Unlocking the potential: Promoting investment in Greater South East Melbourne

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Greater South East Melbourne

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Contents

Executive summary

The functionality of Melbourne's monocentric urban form is under strain, owing to population growth and urban sprawl. Decentralisation interventions can mitigate some of the adverse impacts and simultaneously enhance the sustainability, resilience and productivity of Melbourne.

Project scope

SGS Economics and Planning (SGS) was engaged by Greater South East Melbourne organisation (GSEM) – an incorporated entity that represents the local government areas (LGAs) of Casey, Frankston, Monash, Greater Dandenong, Knox, Kingston, Cardinia and Mornington Peninsula – to undertake independent research and analysis to test the net welfare impacts of decentralisation. Our analysis takes a 'business case' approach. This starts with defining the problems posed by Melbourne's monocentric urban form and potential benefits associated with decentralisation interventions. A potential solution in the form of deliberately decentralised jobs across Melbourne is then evaluated against the 'business as usual' (BAU) distribution of jobs to arrive at a conclusion on whether policies to redistribute jobs would create a net community benefit.

Decentralisation – the current state

Melbourne's central strategic planning document, *Plan Melbourne,*[1] establishes a framework to deliver a more decentralised or 'polycentric' urban form via designation of National Employment and Innovation Clusters (NEICs) and Metropolitan Activity Centres (MACs). There are seven NEICs across Melbourne (two of which are in Greater South East Melbourne; Monash and Dandenong) and nine MACs (three in Greater South East Melbourne; Dandenong, Frankston and Fountain Gate – Narre Warren). While the NEICs and MACs are substantial employment centres, the core public sector functions and knowledge-based sectors are still predominantly located within central Melbourne.

The case for change

COVID-19 has dramatically changed the economic functionality of Melbourne and highlighted a unique opportunity to reimagine how people live and work to create a more equitable, sustainable and productive city. This paper provides evidence of three problems with Melbourne's monocentric urban form and four potential benefits of creating a polycentric city through decentralisation interventions. Figure 1 provides an overview of problems and benefits.

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[1] Victorian Government, Metropolitan Planning Strategy – Plan Melbourne 2017-2050, 2017.

FIGURE 1: PROBLEMS AND BENEFITS OVERVIEW
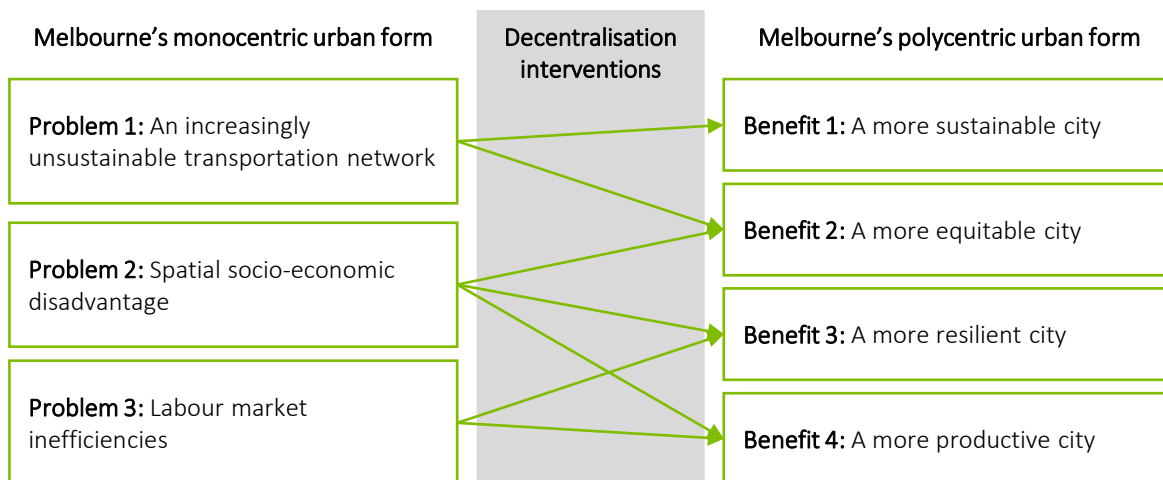
Noteworthy issues in this problem analysis include the following.

▪ The cost of congestion in Melbourne is expected to double from 2020 to 2030, from around $5 billion to $10 billion annually. To alleviate this congestion and support Melbourne's monocentric urban form, the State Government is investing around $100 billion in major transport infrastructure (road and rail) over the coming 10-15 years. While much of this investment is appropriate, diverting a portion of it to deliver a more polycentric city may be a more effective way to address congestion issues and reverse Melbourne's trend of growing transport greenhouse gas emissions.

▪ Melbourne is increasingly becoming a divided city, whereby some citizens have ample choice about where they live while others have limited choice. This leads to contrasting job prospects; those that are able to live within inner Melbourne have convenient access to highly skilled and high paying jobs (e.g. knowledge and service based sectors within the central city), while those in outer Melbourne have comparatively lower opportunity to access such jobs.

Decentralisation scenario assessed

In the decentralisation model, 100 per cent of future State public sector jobs *growth* was redistributed out of central Melbourne and into five of Melbourne's middle and outer ring NEICs (Monash, Dandenong, La Trobe, Sunshine, Werribee). In addition, around two private sector jobs were redistributed to each NEIC for each public sector job that was relocated. This 2:1 ratio was determined through evaluation of cross industry clustering between public and private sector jobs. Over a 30-year period, the decentralisation scenario equates to more than 55,000 jobs being redistributed away from central Melbourne and into Melbourne's five middle and outer ring NEICs.

The modelling explored two variations in the way in which decentralisation might impact our city:

▪ The **core analysis**, where there is a modelled uplift in economic benefits and outputs in Melbourne's NEICs, and potential disbenefits in central Melbourne are mitigated. This reflects that central Melbourne is likely to continue to consolidate its role as the State's knowledge economy hub, and its central role in hosting Victoria's sporting, creative and cultural events.

- **Sensitivity analysis**, which models an uplift in economic benefits and outputs in Melbourne's NEICs as per the core analysis, but some disbenefits/adverse impacts in central Melbourne due to the lower working population that is modelled to locate there (relative to the base case or business as usual growth).

Decentralisation impacts modelled

The perceived quantifiable economic impacts of decentralisation can be grouped within productivity, transport and amenity categories. The rationale for modelling each impact is outlined in Table 1.

TABLE 1: IMPACTS MODELLED – CORE ANALYSIS

Impact and rationale for modelling
Productivity impact – Changes to agglomeration. Redistributing jobs from central Melbourne to five middle and outer ring NEICs will lead to greater agglomeration (business clustering) in the NEICs. Greater agglomeration is empirically evidenced to improve the productivity of workers in a region. The analysis uses SGS' effective job density (EJD) model, which has been applied to multiple state and local government projects. This impact was applied to workers that exist or which are modelled to exist in the future labour force only. That is, we have not modelled any increase in worker population in Melbourne due to decentralisation interventions.
Transport – Direct impacts. This captures changes to travel distance and travel mode, only for those whose jobs which are relocated from central Melbourne to NEICs.
Transport – Mode share impacts. Investment in transport infrastructure would be required in NEICs to support a polycentric city plan. This would facilitate reduced car mode share, increased PT mode share and increased active transport mode share for all workers within NEICs – those redirected from the central city and those that would have been in these suburban centres anyway.
Transport – Broader road network impacts. Transferring jobs from central Melbourne will reduce demand on Melbourne's radial transport network. This will alleviate congestion. Impacts are modelled for the AM and PM peak period and capture all Melburnians who commute via car.
Place/amenity impact – Dwelling price impacts. As well as being a measure of employment density, EJD provides an index of service accessibility – one person's job is another person's service opportunity. Urban amenity – proxied by dwelling values - is to a significant extent tied to proximity to jobs and services. This relationship was modelled and applied to the walking catchments of central Melbourne and NEICs to imputed dwelling value increases as a measure of improvements in place amenity.

Findings

Core analysis outputs (where negative impacts in the CBD are mitigated) and sensitivity analysis (where negative impacts in the CBD are modelled to occur) are summarised in Table 2.

TABLE 2: IMPACT ANALYSIS OUTPUTS – PRESENT VALUE (4% DISCOUNT RATE)

Impact type	Core analysis ($m)	Sensitivity analysis ($m)
Productivity impact	$22,438	($15,112)
Transport – direct impacts	$212	$212
Transport – mode share impacts	$1,820	$1,274
Transport – broader road network impacts	$1,906	$1,112
Place/amenity impact – dwelling price impacts	$1,013	$759
Net impact of decentralisation	**$27,388**	**($11,756)**

Productivity, transport, and amenity impacts over a 30-year appraisal period are briefly outlined below.

Productivity impacts

Productivity impacts relate to changes in agglomeration, with areas of dense economic activity empirically shown to generate higher productivity per hour worked compared to areas of lower density economic activity. There are a number of hypotheses for agglomeration economies, including improved ability to achieve economies of scale, the availability of numerous supply sources, access to deep and diversified labour pools and opportunities for formal and informal knowledge spill-overs due to consolidated supply linkages and face to face contact.

Productivity impacts in Melbourne's NEICs have been modelled to be positive under both the core and sensitivity analysis. The direction of the net impact hinges on whether central Melbourne specialises further once jobs are shifted to the NEICs. With floorspace freeing up, it is expected that higher order employment uses will take up this floorspace and lift average productivity per worker, offsetting the negative impacts on agglomeration of less concentrated employment. Productivity impacts sum to $22.4 billion under the core analysis, and -$15.1 billion under the sensitivity analysis.

Transport impacts

Melbourne's monocentric urban form means that a moderate proportion of CBD based workers currently travel significant distances to work. A more polycentric urban form has been modelled to reduce average commute distance while simultaneously facilitating a more even distribution of travel demand across the metropolis.

Transport impacts sum to a present value of around $3.94 billion under the core analysis and $2.60 billion under the sensitivity analysis. The largest transport impacts have been found to be associated with changes to mode share expected within NEICs and broader road network impacts. Assumptions relating to these impacts are conceptual; delivering these outcomes is subject to government

investment in transport infrastructure and services, along with changes to urban form, work from home choices and other impacts.

Amenity impacts

Amenity impacts have been modelled at around $1 billion under the core analysis and $760 million under the sensitivity analysis. While these impacts are small in comparison with productivity and transport effects, they may be of particular benefit to some business types within NEICs and MACs and may facilitate uptake of commercial and residential property.

Conclusion

Problems with Melbourne's monocentric urban form are becoming increasingly apparent as the city's population increases. Rising congestion, spatial socio-economic fracturing and labour market inefficiencies are major challenges that must be addressed to elevate Melbourne as a prosperous and sustainable city. Decentralisation interventions are a pragmatic solution to alleviate these problems which could be rapidly implemented.

Overall, we find that a decentralisation strategy for Melbourne has a strong prospect of delivering a net community benefit. The policy deserves serious consideration and further investigation.

1. Introduction

COVID-19 has had a major influence on how Victorians live and work, highlighting an unprecedented opportunity to re-frame how Melbourne functions and create a more sustainable and equitable future.

Melbourne's urban form is characterised by the core central business region, a radial transportation network and comparatively high residential densities within the inner ring suburbs. This urban form, while having significant advantages, is under stress due to factors such as transport network congestion and rising spatial inequality. These issues will be compounded over the coming 30 years in a 'business-as-usual' (BAU) scenario, as Melbourne's population increases from around five million to nearly 8.5 million.[2]

It is within this context that the Greater South East Melbourne Organisation (GSEM) is seeking to advocate to Federal and State governments for policies that will facilitate increased decentralisation of government and knowledge sector employment industries into established precincts in the suburbs.

1.1   Project purpose and objectives

SGS Economics and Planning (SGS) was engaged to undertake independent research and analysis that articulates and quantifies challenges with the monocentric city and the benefits of a polycentric city; that is, decentralisation models which concentrate urban growth within strategic centres.

