray (1994) argue that polarisation and inequality measures have one fundamental difference; the use of population frequencies; "by effectively neglecting the population frequency in each category, inequality measurement [distribution] departs from the study of differentiation" (p.821). Further, rather than using occupation clusters, this approach groups jobs according to their skill level so that there is a high level of homogeneity within the skill group and a high degree of heterogeneity across groups (Esteban and Ray, 1994), not necessarily possible with occupation clusters.

For this research, ABS Census of Population and Housing (Census) data for 2006 and 2016 is analysed to explore the relationship between Tasmanians and the labour market and how this has changed over the ten-year period. The economic climate in Tasmania in 2006 was similar to that in 2016 with the state economy growing steadily from a relatively weak base. The detailed analysis of Census data across this 10-year period therefore provides an appropriate basis to examine the structural changes in nature of work for all Tasmanians prior to the GFC and post GFC.

The research uses the occupational classification systems approach which allocates jobs into a hierarchy according to skill level (highest level of educational attainment) and skill specialisation (areas of expertise or field of study). The focus of this research is on skill level only. In Australia, the Australia New Zealand Standard Classification of Occupations (ANZSCO) identifies the level of skill that is typically required to perform the tasks of a particular occupation and provides an indication of the minimum level of education and/or experience required by an individual to perform the tasks. The skill levels are ranked from one (highest) to five (lowest) (Table 1).

At the aggregated level, the hierarchy is not strictly reflective of the level of skill (educational attainment) required for a job. Within each occupational grouping, a number of skill levels exist, representing both the skill specialisation of the grouping and the required educational qualification. For this research, employment is therefore disaggregated by occupation to the ANZSCO 4-digit level which provides the required skill

level to undertake the job, and the corresponding workers' highest level of educational attainment by Australian Standard Classification of Education (ASCED) 3-digit level. Workers with a Certificate III are assumed to have 2 years' experience and therefore appropriately qualified for Skill Level 3 occupations.

Using a population level analysis approach the findings describe the evolution of the employment structure over the decade and the relative change in occupation and skill level demand to identify the existence of workforce polarisation. Within occupation and skill groups, changes are also explored for the entire workforce rather than separating those employed by terms of employment and/or sex as per Esposto (2011) to identify structural changes within the labour force.

Polarisation of the workforce is further analysed by change in the share of full-time and part-time employment to identify potential under-employment and spare capacity in the labour force. Analysis is extended to whether the workers educational attainment matches the skill level requirement of the job they are employed in; the existence of over- or under-qualification.

