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# Productivity is not an accident

## The economics and impact of Victoria's startup ecosystem

June 2020

Deloitte Access Economics

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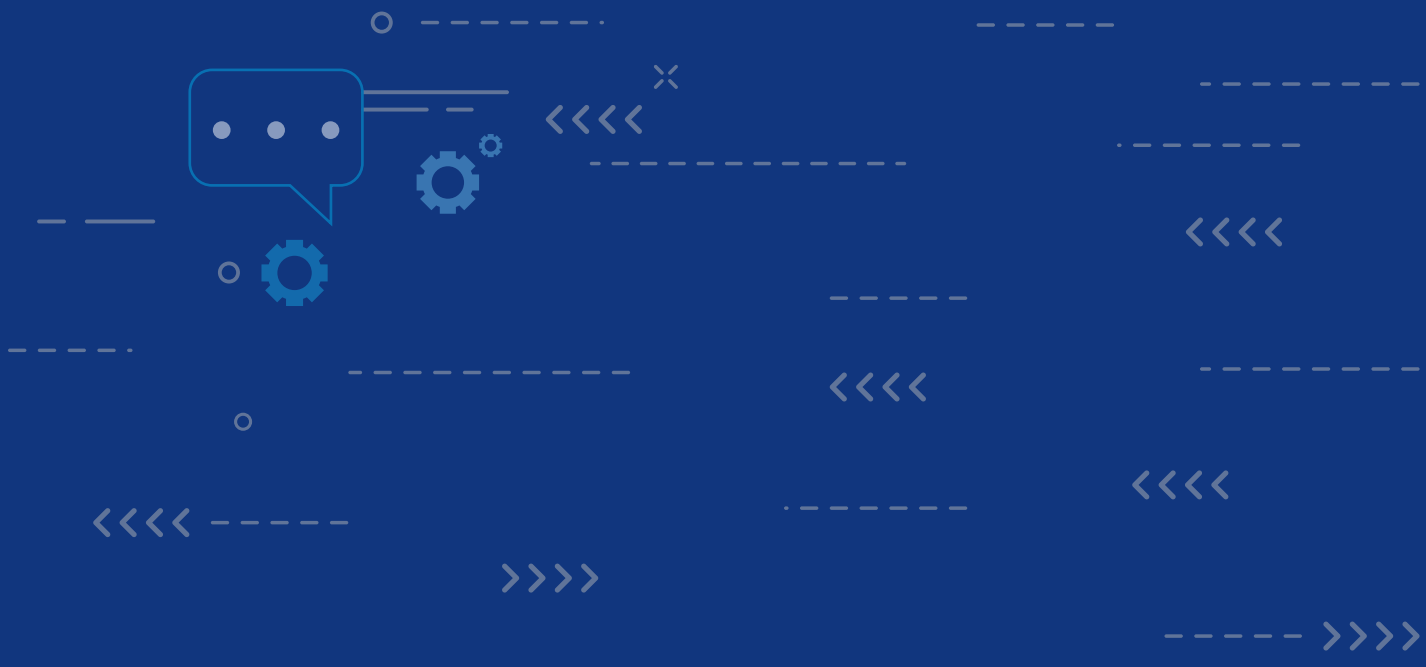

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# Foreword

A lot can change in a small amount of time and these unprecedented times we are experiencing in 2020 are proof of just that. This report - **The economics and impact of Victoria's startup ecosystem** – was commissioned by LaunchVic in late 2019 and finalised in February 2020, all before the global COVID-19 pandemic.

The world, and Australia, now looks very different. The world is trying to work its way out of a public health crisis, while feeling the impacts of the resulting economic crisis. Global economies including Australia are facing economic decline not faced since the Great Depression. The International Monetary Fund has predicted a 6.7% fall in growth for 2020; when in February, only two months ago, our outlook was set for growth to steadily pick up over the next two years, even after the dampening effects from the drought and summer of bushfires.