The scope of work aimed to test the economic merits of GSEM's policy agenda to advance decentralisation interventions across Melbourne. To achieve this, our report and analysis is presented via the lens of a 'business case'; we consider a future decentralisation model against a counterfactual (or BAU scenario) to test whether a net community benefit is generated. The objectives of this study were to:

- **Present the case for change – what is the problem?** – define the role of urban planning, problems with Melbourne's current urban form, and benefits of decentralisation (Section 2).

- **Define future BAU and alternate decentralisation scenarios** – define the parameters of the BAU and decentralisation scenarios, including the type of jobs and number of jobs located within employment precincts across Greater Melbourne (Section 3).

- **Model future BAU and alternative decentralisation scenarios** – model and articulate productivity, transport and amenity impacts of the BAU and decentralisation scenarios (Section 4).

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[2] Victorian Department of Environment, Land, Water and Planning, Victoria in Future, 2019.

1.2   Project context

Greater South East Melbourne – a region of national significance

Reflecting Melbourne's historic growth to the east and strong accessibility via key transport connections, Greater South East Melbourne today accommodates around 27 per cent of metropolitan Melbourne's total population and around 24 per cent of all Greater Melbourne jobs. It is also a region of strong future residential and job growth, projected to add around 660,000 new residents and 390,000 new jobs over the three decades to 2051 (refer Table 3).

TABLE 3: GREATER SOUTH EAST MELBOURNE POPULATION AND EMPLOYMENT GROWTH PROJECTIONS

	Region	2021	2051	Change 2021-2051
Population	Greater South East Melbourne	1,326,268	1,983,601	657,333
	Greater Melbourne	4,948,495	7,887,094	2,938,599
Jobs	Greater South East Melbourne	635,402	1,022,251	386,848
	Greater Melbourne	2,674,897	4,206,593	1,531,696

Source: SGS Economics and Planning Small Area Model, 2023

The current strengths of Greater South East Melbourne lie in manufacturing (with more manufacturing jobs than Western Sydney and Greater Adelaide), health, education, retail and construction. These industries benefit from agglomeration economies – benefits that naturally occur when businesses can readily access other businesses and human resources through physical proximity or fast travel. Agglomeration benefits manifest in more integrated supply chains, greater access to skilled labour and accumulation of knowledge and human capital.

An overview of broad industry types within Greater South East Melbourne is provided in Table 4. Traditional industry jobs within Greater South East Melbourne account for just over one-third of all jobs within Greater Melbourne, while knowledge industries account for just 16 per cent, reflecting the significant role that central Melbourne currently plays in high value-added services.

TABLE 4: GREATER SOUTH EAST MELBOURNE INDUSTRY CLUSTERING

Broad industry classification	% of Greater Melbourne jobs within Greater South East Melbourne
Traditional industries	34%
Population serving industries	25%
Health and education industries	23%
Knowledge industries	16%
Total	**24%**

Source: 2021 Census, Australian Bureau of Statistics

Planning for the future – a shift towards decentralisation

Plan Melbourne[3] recognises the importance of strategic planning as a tool to support sustainable, resilient and prosperous cities. The foreword, written by the former Minister for Planning, Richard Wynne, notes:

> *"As Victoria experiences its third population boom, we need to grow in the **right places** and in the **right way**… this population boom [is] an opportunity for Victoria to grow more liveable, more sustainable and more prosperous. For that to happen, we need to grow in **controlled ways**."*

Plan Melbourne also clearly sets the key challenges for Melbourne, posing the following questions:

- How do we ensure Melbourne remains not just liveable, but sustainable and accessible?

- How do we ensure our suburbs develop jobs and services?

- How do we ensure that the Melbourne that was founded in the 19th century and renewed in the second half of the 20th century continues to flourish in the 21st century?

To deliver a future city that responds to these challenges, *Plan Melbourne* targets a level of decentralisation through consolidating non central city employment growth within National Employment and Innovation Clusters (NEICs) and Metropolitan Activity Centres (MACs).

NEICs are intended to accommodate growth and clustering of business activity of national significance, particularly in knowledge-based industries. These areas are to be developed as places with a concentration of linked businesses and institutions providing a major contribution to the Victorian economy, with excellent transport links and potential to accommodate significant future growth in jobs and in some instances housing. There are seven NEIC's across Melbourne, two of which are within Greater South East Melbourne – Monash and Dandenong.
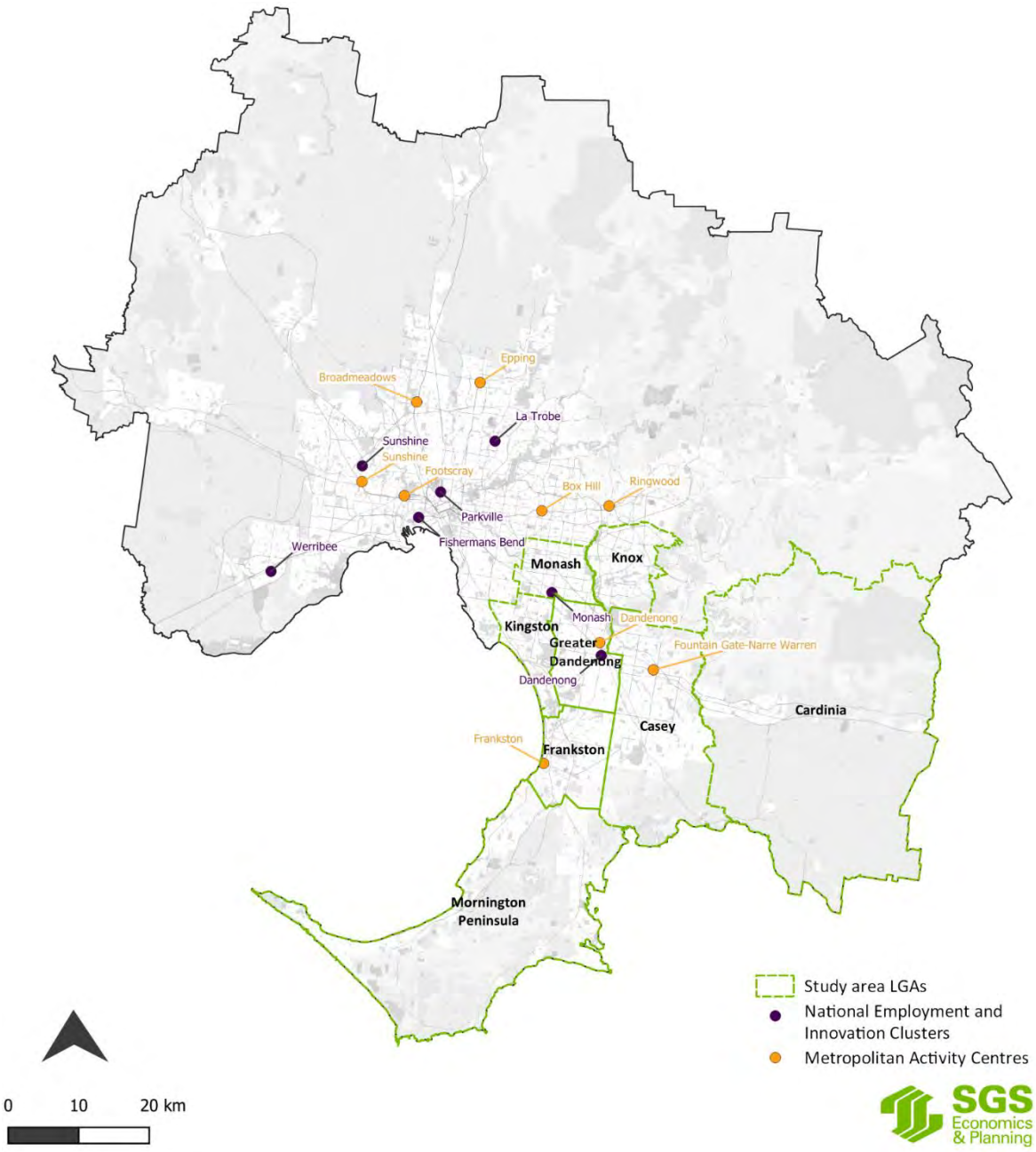
MACs are to provide a diverse range of jobs, activities and housing for regional catchments that are well served by public transport, thereby contributing to significantly reducing Melbourne's environmental footprint. *Plan Melbourne* notes that MACs will play a major service delivery role, including government, health, justice and education services, as well as retail and commercial opportunities. There are nine MACs across Melbourne, three of them are located within Greater South East Melbourne – Dandenong, Frankston and Fountain Gate – Narre Warren.

Melbourne's NEICs and MACs, along with the Greater South East Melbourne study area, are shown in Figure 2, and the NEICs and MACs most relevant to this study are described in Table 5.

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[3] Victorian Government, Metropolitan Planning Strategy – Plan Melbourne 2017-2050, 2017.

FIGURE 2: GREATER SOUTH EAST MELBOURNE STUDY AREA

TABLE 5: NEICS AND MACS WITHIN GREATER SOUTH EAST MELBOURNE

NEIC/MAC	Description
Monash NEIC	The Monash NEIC has the highest concentration of jobs outside the Melbourne CBD. It already supports 75,000 jobs and contributes $9.4 billion to the Victorian economy each year. It is located on key arterial roads, bus routes and the Cranbourne-Pakenham railway line, making it a highly accessible and centralised location.
Dandenong NEIC	The Dandenong NEIC employs more than 66,000 people and is considered one of the most productive manufacturing clusters in Australia. It specialises in advanced manufacturing, health, education, wholesale trade, retail and transport, postal services, and warehousing. It has strong links to other employment areas in Braeside, Carrum Downs, Pakenham and Knox/Bayswater (all within Greater South East Melbourne), which collectively support around 150,000 jobs.
Dandenong MAC	The Dandenong MAC features a growing number of government offices as well as jobs in public administration, health care and retail trade. It is accessible via the Monash Freeway, Eastlink, Princes Highway and the Melbourne to Pakenham-Cranbourne railway line.
Frankston MAC	Health and education are the main services within the Frankston MAC, provided by the Frankston Hospital, Monash University's Peninsula campus and Chisholm Institute. The MAC is well serviced by road and rail to metropolitan Melbourne and the Mornington Peninsula through the Frankston rail line, EastLink, the Frankston Freeway, Moorooduc Highway and Nepean Highway.
Fountain Gate – Narre Warren MAC	Strengthening links to Narre Warren Train Station, job growth within the Fountain Gate Narre Warren MAC is targeted within four key areas – the Narre Warren village, civic and mixed use, retail core, and core business. The MAC is well-connected to the surrounding region via the Monash Freeway, Princes Highway, Eastlink, the Western Port Highway and the Melbourne to Pakenham railway line.

COVID-19 – an opportunity to advance decentralisation to deliver Plan Melbourne targeted outcomes

Decentralisation has been a highly debated topic in Victoria for the better part of 75 years. Although an intuitively positive proposition, it has struggled to gain consistent traction, particularly in an era where so called 'neo-liberalism' has dominated the public policy discussion. It is only in relatively recent times – owing to increasing pressures associated with population growth – that the Victorian Government has sought to achieve a degree of decentralisation via establishment of NEICs and MACs, as well as through targeting additional jobs growth in regional cities. However, core public sector functions and private knowledge-based sectors are still heavily concentrated within central Melbourne.[4]

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[4] Victorian Public Sector Commission website, workforce data, facts and visuals, accessed 2021; SALUP data, 2019.

The approach could now change to deliver a more sustainable and resilient urban form for metropolitan Melbourne. COVID-19 has shaken a number of hegemonic orthodoxies, and the way people work is shifting, particularly within public and private knowledge-based sectors. The most prominent shift has been the adaptation of firms and individuals to remote working. It has been clearly demonstrated that a substantial proportion of economic transactions can be conducted from home or from decentralised locations. Businesses and governments have overcome any lingering reticence about self-supervised workers employed in distributed networks. This does not necessarily mean that future work practices will be unrecognisable from those of the past, but certainly there will be much greater flexibility for enterprises in how and where they conduct business.