4. FINDINGS

In 2006, both Tasmania's and Australia's workforces were polarised, hollowed out in the middle skill occupations, yet skewed slightly to the higher skilled occupations, albeit, Tasmania's workforce was less professionalised than the Australian workforce (26.2 per cent compared with 29.3 per cent) and nearly half the occupational distribution was to skill level 4 or 5 jobs (46.7 per cent). By 2016, both workforces had professionalised further with an increasing proportion of the occupational distribution made up of skill level 1 jobs, 27.4 per cent for Tasmania and 31.6 per cent for Australia (Figure 1).
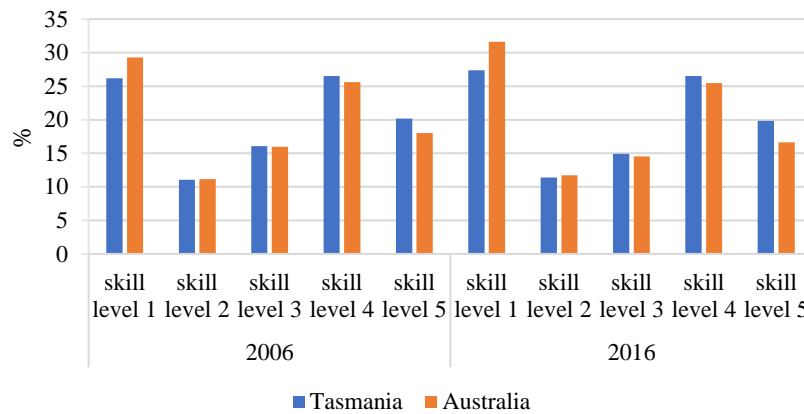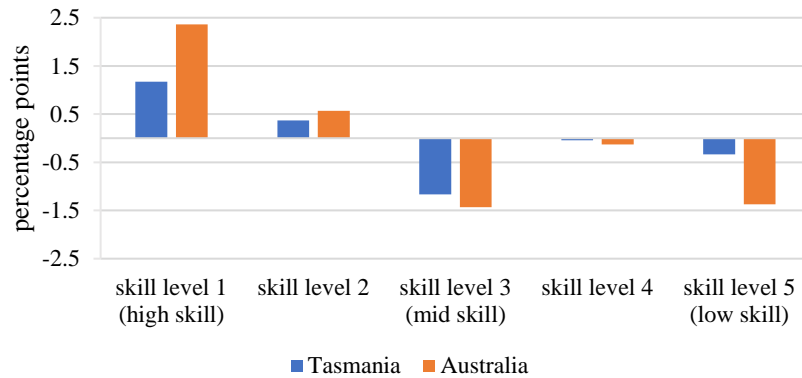
Figure 1. Occupational Distribution, by Skill Level, Tasmania and Australia, 2006 and 2016. Sources: ABS Census of Population and Housing (2006); (2016); author calculations.

However, the Australian workforce professionalised at a greater rate than Tasmania's; the share of skill level 1 jobs increasing by 2.4 percentage points compared with 1.2 percentage points. Australia's larger increase in share of skill level 1 jobs saw a corresponding decrease in the share of both skill level 3 and 5 jobs whereas Tasmania's gain in skill level 1 jobs was offset by a decline in skill level 3 jobs only, hollowing out the workforce structure further, supporting Storper's thesis of growing interregional economic divergence.

Over the ten-year period to 2016, Tasmania's workforce polarised further with a reduction in both the number and share of skill level 3 jobs. However, the polarisation was asymmetrical, showing a slightly greater increase in the professionalisation of the workforce. The greatest increase in both relative and absolute terms was experienced by increases in the number of skill level 1 occupations (10.3 per cent increase) and skill level 2 occupations (9.1 per cent increase). This is compared with a 5.4 per cent and 3.8 per cent increase in skill level 4 and 5 jobs respectively, effectively closing the gap between the proportion of higher and lower skill occupations by two percentage points. Intermediate skill jobs (level 3) experienced both a relative decline in the share of employment (-1.2 percentage points) and absolute decline (2.1 per cent) in the number of jobs (Figure 2).

Figure 2. Change in Share of Occupations, Skill Level, 2006 to 2016, Tasmania and Australia. Sources: ABS Census of Population and Housing (2006); (2016); author calculations.

By 2016, the share of the workforce employed in skill level 1 and skill level 2 occupations increased by 1.2 and 0.4 percentage points respectively, offsetting the decline in skill level 3 and skill level 5 occupations; -1.2 and -0.3 percentage points respectively. The share employed in skill level 4 jobs was stable (Figure 3).
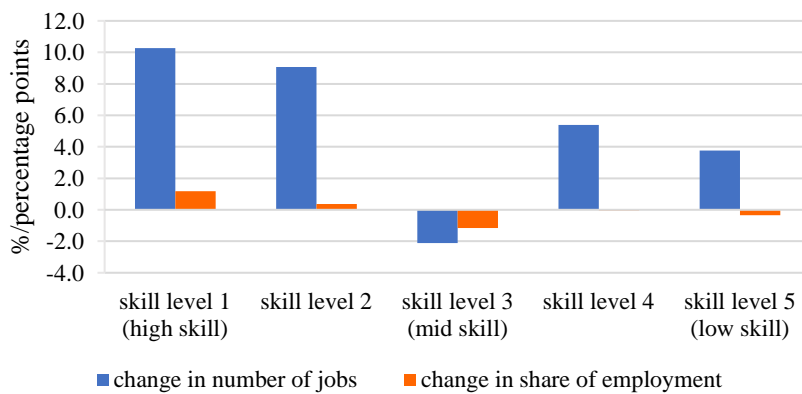
Figure 3. Change in the Workforce by Occupational Skill Level, Number and Share, Tasmania, 2006 to 2016. Sources: ABS Census of Population and Housing (2006); (2016); author calculations.