Before the Australian government's $130bn unemployment stimulus package, we observed that Australia's unemployment rate had skyrocketed to an estimated 12 per cent.

Uncertainty surrounds our current economic trajectory– just like COVID-19. Governments have been juggling the management of a global health pandemic while addressing the resulting economic crisis. At the outset, the management of the heath crisis rightly superseded the economic consequences but as our infection rate begins to slow and curve is flattening, the focus is turning towards our economic recovery.

The challenge for governments and businesses is to find sources of growth and productivity to create a new and higher economic growth path – one which generates jobs and secures prosperity into the future.

Startups and startup ecosystems, from economic policy and commercial perspectives, are that bridge between the current economic growth path, and the creation of a new growth trajectory which will drive growth, income, and jobs into the future.

Today, we are seeing scientists around the world working (literally) around the clock to expedite the development of a vaccine for COVID-19. Businesses are coming up with new ways to keep producing existing products despite disrupted supply chains, or, are creating new ones. The startup and innovation ecosystem of economies can steer the medical and societal advances required to reopen our economy to new pathways of economic growth. Industry, researchers, universities and governments can leverage collective resources to harness the power of science, innovation and markets in real time.

But this will not happen by accident. To produce the medical and societal advances that will reopen our economy will require deliberate investment, collaboration and strong startup ecosystems.

The solution for our economic recovery lies in fostering collective action and innovation; both of which are at the core of startup ecosystems. In economic recovery there is an opportunity to disrupt the old and create the new – ideas, products, systems and solutions – to solve our biggest challenges. COVID-19 has seen a rapid transition of our physical world to a virtual world; think telehealth and online learning. Startups are well placed to take advantage of these new opportunities.

The findings of this report, while drawing on data collected pre-pandemic, demonstrates clearly that innovation, economic growth and job creation is born out of startup ecosystems. Indeed, the modelling highlights that startups are a large driver of net job creation.

Never has it been more important to embrace innovation, foster entrepreneurs and support the role of the startup ecosystem in delivering economic growth and job creation. Now is the time to solve declining productivity, support job creation and work towards creating the sustainable economic growth pathways in our economy – and rightly sharing the dividends of our economic success.

**Dr Pradeep Philip**
Partner, Head of Deloitte Access Economics

# Executive summary

## Productivity is not an accident

Economic growth, generating income and employment for citizens and driving wellbeing in society are the core objectives of governments. Core to realising these objectives is the ongoing and complex search for new sources of productivity to drive growth. Without this, economic policy for growth and jobs is rendered impotent.

As the saying goes, 'productivity isn't everything, but in the long-run it is almost everything'.

Hand in hand with this search for new sources of productivity lies the process of innovation and creativity – driving incremental changes to products, services, processes, as well as generating the disruptive changes which result in discontinuities in business models, markets and the production system itself.

While this much is known, economic policy has been evolving rapidly in its understanding of this 'black box' of innovation and creativity – of how this process works, the conditions which maximise the probability of success and of the support systems needed to facilitate turning good ideas into commercial realities.

The process of developing, testing and scaling innovation to support a trajectory of sustainable and productive economic growth cannot be undertaken in isolation. It is now clear that this requires the support of a wide range of economic actors alongside the economic dynamism of startups and entrepreneurs.

How policy settings can facilitate this activity, its pace and translation into commercial reality matters for policy makers.

It is increasingly becoming clear that maximising the probability of success of entrepreneurial endeavour lies in the dynamic interactions and collaboration between innovative actors/ stakeholders - underpinning a constant feedback loop to form a **startup ecosystem**. Such an ecosystem **is what drives innovation to fuel long-term cycles of productivity gains**; the **demand for services in a highly productive economy**; and **the creation of high-value adding employment**.