Working from home can advantage firms and individuals through direct monetary savings, flexibility over time use and improved worker wellbeing. It may also generate broader economic, social and environmental benefits, such as through enabling people to spend more time with families or in leisure activities (owing to reduced commute times), as well as reduced carbon emissions from transport. Working from central or decentralised office locations will still be critical for the future of businesses, particularly where collaboration and innovation are required as part of their value proposition. In response to the dual benefits of working from home and working within an office, a hybrid approach to work has arisen which is likely to be an enduring model within public and private knowledge sector organisations. This hybrid model can deliver a setting that reduces office overheads while simultaneously enhances workplace culture, collaboration, innovation and productivity.

COVID-19 has illustrated just how important it is to act on (and improve) existing strategies and directions that cater towards a decentralised urban model. The shift towards remote and more flexible working arrangements may cause people to reconsider their locational choices and highlight the benefits of living and working locally. Such an urban form is envisaged via the NEICs and MACs, as well as through other *Plan Melbourne* principles such as environmental resilience and sustainability (transitioning to a low carbon city) and creation of 20-minute neighbourhoods. *Plan Melbourne* defines 20-minute neighbourhoods as accessible, safe, and attractive local areas where people can access their everyday needs within a 20-minute walk, cycle, or public transport trip.

To realise the principles defined in Plan Melbourne, steps must be made towards delivering and/or enhancing the role envisaged for the NEICs and MACs. This will transform Melbourne into a more productive and competitive city with increased human capital and knowledge-based industries located across Melbourne.

The Greater South East Melbourne region, with two NEICs and three MACs, is well placed to support the decentralisation of public sector and knowledge-based sectors. With established key transport infrastructure and ample land for infill development, Greater South East Melbourne is positioned to facilitate execution of *Plan Melbourne* and capitalise on additional decentralisation opportunities associated with COVID-19. This will contribute to creating an equitable urban form that is inclusive and vibrant, while also providing opportunities to decarbonise the transport network. This is a good time for government to reconsider how the ideals of *Plan Melbourne* may be delivered within this context of a post COVID-19 environment.

2. The case for change

This section describes the case for change by articulating the problems with a monocentric city and the benefits of decentralisation.

Although not explicitly stated, Victoria's planning legislation, like most other planning legislation in Australia, seeks to optimise economic efficiency within the confines of environmental limits. Urban planning and regulation of land use and development is deemed necessary because of 'market failure', specifically, the presence of externalities and natural monopolies in the provision of urban infrastructure.

While the legislative framework and general approach to urban planning within Victoria remains mostly sound, current pressures on urban form and function increasingly highlight potential problems with a monocentric city. While the tangible benefits of infrastructure provision continue to 'stack up', challenges associated with controlling negative externalities not reflected in market prices are on the rise, for example, transport externalities and spatial disadvantage. This is a critical problem to address, owing to issues associated with climate change and rising inequality. The conceptual rise of externalities as a portion of tangible benefits is illustrated in Figure 3, noting that both are growing overtime due primarily to population growth.

FIGURE 3: TARGETED BENEFITS OF URBAN PLANNING AND NEGATIVE EXTERNALITIES
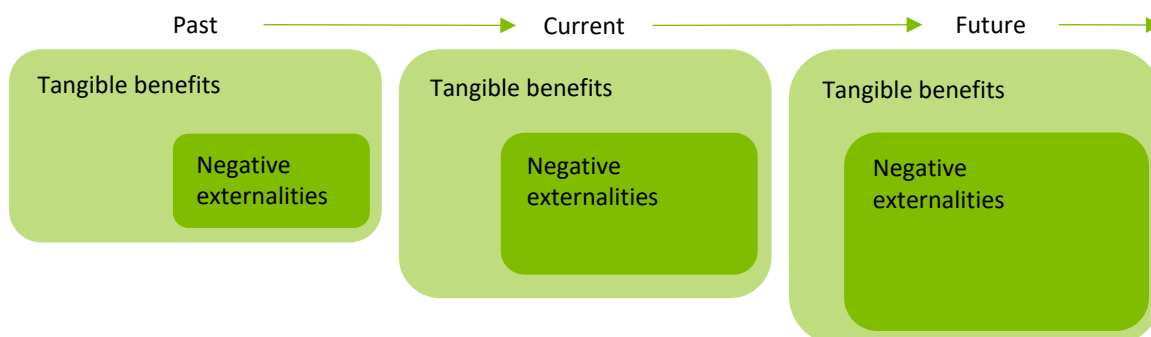
Source: SGS Economics and Planning, 2021.

Optimisation of net community benefit in the urban development process implies the framing of plans and development standards that will correct for negative externalities and protect or create positive externalities. This is becoming more difficult; although the monocentric model of Melbourne has historically seen benefits in terms of transport accessibility and agglomeration economies, it is becoming increasingly evident that the central city is struggling to meet current demands.

This section of the report articulates some of the key challenges associated with Melbourne's monocentric urban form and potential benefits that may arise from accelerating *Plan Melbourne's* decentralisation interventions.

2.1   Problems with a monocentric city

Three broad problems have been identified with Melbourne's monocentric urban form.

- **Problem 1:** An increasingly unsustainable transportation network
- **Problem 2**: Spatial socio-economic disadvantage
- **Problem 3:** Labour market inefficiencies

While these problems have been defined separately, they are closely linked and overlap. Collectively they evidence the case for change from a 'problem' lens.

The problems are described below.

Problem 1: An increasingly unsustainable transportation network

Transport sustainability has a dual definition within this paper. For the purposes of this paper, transport sustainability is taken to mean:

- A transport system that provides ongoing access for Melburnians, thereby maintaining or improving choice of workplace and leisure activities.
- A transport system that is delivering a downward trending consumption of greenhouse gas emissions, which is deemed necessary to generate a positive contribution to Victoria's target of net zero greenhouse gas emissions by 2050.[5]

The current state of the transport network is evaluated against these definitions of sustainability below.

A transport system that provides ongoing access for Melburnians…

> "Congestion is the key market failure affecting the travel experiences of Melburnians… this inefficient congestion, whether on roads or public transport, means people are travelling when the costs, including the costs placed on other travellers, exceed the benefits"[6]

In recent decades, Melbourne's urban sprawl, combined with its monocentric structure and rising population, has created longer average commute distances, growing traffic congestion and increasingly unreliable travel times. The transport network is now struggling to meet demand.

Infrastructure Victoria reports that the cost of congestion, including time, operating costs, and pollution, will double over the next decade under a 'business as usual' scenario, from around $5 billion in 2020 to around $10 billion by 2030.[7] Taking this figure of $10 billion, congestion is expected to cost the average Melburnian around $1,700 by 2030.

In the 'business as usual' scenario, rising congestion will lead to the following impacts:

- A decline in amenity and transport network safety, as increasing traffic on arterial streets pushes traffic, including freight vehicles, onto local streets.

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[5] DELWP website in relation to the Climate Change Act 2017, accessed 2021.
[6] Infrastructure Victoria, Good Move: Fixing Transport Congestion, 2020.
[7] Infrastructure Victoria, Good Move: Fixing Transport Congestion, 2020.

- Increasing travel times for freight vehicles, leading to higher transportation costs and, in turn, higher cost of goods.

- Deterioration of reliable access to important services (e.g. health and education), community amenities and jobs. Emergency vehicle (e.g. police, fire, ambulance) access will also be restricted, affecting response times and associated health and safety outcomes.

- A decline in Melbourne's productivity and overall liveability owing to reduced accessibility, social cohesion, and reduced tolerance for commuting.

Pre-COVID-19, Infrastructure Victoria projected that more than 50 per cent of car trips and 30 per cent of trips by public transport across the morning peak would be undertaken in chronically crowded conditions by 2040. The adverse impacts of projected increases in car trips may now be exacerbated by COVID-19 trends which have seen a shift from public transport patronage to private vehicle use. In a recent study of more than 2,000 Melburnians, up to nine per cent of respondents stated that their mode of travel to work within the CBD will shift from public transport to car post-COVID-19. [8]

The constraints of the transport network have contributed to a stagnation in central Melbourne's productivity growth.[9] To combat this, the State Government is investing heavily in transportation infrastructure that enhances connectivity to central Melbourne. Owing to the constrained urban environment, much of this infrastructure requires tunnelling and/or elevated structures, which comes at a high cost. Victoria's current major infrastructure projects and 10–15-year major infrastructure pipeline that seeks to enhance connectivity to central Melbourne totals nearly $100 billion,[10] which equates to around $20,000 per Melburnian. This is a heavy investment to maintain Melbourne's monocentric form, and, according to academic transport literature, it may be ineffective, as increased transport network capacity only relieves congestion temporarily owing to induced demand effects.[11] A more effective solution may lie in reducing the demand for travel itself, by accelerating delivery of a decentralised urban form that facilitates shorter trips.

A transport system that is delivering a downward trending consumption of greenhouse gas emissions…

> "Current transport emissions exceed the levels required to meet Australia's obligations under the Paris Climate Agreement. These emissions are forecast to increase under the existing policy context. **Sustained** and **unprecedented** action will be required to arrest and then reverse this trend." [12]

Global research comparing transport trends in more than 60 cities worldwide found that Melbourne has comparatively high levels of car ownership.[13] Although vehicles are becoming increasingly more fuel efficient, transport network CO_2 equivalent emissions across Australia are continuing an upward trend, owing to an increase in car ownership and vehicle kilometres travelled.

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[8] Monash University (Graham Currie, Taru Jain, Laura Aston), COVID-19 long term travel impacts study, 2020
[9] DEDJTR, Melbourne Metro Business Case, 2016.
[10] Includes West Gate Tunnel, Melbourne Metro 1 and 2, North East Link, East West Link, City Loop Reconfiguration and Melbourne Airport Link. Values sourced from government departments and agencies.
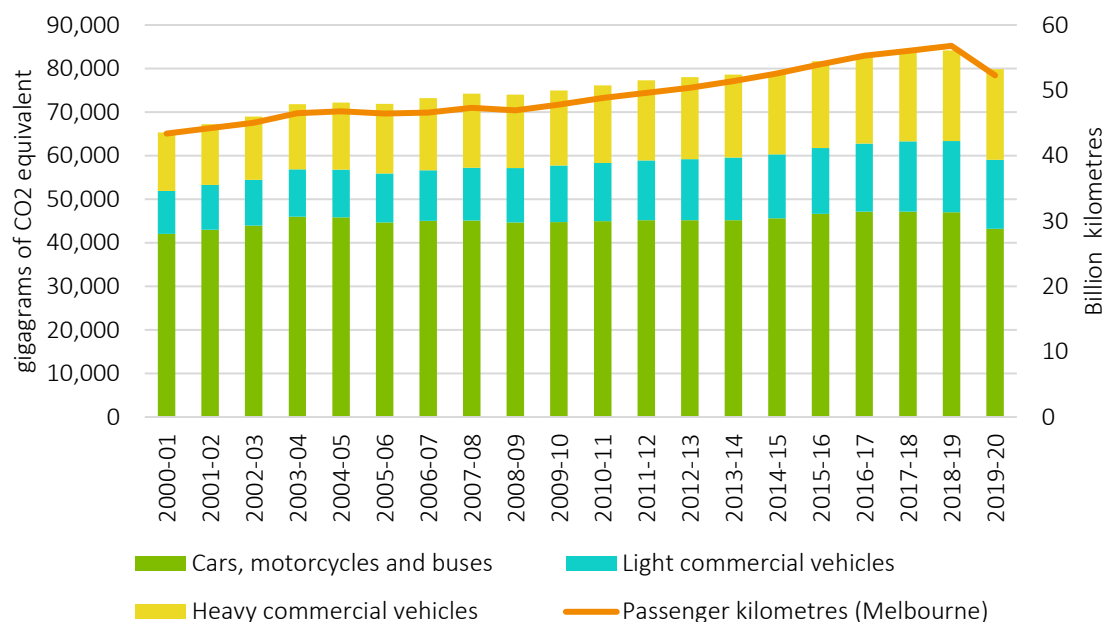[11] See articles published by Peter Newman and Jeffrey Kenworthy for Australian literature.
[12] City of Melbourne, Transport Strategy Refresh: Transport, Greenhouse gas emissions and air quality, 2018.
[13] Climate Council, Waiting for the green light: transport solutions to climate change, 2018

Australia's road transport CO_2 equivalent emissions from 2000-01 to 2019-20 is illustrated in Figure 4, overlaid with Melbourne's passenger kilometres travelled via private vehicle.