Over the same period from 2006 to 2016, the workforce experienced considerable upskilling, improving the potential for the professionalisation of the workforce and restructuring to a knowledge-based, more productive economy. The proportion of the workforce with their highest level of educational attainment equivalent to that required for skill level 1 occupations—bachelor degree or higher qualifications—increased from 18.6 per cent in 2006 to 24.0 per cent in 2016, providing evidence of educational catch-up; as suggested by Montresor (2018). The proportion of the workforce with the highest level of educational attainment equivalent to that required for skill level 5 occupations – certificate I or secondary schooling - declined considerably from nearly half of the workforce (49.6 per cent) to 39.1 per cent. The proportion of the workforce with certificate IV or III qualifications equivalent to the educational requirement for skill level 3 occupations increased by 3.3 percentage points to over a quarter of the workforce (25.5 per cent), despite both the relative and absolute decline in demand for skill level 3 occupations (Figure 4).
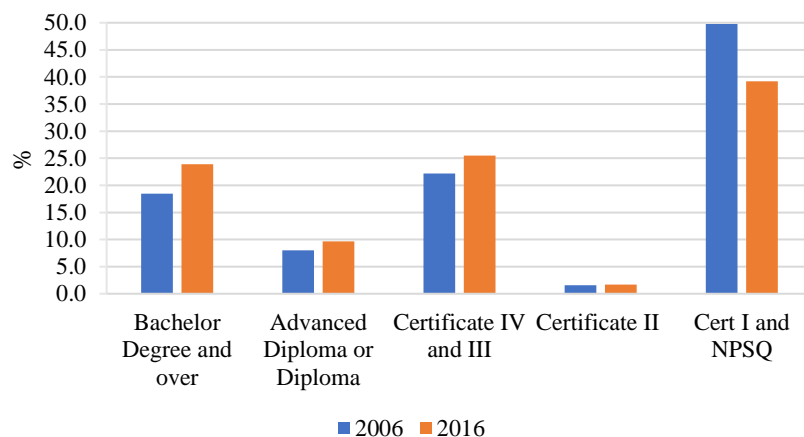
Figure 4. Highest Level of Educational Attainment of the Workforce, Tasmania, 2006 and 2016. Sources: ABS Census of Population and Housing (2006); (2016); author calculations.

The disparity in the change of supply of skills and demand for skills from 2006 to 2016 is evident in Figure 5. While the share of the workforce with bachelor's degree or higher qualifications (required for skill level 1 occupations) increased by 5.4 percentage points (skill supply), the share of skill level 1 jobs only increased by 1.2 percentage points (skill demand).

Similarly, for skill level 2 and skill level 3 jobs, the proportion of the workforce with equivalent qualifications increased by a greater rate than the share of jobs. That is, supply was greater than demand.
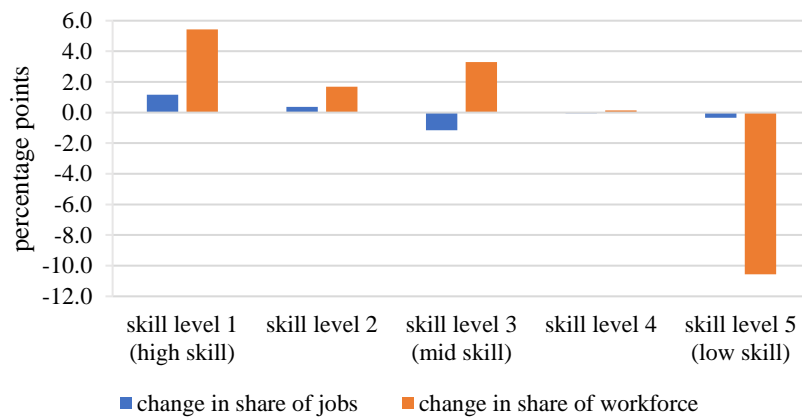
Figure 5. Change in the Share of Jobs and Workforce, by Skill Level, Tasmania, 2006 to 2016. Sources: ABS Census of Population and Housing (2006); (2016); author calculations.