All are factors which make an economy successful, sustainable – and improve standards of living. All are factors which have driven Victoria's economic success over the past several decades. But as we enter a new decade in 2020, this **economic growth trajectory is not a given or a constant – and productivity is not an accident.**

Nationally, productivity growth has slipped well below its long-term average and Victoria's is beginning to slip at the margins. While this can be perfectly normal as part of economic cycles and the course of structural economic change, the question for Victoria remains: *how does productivity growth, employment generation and value-adding innovation become the trend?*

## Startups supporting Victoria to go for growth

While innovation has always been present, economic history highlights periods of discontinuity which interrupt economic growth cycles – and the current level of innovation and disruption tends to occur in such a period. Maturing businesses are seeking new ways to innovate and transform, while startups are visible in all sectors and across all economic domains, disrupting business models and creating new products, services, markets and niches.

The challenge for governments and businesses is to figure out how to find new sources of growth and productivity and how to create a new and higher economic growth path – one which generates jobs and secures prosperity into the future.

Startups and startup ecosystems, from economic policy and commercial perspectives, are that bridge between the current economic growth path, and the creation of a new growth trajectory which will drive growth, income, and jobs into the future.

Over the past three years, **LaunchVic** (starting with $60 million over 4 years) **has successfully embedded the startup ecosystem into the broader Victorian economy** and is supporting a transition from Victoria's traditional economic base, to a more diversified economy.

This has put **Victoria's startup ecosystem on the cusp of globalisation**, with the ecosystem being named as an ecosystem showing potential to make the global top 30 ecosystems within the next 5 years.

The growth path is set. The challenge for Victoria is maintaining the initial momentum of the startup ecosystem to ensure it can develop into an internationally competitive ecosystem – adding to economic value added, employment and economic diversification in the long-term.

## Victoria's startup ecosystem *today*

Deloitte Access Economics estimates the revenue of the Victorian startup industry to be in the order of $4.6 billion in 2019, based on approximately 1,670 startups and scaleups. Using ABS Australian Industry Data and Deloitte Access Economics estimates, the value added of the Victorian startup industry is $2.4 billion in 2019. The startup industry contributes around 0.6% to the Victorian economy – for context, the arts and recreation services industry in Victoria represents around $4.6 billion in value added, or around 1.1% of the Victorian economy in 2018.

Consistent with findings in literature, the startup industry in Victoria supports many jobs. Specifically, it is estimated that the startup industry in Victoria employed around 18,900 people in 2019, representing around 0.7% of Victorian employment.

### Victoria's startup ecosystem *tomorrow*

Deloitte Access Economics modelled the potential economic impact of the Victorian startup industry over 20 years (to 2038) under two analytical scenarios. Each scenario explores distinct, but plausible, future growth paths of the startup industry in Victoria – and the impact these paths have on Gross State Product (GSP) and employment. Chapter 6 provides a detailed description of the modelling method adopted, the economic scenario logic and detailed results.

The two analytical scenarios are modelled relative to the business as usual scenario, where it is assumed that the startup density remains constant over time at 330 startups per million people:

- **Scenario 1 | Moderate growth in the startup ecosystem's density:** the startup density grows linearly to reach 500 startups per million people in Melbourne by 2038 (representing a 52% increase in density by 2038). This would see Melbourne's ecosystem density exceed the current densities associated with other peers including Sydney, Vancouver, Singapore and New Zealand.
- **Scenario 2 | High growth in the startup ecosystem's density:** the startup density grows linearly to reach 750 startups per million people in Melbourne by 2038 (representing a 127% increase in density by 2038). This would bring Melbourne's ecosystem density in line with Boston's current density and would likely place Melbourne in the top 20 ecosystems globally, positioning it as a leading centre of startup activity in the Asia Pacific.

Deloitte Access Economics estimates, under the analytical scenarios that:

**Scenario 1:** By 2038 relative to Victoria's business as usual economic trajectory, GSP could increase by $6.3 billion, or 0.8%. Under this Moderate Growth Scenario, aggregate full time equivalent (FTE) employment across the economy could increase by 10,200, or 0.3%, by 2038.