FIGURE 4: GIGAGRAMS OF CO_2 EQUIVALENT EMISSIONS – 2000-01 TO 2019-20

Legend:
- Cars, motorcycles and buses
- Light commercial vehicles
- Heavy commercial vehicles
- Passenger kilometres (Melbourne)

Source: BITRE, Yearbook 2020: Australian Infrastructure Statistics. Note 1. One gigagram is 1,000 tonnes. Note 2. 2019-20 is an estimate and reflects COVID-19 impacts.

Despite pledges to achieving net zero greenhouse gas emissions by 2050, Victoria's transport emissions continue to rise. Although working from home may contribute to reduced vehicle kilometres travelled and, in turn, reduced CO_2 equivalent emissions (as shown by the reduction in 2019-20), it is likely that more needs to be done to decarbonise the transport network to sustainable levels.
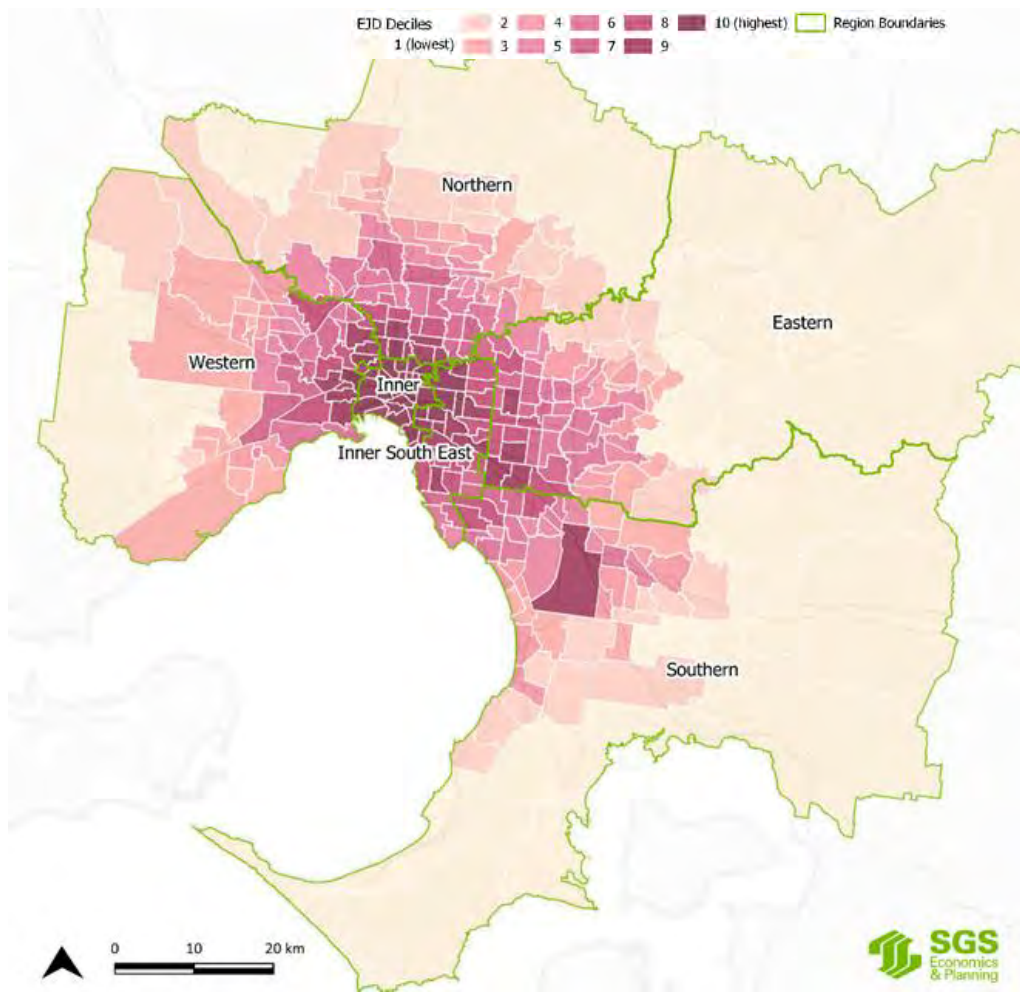
Problem 2: Spatial socio-economic disadvantage

Melbourne's economy is continuing to diversify; reliance on traditional industries is increasingly being complemented with rapidly growing service and knowledge-based sectors that are consolidating within inner urban areas due to their connection to public transport and proximity to Melbourne's CBD. This structural shift is ongoing and is driving an economic core which is both very dense in terms of employment and sharply differentiated from the rest of Melbourne in terms of sectoral composition. Thus, the urban core contributes an outsized share of higher paid 'knowledge jobs' and is a pre-eminent driver of Gross State Product (GSP). While this urban form brings significant benefits, cracks within the monocentric paradigm are becoming increasingly apparent as Melbourne's population rises and continues to sprawl outwards.

A core problem has been the steady evolution of a divided city, where the amenity, opportunities and interests of residents within inner Melbourne vary (sometimes dramatically) from those in more suburban and peripheral regions of the metropolis. A loss of social cohesion not only drives poor social outcomes but carries serious counter productivity implications.

Although mostly used in agglomeration analysis, Effective job density (EJD) is an indicator which can illuminate spatial socio-economic disadvantage within Greater Melbourne. EJD shows the level of concentration of jobs access in given area based on the location of jobs in the area and how long it takes to get to other jobs nearby. A high EJD score generally reflects a large pool of local employment opportunities and/or strong accessibility to other jobs. People who live in areas with a higher EJD score have a greater chance of matching their skills and aspirations to available jobs. This allows individuals to develop their skills in a satisfying job and earn higher incomes. EJD across Greater Melbourne clearly demonstrates that access to jobs reduces with distance from central Melbourne (see Figure 5).

FIGURE 5: GREATER MELBOURNE EJD

Source: SGS Economics and Planning, 2021.

Spatial socio-economic disadvantaged within Melbourne is also evidenced through analysis of socio-economic index for areas (SEIFA) data compiled by the Australian Bureau of Statistics (ABS). SEIFA data ranks areas according to relative socio-economic advantage and disadvantage. Indicators include job accessibility, education attainment, income and others. A high SEIFA score (around 1,100) indicates greatest advantage, while a low score (around 900) indicates greatest disadvantage. Analysis shows that SEIFA score is strongly correlated with distance from central Melbourne.

For every 10 minutes travelled outward from central Melbourne, the average SEIFA score decreases by around 16. While the average SEIFA score within central Melbourne is around 1066 (towards the high end of the scale), the average SEIFA score at approximately 30 minutes from central Melbourne is 1,018 (around mid-range), and the average score 60 minutes from central Melbourne is 970 (trending towards the bottom end of the scale).[14]

The effects of urban sprawl, gentrification and 'suburbanisation of disadvantage' mean that Melbourne's socio-economically disadvantaged populations are being pushed away from high-amenity inner-city areas and are clustered into middle and outer metropolitan areas. Not only are these lower-income households distanced from employment centres, but they also lack a sufficient means of travel to access them – making them more susceptible to the effects of economic decline.[15] This spatial mismatch can impair overall urban productivity, thereby imposing costs not just upon the lower-income groups, but on society as whole.[16]

Problem 3: Labour market inefficiencies

Human capital is the set of knowledge, skills and characteristics that make someone valuable to their workplace and the broader economy.[17] Within an urban economy, labour markets are most efficient when human capital can be effectively matched to the highest skilled job opportunities. An inefficient labour market is the opposite, whereby human capital is not productively utilised; this detracts from GSP.

Sources of human capital include innate ability, education, training, work experience and sociological factors. While individuals can accumulate human capital through these factors, particularly by investing in education, absence of these factors, along with other considerations such as poor job accessibility and spatial inequality (see problems 1 and 2), can lead to the depreciation of human capital.

Within Melbourne, individual human capital is consistently highest within inner areas. This is understandable, as the high wages earned by people with high levels of human capital (by definition) mean that they can afford to live in the high-amenity inner suburbs where housing costs are greater. While this is desirable in some senses – proximity between areas of high human capital to high skilled jobs enables efficient allocation of resources – it is undesirable in others, as the urban form detracts from the ability to effectively develop and maintain human capital in middle and outer parts of Melbourne.

Central to building human capital is labour market participation. Within inner Melbourne, the labour force participation rate is around 74 per cent for males and 65 per cent for females, while within Greater South East Melbourne the labour force participation rate is around 70 per cent for males and 58 per cent for females.[18] The comparatively lower labour market participation in Greater South East Melbourne is in part the result of poor EJD in this region.

SGS analysis, shown in Figure 6, indicates that the further out from the centre of Melbourne that someone lives, the more likely they are to be overqualified for their position. That is, human capital is

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[14] SGS analysis, using SA2 data sourced from the ABS and travel time matrix data created by SGS, 2021.
[15] Dodson, 2004, Mismatch between housing affordability and employment opportunity.
[16] Pawson et al., 2015.
[17] This focus on knowledge and skills aligns with the notion of human capital developed by Becker, 1964.
[18] SGS Economics and Planning, derived from ABS Census 2016.

not efficiently matched with highest skilled job opportunities. Especially high rates of overqualified workers can be found in the highly disadvantaged areas of Doveton and Dandenong in the south east, Epping and Craigieburn in the north, and Rockbank and St Albans in the west.

FIGURE 6: OVERQUALIFIED WORKERS WITH A BACHELOR DEGREE OR HIGHER
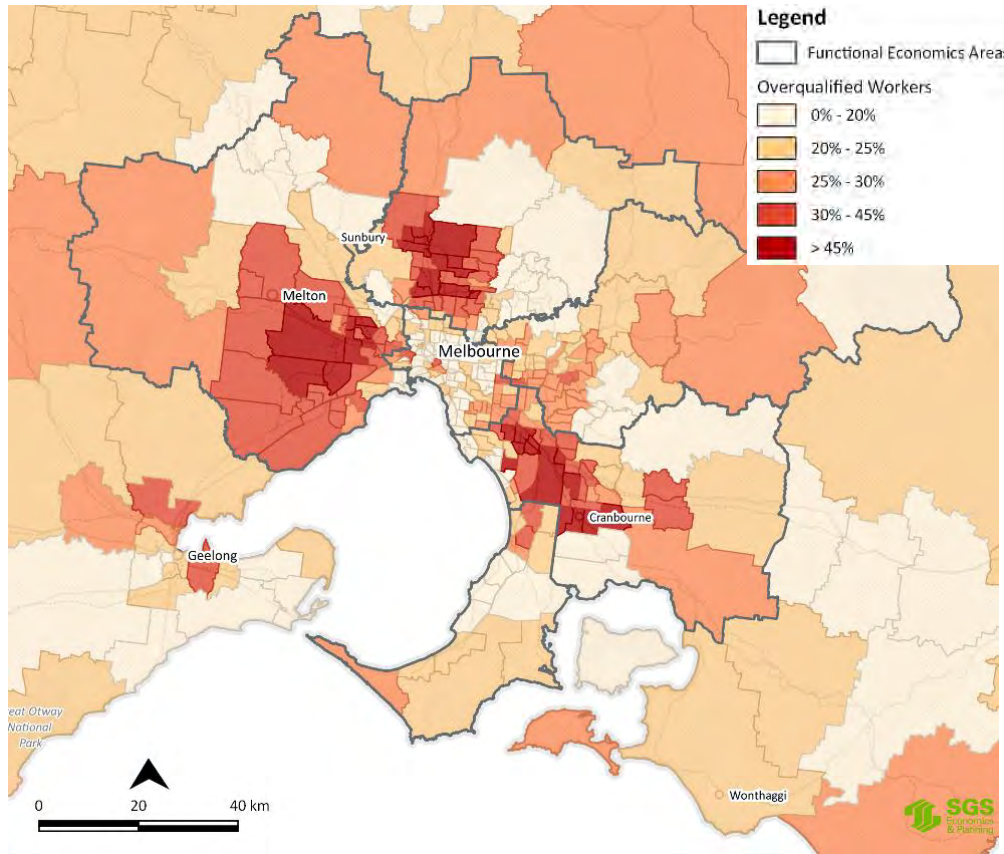
Source: SGS Economics and Planning, derived from ABS Census 2016.