While there has been an upskilling of the workforce, considerable levels of over-qualification and under-qualification are also evident. This does not necessarily mean there is a skill mismatch however, as over/under-qualification measures can hide skill heterogeneity or tacit knowledge and skills acquired through experience and on-the-job training (Quintini, 2011b), particularly in an ageing workforce, such as Tasmania's (Author A).

Table 1 shows the proportion of workers in occupation skill levels by their educational attainment. The highlighted cells show the proportionate correct match of qualification level to occupation skill level. The cells to the left of the highlighted cell indicate the proportion which was over-qualified and the cells to the right show the proportion which was under-qualified. In 2016, three in five (63.0 per cent) workers employed in skill level 1 occupations were appropriately qualified for the job and held a bachelor's degree or higher qualification, 14.4 per cent held either a certificate I or did not have a post-school qualification, indicating a high level of under-qualification. The majority of workers employed in skill level 2 jobs were under-qualified (58.4 per cent). Nearly half (47.3 per

cent) of workers in skill level 4 occupations held a certificate IV or III or higher, that is, they were over-qualified, providing evidence of crowding out of lower skilled workers resulting from polarisation. In addition, 4.9 per cent of workers in skill level 5 occupations held a bachelor's degree or higher qualification where no post school qualifications were required for the job they were employed in.

Table 1. Highest Level of Educational Attainment by Occupation Skill Level, Proportion, Tasmania, 2016.

		Education				
		Bachelor Degree and higher	Advanced Diploma or Diploma	Certificate IV and III	Certificate II	Certificate I and NPSQ
Occupation	Skill level 1	63.0	11.4	11.2	0.4	14.0
	Skill level 2	21.6	20.1	23.8	1.5	33.1
	Skill level 3	5.1	6.6	59.2	1.4	27.7
	Skill level 4	9.1	9.7	28.5	2.3	50.4
	skill level 5	4.9	3.8	15.8	3.2	72.3
	Total	24.0	9.7	25.5	1.7	39.1

Source: ABS Census of Population and Housing (2016).

Not only has there been a considerable shift in the share of the workforce across skill levels, there has been a substantial change in the share of labour force attachment within skill levels. The share of the workforce employed full-time dropped from 64.6 per cent in 2006 to 59.8 per cent in 2016 so that in 2016 two in five (40.2 per cent) of the workforce were employed part-time. For all skill levels, the share of the workforce employed full-time declined. The greatest change was experienced in the skill level 4 workforce, dropping 5.9 percentage points to 54.0 per cent followed by skill level 5 (5.6 percentage points less to 36.5 per cent) and the skill level 2 workforce (5.3 percentage points less to 71.5 per cent).

In terms of the share of the total workforce, all skill levels experienced a reduced share of full-time employees, with a marked shift to an increased share of part-time employees, particularly for the skill level 1 (1.4 percentage point increase) and skill level 2 (0.7 percentage point increase) workforces. Therefore, the professionalisation of the Tasmanian workforce