**Scenario 2:** By 2038, relative to Victoria's business as usual economic trajectory, GSP could increase by $7.6 billion, or 1%. Under this High Growth Scenario, aggregate FTE employment across the economy could increase by 15,700, or 0.4%, by 2038.

This modelling excludes the company exits which emerged from the startup ecosystem – active firms, such as Carsales.com, Seek and REA Group, that have gone public or been acquired are no longer considered startups/scaleups. In the last year alone, there have been three acquisitions valued at over $100 million each, including the $230 million sale of Catch.com.au to Wesfarmers. These acquisitions build on a growing number of recent $100 million+ exits including CrownBet, Aconex and Click Energy in 2018.

Although these acquisitions mark the departure of some firms from what we define as the Victorian startup ecosystem, they are a reflection of the maturity of the ecosystem and its significant economic impact. For example, Startup Genome estimates that since Carsales.com, Seek and REA Group went public in the 2000s, the three firms have together created more than $10 billion in additional economic value.

These successes and impacts are no accident. It is ultimately powered by deliberate innovation and creativity, given economic form in startups, entrepreneurs, and the ability of existing economic organisations to adopt, adapt and facilitate the diffusion of new ideas into the market.

This is a key area for government economic policy agendas globally and in Australia – and is one which requires an understanding of the processes which give rise to innovation and the translation of this into economic outcomes.

# CURRENT STARTUP ECOSYSTEM

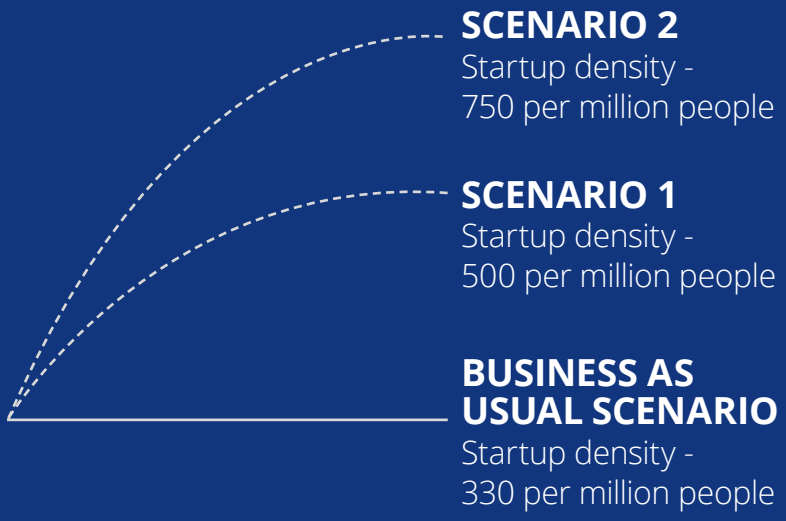
*In **2019**, the Victoria startup industry contributed...*

**19,000** jobs

**$4.6 billion** in revenue

**$2.4 billion** in value-added

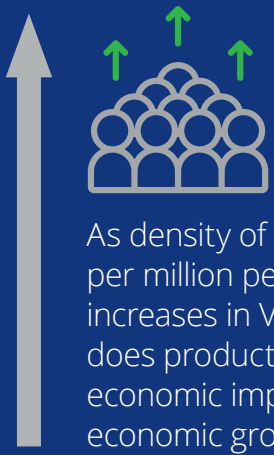
# FUTURE STARTUP ECOSYSTEM



**SCENARIO 2**
Startup density -
750 per million people

**SCENARIO 1**
Startup density -
500 per million people

**BUSINESS AS USUAL SCENARIO**
Startup density -
330 per million people



As density of startups per million people increases in Victoria, so does productivity and the economic impact, including economic growth and jobs