Given inner Melbourne's constrained urban area and relatively high property prices, it is difficult to plan a city where people who want to can shift closer to high skilled jobs. Shifting the high skilled jobs to create a polycentric city may be a feasible alternative, and could contribute to reducing spatial socio-economic disadvantage through increasing utilisation of human capital and thus enhancing productivity within middle and outer regions of Melbourne.

2.2 Benefits of decentralisation

Although *Plan Melbourne* contains decentralisation initiatives and principles such as creation of 20-minute neighbourhoods, it is clear through the problems evidenced above that more needs to be done. There are a range of options available to address the problems. Three key options include:

- **Option 1:** Continued major investment in the transport network.

- **Option 2:** Consolidating densification in inner Melbourne.

- **Option 3:** Advancing decentralisation policies.

While options 1 and 2 address aspects of the problems described in the previous section in the short-term, they emphasise Melbourne's monocentric layout and may further exacerbate the problems over the medium to long-term. Option 3, advancing decentralisation policies, has potential to alleviate the problems over the long-term. Shifting the core central city to multiple suburban activity centres provides a strong alternative to the monocentric city, due to their combination of development capacity, lower land prices and lower levels of traffic congestion.

By addressing the problems through decentralisation interventions, four important benefits may be generated for Melbourne's residents and economy. The benefits are:

- **Benefit 1:** A more sustainable city.

- **Benefit 2:** A more equitable city.

- **Benefit 3:** A more resilient city.

- **Benefit 4:** A more productive city.

It is important to note that these benefits are not automatically generated via decentralisation interventions; the form of interventions will affect whether these benefits are generated and the degree to which they are generated. The conceptual link between current problems and benefits derived by decentralisation interventions is shown in Figure 7.

FIGURE 7: PROBLEMS AND BENEFITS
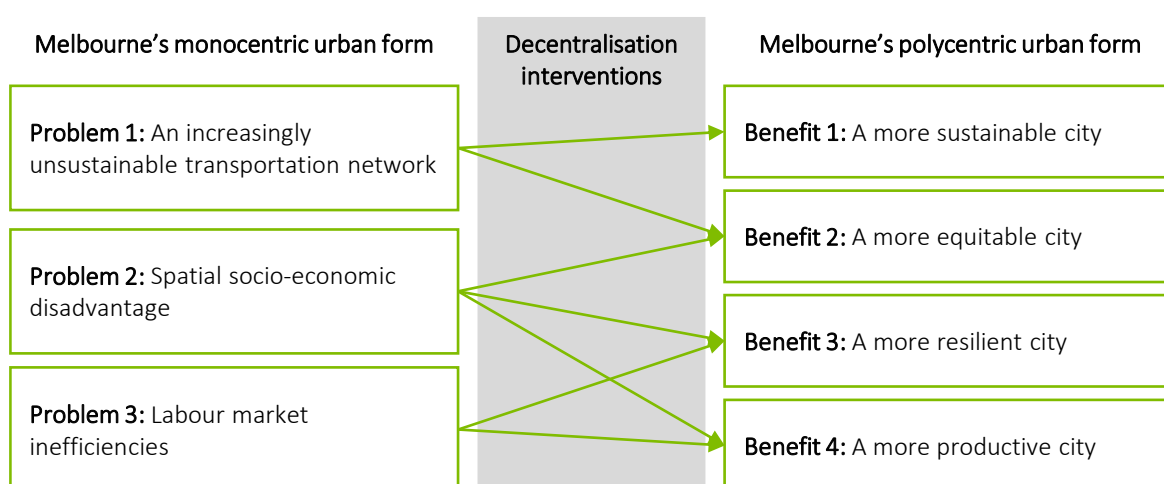
The benefits are described below.

Benefit 1: A more sustainable city

A central benefit of decentralisation interventions will be comparatively shorter, faster, and safer commutes, with traffic more evenly distributed across the network rather than converging within central Melbourne. Shorter commutes and a mode shift away from private vehicle and towards public and active transport modes can lead to significant health and environmental benefits that will contribute to a more sustainable urban outcome.

Decentralisation interventions will lead to a greater number of people converging on NEICs, MACs and other employment centres. As a result, the demand for and the viability of public transport (for example, heavy and light rail, bus rapid transit and standard bus routes) in these centres will increase. Similarly, the viability of advancing active transport infrastructure in NEICs and MACs will also improve. This includes the delivery of Victoria's strategic cycling corridors, which are intended to be the arterials of the cycling network that generate State significant benefits for transport users.

There are many positive social and environmental ramifications from reducing commute times and congestion (evidenced in problem 1). This includes environmental benefits such as the reduction of greenhouse gas emissions and air and noise pollution, and important social benefits such as increased social spare time for commuters. The environmental benefits will make an important contribution to achieving a cleaner, decarbonised transport network and a more sustainable city.

Benefit 2: A more equitable city

Diverting employment growth to NEICs and MACs would be expected to address the mis-match of skills in some of Melbourne's most disadvantaged suburbs (refer Problem 2), and may also reduce overall levels of unemployment within Melbourne. Decentralisation also provides opportunities to advance social cohesion, that being a society that works towards the wellbeing of all its members, fights exclusion and marginalisation, creates a sense of belonging and offers citizens the opportunity of upward mobility.

Benefit 3: A more resilient city

Achieving a more diverse industry base at the local level can reinforce a community's level of self-sufficiency and resilience. Diversifying the industry base within middle and outer metropolitan Melbourne will make these regions less dependent upon individual or a small number of industries for income and wealth. This can lessen the impact of exogenous shocks to a particular industry or industry group (e.g. appreciation of the Australian Dollar making tourism on the Mornington Peninsula less competitive or affecting export markets).

Importantly, decentralisation projects in the form of long-term commitments by government have benefits outside what is economically quantifiable, such as the boost in confidence and morale this would provide to locals.

Benefit 4: A more productive city

The spatial socio-economic disadvantage of the monocentric city model can impede overall urban productivity. This occurs due to a large part of the population struggling to access services and the labour market from the urban fringes. The costs of this are not just incurred individually, but across

society.[19] As described in problem 3, Melbourne experiences substantial labour market inefficiencies with human capital not efficiently matched with the highest skilled job opportunities.

Well executed decentralisation projects such as the relocation of a government agency can deliver greater employment opportunities within a centre and/or region. Successful decentralisation projects encourage people to move to the destination, bringing new economic activity, as a result of the additional wages spent in the region and their subsequent flow through the economy. This provides a major benefit to local businesses. Decentralisation in the form of public investment in an area can also act as a catalyst for private investment with the private sector attracted by the improvement of a centre's image and an uplift in confidence given the long-term public commitment to that area.

Transport remains a key barrier for both job seekers and the existing workforce to find and maintain employment (see problems 1 and 3). Decentralisation interventions not only improve proximity between people and high skilled jobs, but it also provides an opportunity to distribute traffic more evenly across the metropolitan network to alleviate growing congestion. Such an outcome would improve EJD across middle and outer regions of Melbourne and has potential to elevate advantage and reduce disadvantage in these regions (see problem 2). Decentralisation may also provide travel time savings for those that maintain employment within central Melbourne, owing to more free-flowing traffic conditions associated with less traffic.

These changes are likely to reduce unemployment in middle and outer Melbourne and increase labour force participation, which will provide opportunity to better match highly skilled people with highly skilled jobs. This will advance human capital and productivity within middle and outer regions, particularly in areas surrounding NEICs and MACs.

[19] Pawson et al., 2015.

3. Method for modelling the future

This section describes the approach to modelling, including BAU and decentralisation scenarios, and impacts modelled.

Modelling the future with confidence is difficult for this project. Key variables that affect how Melbourne will function into the future include population growth, built form (influenced in part by government investment in transport and services infrastructure), home and work locations, work from home choices and travel behaviour. These variables are interlinked via complex, non-linear relationships. They are also influenced by a range of economic, social and environmental factors, such as GSP, government policy, COVID-19, technological change and climate impacts.

To control for risks associated with an unknown future, our modelling maintains most variables consistent across a BAU scenario and alternative future decentralisation scenarios, while place of work is modelled to change. In addition, our modelling focusses on the incremental difference between the BAU and alternative future decentralisation scenarios, as opposed to modelling overall outcomes of each scenario. This approach limits modelling risks and is likely to illustrate the order of magnitude impacts that may be directly associated with decentralisation interventions that influence where people work.

In line with the 'business case' lens adopted for this project, our quantitative analysis takes a modified form of conventional cost-benefit analysis (CBA). Conventional CBA for government projects typically contains numerous variables which can be categorised as:

1. Capital and/or operating **costs** associated with a program or infrastructure project, or

2. Consequential **impacts** of the program or project, the balance of which are typically benefits.

Owing to uncertainty about the costs of decentralisation interventions, a conventional CBA is not feasible for this project, and our analysis captures the expected impacts only. This is a suitable approach as the costs of allocating and supporting future growth within NEICs and MACs across Melbourne are likely to be partially, wholly, or greater than offset by cost savings of not consolidating the same growth within central Melbourne.

Overall modelling parameters are shown in Table 6, and an overview of scenarios and impacts modelled is shown in

Figure 8. Note that central Melbourne is defined as Melbourne CBD, Docklands, Southbank and East Melbourne. Scenarios are detailed further in section 3.1 and the approach to calculating impacts, including assumptions and key limitations, is explained in section 3.2.

TABLE 6: MODELLING PARAMETERS

Aspect	Parameter
Modelling period	30 years of impacts, from FY2024 to FY2053
Discount rate	4%, reflecting the regulatory nature of the reforms
Base year for discounting	The current financial year – FY2023

FIGURE 8: SCENARIOS AND IMPACTS MODELLED

SCENARIOS MODELLED	
BAU scenario	**Decentralisation scenario**
The future assuming no decentralisation interventions beyond those outlined in *Plan Melbourne.*	Shift 100% of all future (State) public sector professional jobs that were destined within central Melbourne to five NEICs (Monash, Dandenong, La Trobe, Sunshine, Werribee), and model relocation of a proportion of private sector professional and supporting jobs (e.g. connected professional services jobs, plus hospitality and retail jobs).

IMPACTS MODELLED		
Transport impacts	**Productivity impacts**	**Place impacts (amenity)**
Including changes to travel time, environmental externalities, vehicle operating costs and crash costs.	Change in agglomeration associated with a shift of future jobs growth from central Melbourne to NEICs.	Change in amenity associated with a transfer of jobs from central Melbourne to NEICs.

3.1   Scenarios modelled

Business as usual

The BAU scenario is our counterfactual case. It is the base level of employment change expected within Greater Melbourne, based on the most recent socioeconomic trends. BAU employment projections have been informed by:

- SGS Small Area Model (SAM) data, which is maintained by SGS using inputs and assumptions relating to employment growth by industry[20] and distribution of growth based on policy and strategic directives as of 2023.