shown in Figure 6 has been in part-time employment. This may, or may not, be by choice.
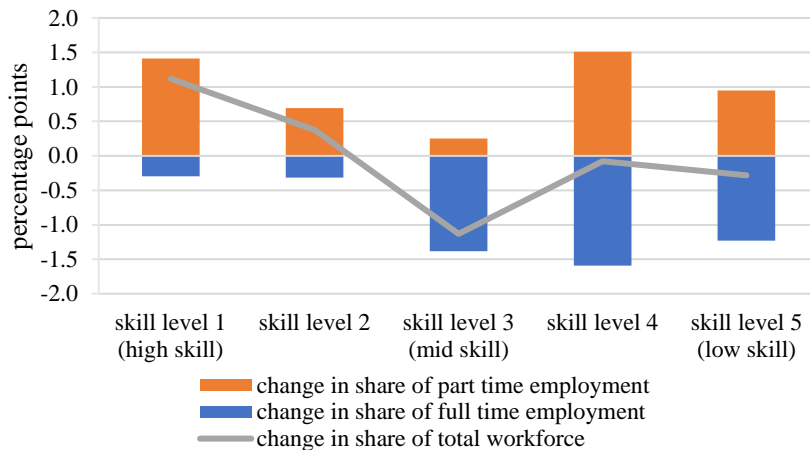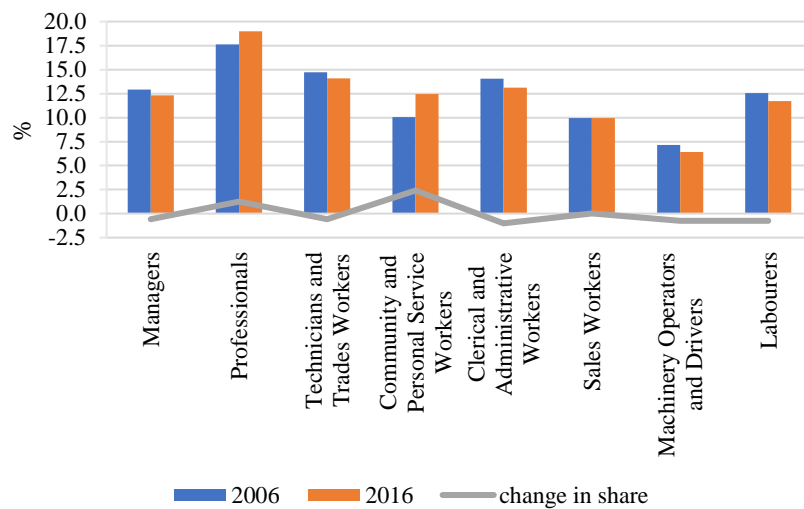

Figure 6. Change in Share of Employment by Labour Force Status, 2006 to 2016. Sources: ABS Census of Population and Housing (2006); (2016); author calculations.

When considered by occupation, the Tasmanian labour market has changed substantially since 2006 (Figure 7). Workers in professional occupations made up the largest share of the total workforce in both 2006 (17.6 per cent) and 2016 (19.0 per cent) followed by technicians and trade workers, and clerical and administrative workers. While these three occupational groups remained the top three in 2016, only professionals increased both the number and share of their workforce while the clerical and administrative workers reduced both the number and share of their workforce.

In the decade there was a large increase in both the number of community and personal service worker jobs (30.8 per cent) and as a share of the total workforce (2.4 percentage points), reflecting job creation in the services sector largely resulting from changes in the social organisation of care, including child and disability care, as well as an ageing population. The only other occupational category to experience both an increase in number of jobs and share of the workforce was professionals (13.6 per cent and 1.2 percentage points respectively), largely health professionals such as registered nurses and medical practitioners, again reflecting increasing demand for health services within the population. While the number of

managers, technicians and trade workers, and sales workers increased over the decade, their respective share of the total workforce decreased. In addition to clerical and administrative workers, the number of jobs and the share of the machinery operators and drivers and labourers' workforces also declined between 2006 and 2016.

Figure 7. Employment Change by Occupation, 2006 to 2016. Sources: ABS Census of Population and Housing (2006); (2016); author calculations.