- Victorian Public Sector Commission workforce data.[21]

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[20] ABS defines 19 industry classifications.
[21] Victorian Public Sector Commission website, Workforce data, facts and visuals (state of the public sector), accessed 2021

Public sector jobs are classified as Victorian Public Service (VPS) jobs and public entity jobs. For modelling, 100 per cent of VPS jobs were assumed to be within the 'public administration and safety' industry, while Government public entity jobs were assumed to be evenly allocated across the 'public administration and safety' and 'professional, scientific and technical services' industries. The breakdown of industry classification is relevant to modelling productivity impacts.

Based on data inputs and assumptions about industry allocation, public sector employment within central Melbourne for the years 2021, 2031, 2041 and 2051 is shown in Table 7.

TABLE 7: BAU PUBLIC SECTOR EMPLOYMENT GROWTH WITHIN CENTRAL MELBOURNE

Industry	2021	2031	2041	2051
Professional, scientific and technical services	11,141	14,155	15,994	18,353
Public administration and safety	37,008	41,817	43,728	49,049
Total employment	48,149	55,972	59,722	67,402
Employment growth (cumulative)	-	7,823	11,573	19,253

Over the three decades to 2051, public sector jobs within central Melbourne are modelled to increase by around 40 per cent in the BAU scenario, from 48,149 jobs to 67,402 jobs. In part because of this growth, additional private sector knowledge economy and population-serving businesses will also choose to locate within central Melbourne.

Decentralisation scenario

100 per cent of future public sector growth is transferred out of central Melbourne and distributed to five of Melbourne's NEICs (Monash, Dandenong, La Trobe, Sunshine, Werribee). Consequently, public sector employment within central Melbourne remains constant at 48,149 over the three decades to 2051 (refer to total employment in 2021 in the above table).

By 2051, 19,253 public sector jobs are modelled to have been redistributed away from central Melbourne. Beyond these jobs (the location of which is in control of the State Government), a further 2.01 private sector jobs are assumed to relocate to the five NEICs for each public sector job reallocated. This ratio was determined via regression analysis of 'public administration and safety' and 'professional, scientific and technical services' industry jobs within Greater Melbourne. That is, our analysis evaluates the natural clustering that occurs between these industries, noting limitations associated with imprecise industry definitions and the inevitable inclusion of other factors that influence where jobs within these industries are located.

To reflect a degree of uncertainty, we have taken a conservative approach in our analysis – rather than assuming all 2.01 private sector jobs reallocated are in the 'professional, scientific and technical services' industry, we have included three other industries that are likely to be affected by interventions that reallocate these public sector jobs to NEICs across Melbourne. These industries are 'retail trade', 'accommodation and food services' and 'administration and support services'.

In total, 19,253 public sector jobs and 38,697 private sector jobs are redistributed away from central Melbourne in our decentralisation scenario (total 57,950 jobs). For context, 57,950 jobs equates to around 37 per cent of current employment within the Melbourne CBD, or around 19 per cent of employment within the City of Melbourne today.[22]

Jobs redistributed away from central Melbourne is shown in Table 8. By 2051, Greater South East Melbourne NEICs are modelled to absorb a an additional 15,839 additional jobs. The redistribution of jobs to NEICs is in line with growth expected within these clusters under the base case (which includes delivery of Suburban Rail Loop East), to reflect the general function and capacity of these centres.

TABLE 8: PUBLIC AND PRIVATE SECTOR JOBS REALLOCATED AWAY FROM CENTRAL MELBOURNE

Industry	2021-2031	2031-2041	2041-2051
Professional, scientific and technical services	11,860	6,079	11,041
Public administration and safety	4,809	1,911	5,321
Retail trade	1,644	788	1,614
Accommodation and food services	3,386	1,623	3,324
Administration and support services	1,849	886	1,815
Total employment shift during period	**23,549**	**11,286**	**23,115**
Total employment shift (cumulative)	**23,549**	**34,835**	**57,950**

TABLE 9: REDISTRIBUTION OF PUBLIC AND PRIVATE SECTOR JOBS TO NEICS

Location	2021-31	2031-41	2041-51
Monash NEIC	6,055	2,902	5,944
Dandenong NEIC	10,081	4,832	9,895
GSEM total employment shift during period	**16,136**	**7,734**	**15,839**
GSEM total employment shift (cumulative)	**16,136**	**23,870**	**39,710**
Other NEICs total employment shift (cumulative)	**7,412**	**10,965**	**18,241**
Greater Melbourne total employment shift (cumulative)	**23,549**	**34,835**	**57,950**

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[22] Based on City of Melbourne Census of Land Use and Employment data for the Melbourne CBD.

3.2 Impacts modelled

SGS modelled impacts across three categories:

- **Impact 1.** Changes to productivity
- **Impact 2.** Changes to travel behaviour
- **Impact 3.** Changes to place quality/amenity.

Due to uncertainty about how the role of the CBD will change under the decentralisation scenario, SGS has modelled two variations of impacts in central Melbourne, as follows:

- The **core analysis**, where there is a modelled uplift in economic benefits and outputs in Melbourne's NEICs, and potential disbenefits in central Melbourne are mitigated. This reflects that central Melbourne is likely to continue to consolidate its role as the State's knowledge economy hub, and its central role in hosting Victoria's sporting, creative and cultural events.

  Historically, Melbourne and other cities across Australia have seen an 'unbundling' of the value chain so that different stages of production are compartmentalised to promote greater efficiency. In the wake of free trade and globalisation, Melbourne's knowledge economy surged as the city capitalised on its relative strengths.

  The pandemic has shown that transactional functions, such as certain roles in banking, super funds, and many government departments can be performed in an equally productive manner in a more distributed setting (i.e., working from home). Considering this new paradigm, firms may find it beneficial to locate these functions in Melbourne's NEICs, unlocking space in the CBD for more creative and collaborative employment uses.

- **Sensitivity analysis**, which models an uplift in economic benefits and outputs in Melbourne's NEICs as per the core analysis, but some disbenefits/adverse impacts in central Melbourne. In this scenario, additional productivity is not unlocked in central Melbourne, and productivity per worker declines.

The core analysis may be considered as a more optimistic scenario, while the sensitivity analysis is a more pessimistic scenario.

Impact 1: Changes to productivity

A key driver of productivity in urban areas is 'agglomeration economies'.

Agglomeration economies relate to the productivity enhancements that enterprises gain from locating in an area of relatively dense economic activity. This higher level of productivity translates into an increase in Gross Value Added (GVA) per hour worked.

Agglomeration benefits stem from a variety of factors including:

- The ability to achieve economies of scale and scope through specialisation given the large numbers of potential customers that are readily accessible.
- The availability of numerous supply sources and potentially specialised infrastructure, and the competitive environment that stems from this.

- Access to a deep and diverse pool of skilled labour, often complemented by high levels of technological/knowledge transfer between firms, which helps bolster innovation.

- Further opportunities for knowledge spill-overs due to local supply linkages, face to face contact and trust based commercial relationships.

To measure the ease with which enterprises can interact with each other, SGS applies an index of accessibility within a specified geographical region known as Effective Job Density (EJD).

In calculating EJD, SGS uses the level of employment relative to the time taken to gain access to that employment and the transport mode split that is experienced by those workers in their travel to employment. The formula used to calculate EJD at an area unit level is presented below.

$$EJD_i = \sum_j \left(\frac{PT\ Mode\ Share_j \times Emp_j}{PT\ Travel\ Time_{ij}} + \frac{(1 - PT\ Mode\ Share_j) \times Emp_j}{PV\ Travel\ Time_{ij}} \right)$$

Where:

- EJD_i = Effective Job Density for area unit i

- $PT\ Mode\ Share_j$ = per cent of work trips which involve public transport for area unit j

- Emp_j = number of jobs/ employment within area unit j

- $PT\ Travel\ Time_{ij}$ = time it takes to travel on public transport from area unit i to area unit j

- $PV\ Travel\ Time_{ij}$ = time it takes to travel by private vehicle from area unit i to area unit j

Evidence from international literature and SGS's EJD model show that a doubling of EJD leads to a seven per cent increase in overall labour productivity, on average.

In our analysis, jobs were distributed to NEICs as per decentralisation scenario outlined in section 3.1. An unmodified version of SGS's EJD model was applied to model changes to productivity. Our approach to estimating changes in labour productivity due to changes in EJD can be summarised into the following steps:

1. Establish a relationship between EJD and labour productivity using historical data.

2. Compute EJD for Greater Melbourne for the BAU scenario and decentralisation scenarios. Modelling decentralisation scenarios required redistributing jobs from central Melbourne to NEICs and MACs within the EJD model.

3. Forecast labour productivity for each scenario. Note that changes to productivity impacts all workers in Greater Melbourne, not just those workers who are directly impacted by decentralisation interventions.

4. Apply the results of the regression analysis (step 1) to the estimated change to EJD between the BAU scenario and each of the decentralisation scenarios to produce estimated labour productivity impacts.

In the **core analysis**, agglomeration gains were modelled in the NEICs due greater concentration of workers there, while the CBD as a whole was modelled to maintain productivity levels as per the base case into the future for the reasons outlined at the start of this section.

In the **sensitivity analysis**, agglomeration gains were modelled in the NEICs as per the core analysis, however, the productivity of each CBD worker was modelled to reduce due to lower formal and informal opportunities for collaboration.

Modelling limitations

Productivity impacts modelled may be overstated because of the following factors:

▪ The agglomeration elasticities used within the modelling are based on a pre-COVID-19 economy and, therefore, prior to recent widespread adoption of technology platforms that support remote working and enable 'digital' proximity. Due to the evolving nature of work in a post-COVID-19 environment, it is too early to adapt the EJD model to accurately capture potential changes to agglomeration elasticities associated with adoption of new and emerging remote working technologies.

▪ SGS is aware of emerging Australian research which has sought to disentangle 'sorting' from agglomeration effects in the formation of positive elasticities between changes in EJD and changes in productivity. Sorting refers to more highly skilled individuals choosing to move to areas of denser employment to better match their skills with employment opportunities. Based on the longitudinal Household, Income and Labour Dynamics in Australia (HILDA) data, the research shows that agglomeration elasticities which have been routinely used over the past 15 years or so may be overstated, as they may also capture sorting effects. In addition to 'sorting' effects, international literature shows that 'selection' effects are also a significant factor driving higher productivity in dense urban areas. Selection refers to larger markets encouraging many firms to enter, with increasing competition resulting in unproductive firms ultimately leaving the market. A literature review was undertaken to better understand sorting, selection and agglomeration effects within the context of transitioning from a monocentric city to a polycentric city. The literature review is provided in **Appendix A**. In short, most studies found that sorting has a greater effect on productivity than agglomeration effects, and selection effects were unclear, with two studies finding that selection has no impact on spatial differences in productivity. Importantly for decentralisation, two research articles reviewed found that non-routine labour experienced far larger benefits from agglomeration effects than more routine and lower skilled employees. This suggests that maintaining higher skilled jobs within dense areas is beneficial for urban productivity, however, this benefit needs to be balanced in light of rising spatial socio-economic disadvantage.

▪ SGS's EJD model assumes that workers work wholly from their primary place of work. In reality, it is likely that a hybrid approach to working will endure in a post-COVID-19 world, with workers spending a portion of their week working from home or potentially from a decentralised office.

▪ EJD is a function of job density and job connectivity (travel time between jobs). While the EJD modelling undertaken assumes changes to job density across the BAU and decentralisation scenarios, it does not capture differences in the other variable – job connectivity. This is unlikely to reflect reality, as establishing Melbourne as a truly polycentric city would require enhanced transport connectivity within and to/from NEICs. If job connectivity was accounted for, higher productivity growth impacts would have been modelled.

Impact 2: Changes to travel behaviour

Travel impacts were modelled using assumptions relating to job decentralisation as set out in section 3.1, ABS data, SGS travel distance and travel time matrices, and broad assumptions relating to changes in travel behaviour and network impacts. Modelling software, such as the Victorian Integrated Transport Model (VITM) or more sophisticated land use/transport interaction (LUTI) models were not adopted for the analysis due to time and resource constraints.

Australian Transport Assessment and Planning (ATAP) guidance provides parameters for modelling impacts associated with changes to vehicle hours travelled (VHT) and vehicle kilometres travelled (VKT). These parameters are endorsed by the Victorian Government. Parameters are provided for the following components of transport impacts:

- Travel time costs (calculated using VHT)

- Environmental externality costs, for example, greenhouse gas emissions, noise, urban separation (calculated using VKT)

- Vehicle operating costs (calculated using VKT)

- Crash costs, mostly costs of fatal and serious injuries (calculated using VKT)

Three types of transport impacts are likely to occur due to decentralisation interventions:

- **Direct impacts.** Impacts to those who are modelled to work in NEICs and MACs as a direct result of decentralisation interventions.

- **NEIC mode share impacts.** Impacts to other workers within NEICs and MACs who change their transport mode due to assumed delivery of public and active transport infrastructure.

- **Broader road network impacts.** Impacts across the road transport network during peak commute travel periods, associated with a more even distribution of traffic.

The approach taken to quantify these impacts is outlined below.

Direct impacts

Melbourne's monocentric form means that some people travel significant distances to work. ABS data shows that average commute distances to NEICs is less than average commute distances to central Melbourne, highlighting potential travel time and travel distance benefits of relocating jobs away from central Melbourne and to NEICs. The approach underpinning calculation of direct transport impacts is outlined below:

1. Average public transport and private vehicle travel distance and travel time was calculated for central Melbourne and NEICs, using journey to work data sourced from the ABS[23] and SGS's travel distance and travel time origin-destination matrices.

2. The reduction in travel time and distance to central Melbourne and the increase in travel time and distance to NEICs was calculated for each year of the 30-year appraisal period. For the base case and two decentralisation scenarios, workers within the 'public administration and safety',

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[23] Travel distance and travel time matrices were developed at the SA2 level.

'professional, scientific and technical services' and 'administration and support services' industries were modelled to travel to work three days per week and work from home two days per week, while workers within 'retail trade' and 'accommodation and food services' industries were modelled to travel to work five days per week.

3. The net change in travel time and travel distance was calculated. This net change was monetised using ATAP parameters.

Modelling limitations

▪ Place of residence has been maintained constant for all workers. It is possible that decentralisation of jobs will increase the attractiveness of peri-urban and regional areas, thereby leading to longer travel journeys and travel times. Offsetting this modelling limitation is the likelihood that residential density would increase within and nearby to NEICs.

▪ Travel speed has been modelled to remain constant over the 30-year appraisal period. This reflects SGS's point-in-time travel speed matrix. Compared to the base case, it is likely that decentralisation will lead to reduced congestion in central Melbourne and increased congestion around NEICs and MACs.

▪ The approach calculates changes in commuting trips only. It is possible that this understates impacts, as improving the service offering and amenity within NEICs may support shorter trips for recreational and leisure purposes.

NEIC and MAC mode share impacts

Central Melbourne is characterised by comparatively high public transport and active transport mode share and comparatively low private vehicle mode share. In contrast, NEICs are generally accessed via private vehicle for work purposes, with comparatively low levels of public and active transport. Serious action to deliver a more poly-centric urban form will require investment to upgrade public and active transport infrastructure within NEICs, as well as potentially changing restrictions relating to commercial and residential density. While it is unlikely that such changes would lead to a mode share that reflects that of central Melbourne, it is likely that private vehicle mode share would be partly replaced by public and active transport modes. Such an outcome supports ideals presented within the Transport Integration Act 2010 (TIA) and the Climate Change Act 2017.

The approach underpinning calculation of NEIC mode share impacts is outlined below:

▪ Current mode share within central Melbourne and NEICs was calculated using ABS data. Average active transport commute distance (walking and cycling) for central Melbourne was also calculated using ABS data.

▪ In the **core analysis,** a transport mode share shift for the decentralisation scenario was estimated. In this scenario, car mode share was modelled to shift 50 per cent to car mode share within central Melbourne. For example, car mode share within central Melbourne is currently 25 per cent, while for the Monash NEIC it is around 76 per cent.[24] In the decentralisation scenario, car mode share

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[24] ABS data, 2016

within Monash was modelled to shift to 51 per cent (50 per cent of the way to central Melbourne). This sees a reduction in private vehicle use within NEICs. Public transport and active transport modes were modelled to make up the difference. The change in mode share was applied to all workers within NEICs over the 30-year evaluation period.

- In the **sensitivity analysis**, a car mode shift of only 35 per cent of the way to central Melbourne was modelled. This scenario reflects a future where, despite the successful delivery of SRL East, supporting active and public transport infrastructure is not developed to meet the current aspirations. Residents of Greater South East Melbourne are still quite car-reliant in this scenario.

- The incremental change in travel time and travel distance by private vehicle and public transport was calculated using SGS's travel distance and travel time matrices. The incremental increase in walking and cycling distance was also calculated, using ABS data and based on assumptions detailed above. Incremental changes were annualised and assume that all workers travel to work four days per week and work from home one day per week.

- The net impacts associated with changes to travel time and travel distance by mode were monetised using ATAP parameters.

Modelling limitations

- The 50 per cent mode shift towards central Melbourne mode share is assumed (i.e. it is not based on any literature or empirical evidence). The assumptions reflect varying levels of State and local government support of decentralisation interventions, including land use changes to increase precinct density, delivery of new public and active transport infrastructure, and delivery of new public transport services. Changes to transport mode affects network congestion for all modes, which leads to flow on impacts as people seek to optimise their travel utility. The flow on impacts and future transport mode equilibrium is difficult to model with confidence, and the 50 per cent shift to central Melbourne mode share scenario should be considered as an illustrative example, rather than a precise decentralisation impact.

- As with direct transport impacts, the approach calculates changes in commuting trips only. It is possible that this understates impacts, as improving active and public transport infrastructure to and within NEICs may support more sustainable mode share for recreational and leisure purposes.

- The viability of expanding public transport infrastructure and services within NEICs has not been modelled, hence the introduction of a sensitivity test.

Broader road network impacts

As evidenced in problem 1, Melbourne's transport system is under pressure, in part due to the city's monocentric urban form. Redistributing jobs more evenly across the metropolis is likely to have comparative traffic distribution impacts. Such redistribution will improve travel times to central Melbourne compared to the base case and may result in broader improvements to road network travel time. The approach underpinning calculation of road network impacts is outlined below:

- The number of workers commuting via private vehicle across Greater Melbourne was calculated for 2016 using ABS data. Projections for each year of the 30-year appraisal period were modelled using the base 2016 value and Melbourne's forecast population growth.[25]

- Total commuter travel time in the BAU scenario was calculated for the road network, using the number of private vehicle commuters calculated in step 1 and HILDA data about average travel time. Total daily travel time in Melbourne was annualised using an assumption that all workers travel to work four days per week and work from home one day per week. This is a high-level assumption that is not underpinned by any data about systemic changes to labour force work location and and commute preferences.

- Total commuter travel time in the **core analysis** assumes a 3 per cent improvement in transport time. Under the **sensitivity analysis,** an improvement of 1.75 per cent is considered to account for the higher car mode share.

- The marginal improvement in travel time was monetised using ATAP parameters.

Modelling limitations

- As with direct impacts, place of residence has been maintained constant for all workers. It is possible that decentralisation of jobs will increase the attractiveness of peri-urban and regional areas, thereby leading to longer travel journeys and travel times. Offsetting this modelling limitation is the likelihood that residential density would increase within NEICs.

- The marginal improvement in commute time is assumed. As with mode share impacts, broad road network travel improvements should be considered illustrative examples, rather than precise decentralisation impacts. No robust transport modelling was undertaken as part of this project.

Impact 3: Changes to place quality

The analytical method adopted to quantify impact 3 assumes that an area's activity and service offer is reflected in land prices. That is, other things equal, housing in and around 'better' activity centres will have a higher market price.

As well as being a measure of employment density, EJD provides an index of service accessibility – one person's job is another person's service opportunity. It follows that if service rich areas command a land value premium, housing values should be positively related to EJD. Adopting this thesis, SGS applied the following calculation method:

- Estimate the elasticity between EJD and housing prices.

- Calculate the EJD of the host location without the addition of the decentralised jobs.

- Calculate the EJD of the host location with the addition of the decentralised jobs.

- Estimate the _notional_ increase in housing prices in and around the host location to monetise the improvement in activity and local services.

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[25] Victoria in Future, DELWP, 2019.

4. Impact analysis findings

This section examines the outputs of productivity, transport and amenity impacts.

4.1 Overview

Decentralisation scenario impacts for the core analysis and sensitivity analysis are outlined in Table 10 and presented visually in Figure 9.

TABLE 10: IMPACT ANALYSIS OUTPUTS – PRESENT VALUE (4% DISCOUNT RATE)

Impact type	Core analysis ($m)	Sensitivity analysis ($m)
Productivity impact	$22,438	($15,112)
Transport – direct impacts	$212	$212
Transport – mode share impacts	$1,820	$1,274
Transport – broader road network impacts	$1,906	$1,112
Place/amenity impact – dwelling price impacts	$1,013	$759
Net impact of decentralisation	**$27,388**	**($11,756)**

FIGURE 9: IMPACT ANALYSIS OUTPUTS – PRESENT VALUE (4% DISCOUNT RATE)
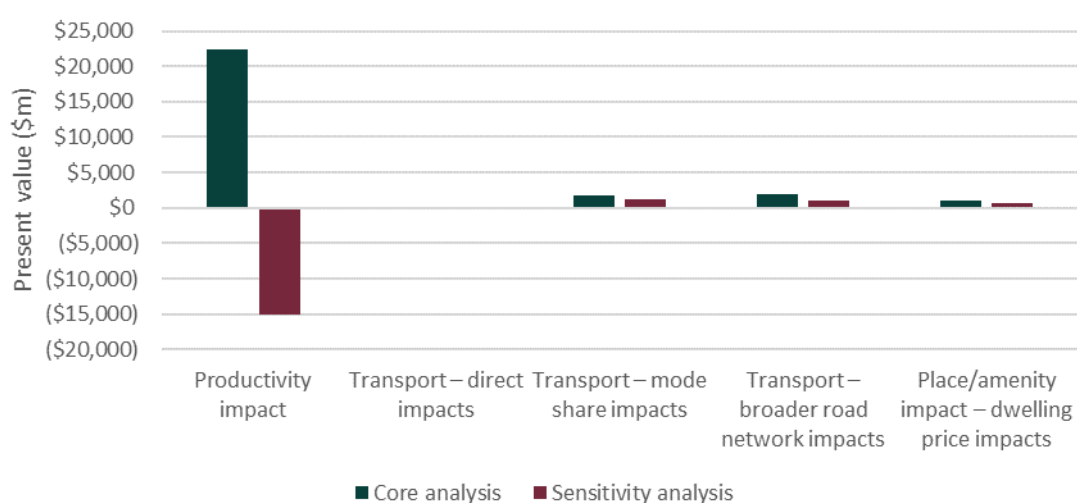
Productivity impacts

Over a 30-year evaluation period and using a discount rate of four per cent, net productivity impacts total around $22.4 billion under the core analysis, and -$15.1 billion under the sensitivity analysis.

Improvements in the NEICs' productivity drive majority of the impact, with the increased concentration of workers leading to positive agglomeration effects as outlined in section 3. However, under a pessimistic scenario where productivity in central Melbourne declines, the dilution of jobs outweighs the productivity gains in the NEICs.

The modelled productivity impacts calculated must be considered within the context of limitations detailed in Section 3.2. In particular, SGS is of the view that the negative productivity impacts may be overstated, due to incorporation of sorting effects and, to a lesser extent, selection effects.

Transport impacts

Transport impacts sum to a present value of around $3.94 billion under the core analysis and $2.60 billion under the sensitivity analysis. These positive impacts seem plausible within the context of Melbourne's transport network congestion costs, which currently sum to around $5 billion per year and are expected to increase to around $10 billion per year by 2030 (refer to problem 1 in section 2.1). Assuming the cost of congestion does not increase beyond 2030, the present value cost of congestion within Melbourne over a 30-year appraisal period using a discount rate of four per cent is around $160 billion. The analysis suggests that under the core analysis, decentralisation may reduce the cost of congestion by around 2.5 per cent compared to the BAU scenario, whereas the pessimistic scenario considered by the sensitivity analysis forecasts a reduction of around 1.6 per cent.