For all occupational categories, only the community and personal services workers increased their share of both full-time and part-time employment (0.4 percentage points and 2.0 percentage points of the total workforce respectively). Professionals employed full-time reduced their share of the workforce by 0.1 of a percentage point which was offset by a 1.3 percentage point increase for professionals employed part-time. While managers, technicians and trade workers, sales workers, machinery operators and drivers and labourers increased their respective share of the workforce employed part-time, the total share was offset by larger declines in the share employed full-time. Clerical and administrative workers experienced a decline in both the share of full-time and part-time workers (Figure 8).
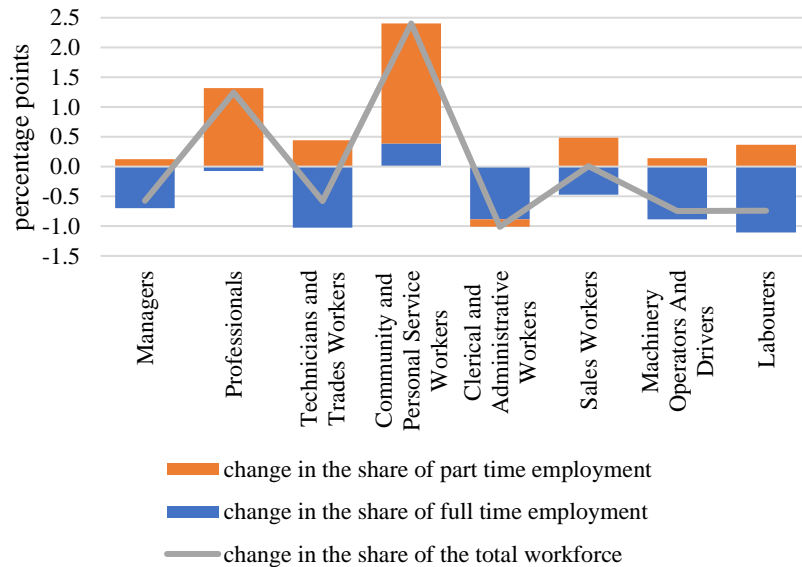
Figure 8. Change in Share of Employment by Labour Force Status, 2006
to 2016. Sources: ABS Census of Population and Housing (2006); (2016); author calculations.

5. DISCUSSION

Polarisation affects not only individuals but the broader economy as well. The number of jobs at each skill level is determined by the interaction between demand and supply (McIntosh, 2013) and, as evidenced in this research, employment growth in the low skill occupations has occurred in spite of the substantial increase in educational attainment. Polarisation presents considerable implications in inequality and opportunities for labour market mobility, particularly for young people (Holmes and Mayhew, 2015; Peat, 2016; Keep and Mayhew, 2010). Not only are the number and share of entry level jobs reducing, the opportunity for low to mid–qualified individuals to enter the workforce is contracting and the chance of progression or the ability to move from low skill level jobs to higher skill level jobs is increasingly difficult (Goos and Manning, 2007; Holmes and Mayhew, 2010b; McIntosh, 2013; Peat, 2016). Not only is over-qualification detrimental to society and the economy, so too is under-employment. Under-employment in Tasmania increased 2.3 percentage points to 9.5 per cent in the decade to 2016 and has since increased further

to 10.0 per cent in December 2018 (ABS, 2018). The structural changes in the labour market are resulting in a situation where having a job does not necessarily mean that an individual has a stable and reliable income. Under-employment indicates that there is spare capacity in the workforce coupled with people working below their level of educational attainment (Greve, 2017). Moreover, this scenario is extending into high skill areas of the labour market. The inability to secure quality work has flow on detrimental effects which accumulate disadvantage for individuals and society (Gallie, 2017).

Analysis of the change in the occupational distribution of the workforce between 2006 and 2016 provides evidence of increasing polarisation of the Tasmanian labour market and a shift to more precarious employment situations. As is evident in the change in occupations, and their skill levels, in Table 2 below, economic restructuring and diversification away from traditional industries such as forestry and manufacturing to the services industries, namely care, education and tourism, has contributed to the polarisation of the workforce in Tasmania.

It can therefore be interpreted that, routine biased technological change (RBTC) as well as globalisation and offshoring, have reduced the number and share of intermediate skilled jobs, those routine and non-cognitive jobs found in the manufacturing and administration sectors, such as machinery operators, process workers and administrative and clerical workers, in Tasmania. While jobs requiring human input and interpersonal skills, largely found in the care and services sector, however low–skilled, such as aged, disability and other care workers and hospitality workers, increased over the period. There is little evidence of skill biased technological change (SBTC) in the changing occupational distribution in Tasmania. That is, an increase in cognitive, yet non-routine jobs whereby technology amplifies human comparative advantages of problem-solving, creativity and interpersonal skills requiring higher levels of educational attainment, and professionalisation of the workforce, such as that in the professional, scientific and technical services sector, is not evident. The professionalisation of the workforce is more likely to be associated with the ageing population and the increasing demand for health and care professionals (Banks and Denny, 2018), further associated with the roll-out of the National Disability Insurance Scheme (NDIS) in Australia and the changed regulatory environment of the early childhood education and care (ECEC) sector.

Table 2. Occupational Changes, Top 20 Increases and Decreases, 2006 to 2016, Tasmania.

Increase			Decrease		
	No.	Skill level		No.	Skill level
Aged and Disabled Carers	1 841	4	Secretaries	-883	3
Sales Assistants (General)	1 421	5	Livestock Farmers	-754	1
Registered Nurses	726	1	Retail Managers	-686	2
Chefs	622	3	Metal Fitters and Machinists	-509	3
Education Aides	613	4	Forestry and Logging Workers	-387	4
Kitchenhands	496	5	Sales Assistants and Salespersons, nfd	-369	5
Checkout Operators and Office Cashiers	467	5	Timber and Wood Process Workers	-365	5
Enrolled and Mothercraft Nurses	456	2	Corporate Services Managers	-362	1
Construction Managers	444	1	Sales Representatives	-316	4
Nursing Support and Personal Care Workers	435	4	Textile and Footwear Production Machine Operators	-292	4
Domestic Cleaners	406	5	Bank Workers	-276	4
Child Carers	395	4	Food and Drink Factory Workers	-274	5
Cafe Workers	374	5	General Clerks	-273	4
Bar Attendants and Baristas	359	4	Other Cleaners	-258	5
Commercial Cleaners	345	5	Manufacturers	-249	1
Waiters	318	4	Paper and Wood Processing Machine Operators	-240	4
University Lecturers and Tutors	310	1	Mixed Crop and Livestock Farmers	-225	1
Generalist Medical Practitioners	291	1	Metal Engineering Process Workers	-203	5
Receptionists	289	4	Other Factory Process Workers	-198	5
Electricians	275	3	Engineering Production Systems Workers	-194	4

Sources: ABS Census of Population and Housing (2006) and (2016).

6. CONCLUSION

Social and economic restructuring have contributed to considerable industry diversification in Tasmania over the decade from 2006 to 2016, shifting from a traditional industrial base to one dominated by the care and services sectors. This has resulted in increasing workforce polarisation. Like other advanced economies and regions within nations, job polarisation has heightened in Tasmania since the GFC. Increasing job polarisation, under-employment and people working below their level of educational attainment indicates spare capacity in the labour market. Further, the current trends of workforce polarisation suggest that demand for labour and skills is a greater issue than the supply of skills. While there are more Tasmanians in employment in 2016 than in 2006, the extent of job polarisation and under-employment evident suggests that having a job does not necessarily mean that a person has a stable and reliable income nor that they are using their level of education effectively. This predicament has substantial economic and social implications for regional areas, particularly school leavers and graduates, as well as policy makers. Further analysis of the occupational distribution change by sex, industry sector and age would provide greater insight into the implications of workforce polarisation for the economy and society as well as better informed policy development.

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