Most transport impacts are associated with mode share and broader road network impacts. Assumptions relating to these impacts are conceptual; delivering these outcomes is subject to government investment in transport infrastructure and services, along with changes to urban form, work from home choices and other impacts.

Amenity impacts

At around $1 billion under the core analysis and $760 million under the sensitivity analysis, amenity impacts are considered minor compared to productivity and transport impacts. However, it is still an important benefit, particularly considering spatial socio-economic disadvantage evidenced in problem 2.

Net impacts

The net impact for decentralisation under the core analysis is around $27.4 billion, and under the sensitivity analysis it is around -$11.8 billion. This highlights that decentralisation interventions have potential to deliver net welfare gains for Victorians. However, these outputs must be considered as indicative, order of magnitude impacts only. As detailed in Section 3, modelling the future with confidence is difficult for this project, as key variables that affect how Melbourne will function into the future include population growth, built form, home and work locations, work from home choices and travel behaviour. SGS's analysis was undertaken at a high-level given time and resource constraints. It is unlikely that the full range of nuanced risks, costs and impacts were captured.

A key aspect of our analysis which was conservative in nature was that the total number of jobs in Melbourne was modelled to remain the same under the BAU and decentralisation scenarios. With lower labour market participation (see Problem 3) in the middle and outer parts of Melbourne, it is reasonable to expect that improving the supply of suburban jobs under a more polycentric urban form could lift participation rates in middle and outer suburban areas. Previously overqualified workers, and those who have left the labour market, would be more able to access suitable employment opportunities, providing private benefits in the form of increased wages, and additional productivity benefits by further increasing the positive effects of agglomeration. A net increase in the number of workers under a decentralisation scenario is particularly plausible given the current worker shortages across many industries in Victoria, as set out by the Victorian Skills Commission.

5. Conclusion

Problems with Melbourne's monocentric urban form are becoming increasingly apparent as the city's population increases. Rising congestion, spatial socio-economic disadvantage and labour market inefficiencies are central challenges that must be addressed to elevate Melbourne as a globally competitive city. Decentralisation interventions are a pragmatic solution to alleviate these problems which could be rapidly implemented.

Quantitative analysis suggests that a proactive decentralisation initiative of focussing *future* public sector jobs within NEICs will facilitate organic private sector jobs growth in the same NEICs, at a ratio of around two private sector jobs per one public sector job.

Productivity impacts, as with transport and amenity impacts, were found to be positive in the core decentralisation scenario, with future jobs focussed within five NEICs. This finding is dependent on central Melbourne increasing in specialisation, raising average productivity per worker to offset the loss of workers through decentralisation. Given the direction of the CBD, and the future build out of specialised employment districts such as Fishermans Bend, such a future is plausible.

Decentralisation interventions are considered to be good public policy that is worthy of further investigation. However, other modelling limitations must also be considered, especially those relating to transport impacts. Further analysis incorporating more granular modelling parameters and consideration of more specific land use changes (i.e. changes to residential and employment locations and densities) would support the refinement of the decentralisation interventions modelled in this study to generate greater and enduring positive welfare gains for Melbourne's citizens and businesses.

Appendix A – Urban productivity literature review

Relationship between agglomeration effect and city size

A literature review was undertaken to contextualise the relationship between agglomeration and larger labour markets. Increasing employment density results in cities becoming more productive because of a range of factors, resulting in higher individual worker productivity. While agglomeration effects partly explain higher worker productivity, there are many other factors that also contribute. Throughout academic literature, the three key themes of sorting, selection and agglomeration are frequently presented as individual drivers of higher urban productivity.

Sorting refers to more highly skilled individuals choosing to move to areas of denser employment to better match their skills with employment opportunities. Selection (referencing Darwin's natural selection) refers to larger markets encouraging many firms to enter, with increasing competition resulting in unproductive firms ultimately leaving the market. Another factor examined in two studies was natural endowments, which are specific natural features such as ports or natural mineral resources which can increase the productivity of certain areas above others.

In most case studies reviewed, sorting was found to have the greatest effect on worker productivity

within a region. While agglomeration benefits did indeed influence worker productivity, these benefits were usually smaller in magnitude. Selection effects had less clear outcomes, with two studies finding it to have no impact on spatial differences in productivity at all. Importantly for our analysis, it was found that agglomeration benefits varied widely between industries and the type of work completed. In two studies it was found that non-routine labour experienced far larger benefits from agglomeration effects than did more routine and lower skilled employees. Indeed, one study found that the agglomeration benefit for routine work was nearly non-existent.

Title	The sources of the urban wage premium by worker skills: Spatial sorting or agglomeration economies?
Authors	Andersson, M; Klaesson J; Larsson, J
Year	2013
Publication	Regional Science; Volume 93, Issue 4

In this study, Andersson, Klaesson and Larsson sought to explain differences in urban and rural wages through a combination of spatial sorting and agglomeration economy effects. Spatial sorting can have a few different definitions, but here refers to individuals choosing to work and live in areas with labour markets that best match their specific skill sets. While wages do not fully measure worker productivity, there is a high correlation between the two, so the findings remain relevant to this study. Furthermore, in many studies, wages have been used as a proxy for productivity due to this close relationship.

The study was based in Sweden, using data from 2002 to 2008. Modelling was completed by taking employment density by municipality, and then weighted according to accessibility for workers. A range of different controls, including wage, years of work experience and schooling, education specialization, immigrant status, sex, tenure, number of prior employers, and job change during the period were considered to disentangle the effects of skill levels and employment density.

It was found that there are significant differences between workers with routine and non-routine employment and related skills, when considering productivity and wages. Non-routine workers were found to have statistically significant agglomeration economic benefits, but these were still of smaller magnitude than the productivity benefit derived from spatial sorting.

It was also found that non-routine workers appear to be better at accumulating human capital. These workers are able to retain a long-term knowledge benefit from working in more dense areas, even after leaving the agglomerated center. This is shown through their ability to move away from dense centers but retain higher wages. For workers with routine job task related skills, agglomeration benefits were "non-existent".

Title	The Productivity Advantages of Large Cities: Distinguishing Agglomeration From Firm Selection
Authors	Combes, P., Duranton, G., Gobillon, L., Puga, D., and Roux, S.
Year	2012
Publication	Econometrica, 80(6)

This study by Duranton, Gobillon, Puga and Roux assessed the benefits of agglomeration with regards to denser labour markets being able to better account for shocks in demand, the ability for similar firms to share suppliers and knowledge spill overs. Alongside this, the study also looks at 'firm selection', which they define as larger markets attracting more firms and therefore generating an increase in competition. This results in less productive firms eventually leaving the market.

Modelling was completed using a French municipality dataset. The modelling differentiated between agglomeration with firm selection. This looked at total factor productivity at the firm level, and then develop a quantile approach to compare distribution of firm productivity in different sectors. It was found that firms in denser areas were on average 9.7 per cent more productive than those in less dense areas. However, productivity advantage is only of 4.8 per cent for firms at the bottom quartile (of productivity) and 14.4 per cent for firms in the top quartile. Agglomeration was found to be a more significant factor to productivity uplift than selection.

Title	Identification of agglomeration economies
Authors	Combes P, Duranton G, Gobillon L
Year	2011
Publication	Journal of Economic Geography, Volume 11

This research was a meta-analysis of previous studies and modelling of agglomeration effects in various cities. The study found that standard estimates for the agglomeration density elasticity ranged from

between 0.02 to 0.05 (two per cent to five per cent). Combes, Duranton and Gobillon found that the limitations of previous studies meant that the breadth of historical data required to model effects in a completely robust fashion is often not available to researchers and this influences the modelling choices of researchers. In particular, attempts to disentangle time variation of wages and density can be difficult. It is also found that self-sorting by location is quite difficult to account for in any modelling. Location is discrete in nature and there are a very large number of locations that could be chosen (all around the world). There are no clear methodologies that show how to deal with this in time-series data sets.

Another shortcoming is that a variable is needed to explain location without having an effect on wage. Determinants of migration usually used as variables in previous modelling do not satisfy this. For example, family status can mean that individuals are less mobile in terms of labour provision, and this means that there will be some form of link with wages. Possible solutions to some of these issues are to look at location choice as a non-linear equation, which brings significant complexity when using panel data.

Title	Spatial wage disparities: Sorting matters!
Authors	Combes P, Duranton G, Gobillon L
Year	2008
Publication	Journal of Urban Economics, 63

This paper by Combes, Duranton and Gobillon contended that individual skills (sorting) account for a large share of existing spatial wage differences. While interaction effects are still driven by employment density, this agglomeration effect was of smaller significance. The authors stated that not controlling for differences in worker skillset effectively leads to very biased estimates of interaction effects. Endowments were also examined, which refer to largely non-human features of an area such as a port, natural resource or favorable climate, which is especially important in agricultural settings. The study found it difficult to disentangle market or urbanisation economies, and geographical concentration at the industry level, termed localisation economies. It was found that differences in skill level between regions accounts for 40 to 50 per cent of wage differences between areas. The study estimates the elasticity of wages with respect to employment density at three per cent. This finding was on the lower end of most studies, which found that most in the four to eight per cent range were too high because other literature "does not control properly for uncontrolled individual heterogeneity", referring to differences between workers including their inherent skills. This was controlled for in this model due to the very large panel of worker data and consistent approach to looking at skill and other worker related variables. The review concludes that workers with better labour market characteristics tend to join together in larger markets due to sorting, and this was a key driver of higher productivity in urban areas.

Title	Productive Cities: Sorting, Selection, and Agglomeration. Journal of Political Economy
Authors	Behrens, K., Duranton, G., & Robert-Nicoud, F
Year	2014
Publication	Journal of Political Economy, 122(3)

This 2014 study outlined modelling that considers three main contributors to higher productivity in cities; agglomeration, sorting, and selection. The authors find that selection effects are similar between large and small cities, once controlled for sorting and agglomeration. The authors also stated that a major limitation of many such studies was that cities are passive in their modelling; in reality, a city will limit or regulate its population growth through a variety of governmental controls, which may artificially increase sorting further.

Title	Agglomeration of knowledge intensive business services and urban productivity
Authors	Zhang, C
Year	2015
Publication	Papers in Regional Science, 95(4)

This study looked to more closely link relationship between knowledge intensive jobs and agglomeration productivity uplifts compared with other industries. The study was based on 280 prefecture level cities in China. The first conclusion is that agglomeration is an important source of productivity. Secondly, it was found that knowledge-based industries derive a greater benefit from agglomeration than do other industries.

Title	Plants' self-selection, agglomeration economies and regional productivity in Chile
Authors	Saito, H., & Gopinath, M
Year	2009
Publication	Journal of Economic Geography, 9(4)

This study argued that self-selection (termed sorting in other studies) had a larger effect on firm productivity than agglomeration effects. This was examined through modelling the Chilean food industry. This industry is quite notable as it is well dispersed between regions in Chile as well as being a key source of employment, GDP and exports. Self-selection here refers to the choice of firms to locate in markets with specific desirable characteristics. As such, it is assumed that high productivity firms

choose to locate in large markets. Plant level productivity was modelled, with agglomeration elasticities found to be 0.067 (6.7 per cent). However, effects of self-selection outweighed this result.

Title	Productivity and the density of economic activity
Authors	Ciccone A, Hall RE
Year	1996
Publication	American Economic Review, 86

This study found that that a doubling of employment density increases average labour productivity by around six per cent. Two theories put forward were 1) production technology is adopted more readily in larger urban environments, and 2) urban environments have more integrated supply chains, generating comparatively lower and more efficient supply chains. Furthermore, firms could specialize more in areas of higher density.