*By **2038**, relative to Victoria's business as usual economic trajectory...*

## GSP increases by:

**$7.6 billion**
SCENARIO 2

**$6.3 billion**
SCENARIO 1

## EMPLOYMENT increases by:

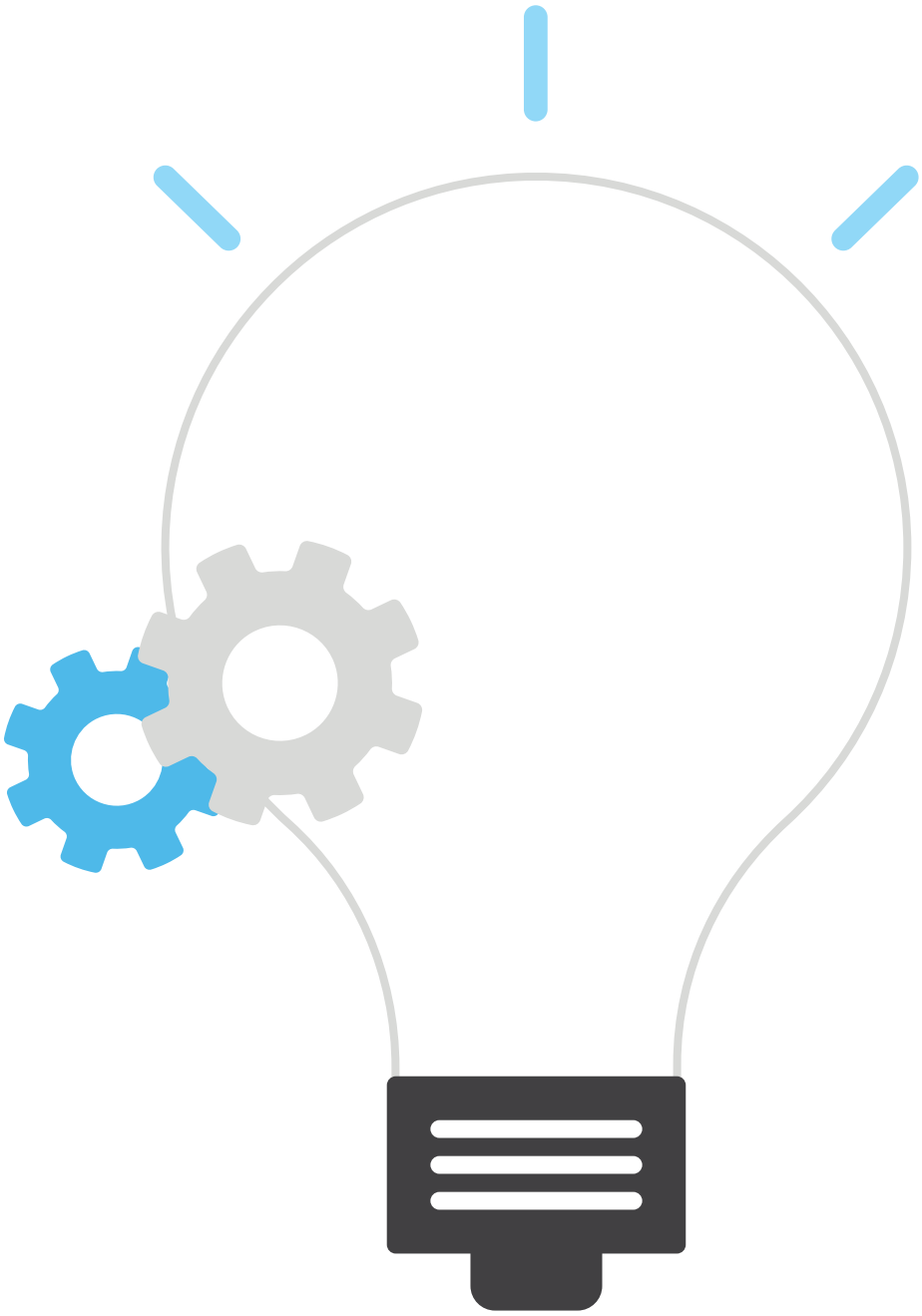
**15,700 FTEs**
SCENARIO 2

**10,200 FTEs**
SCENARIO 1

# Part I

## ECONOMICS + STARTUPS + THE ECONOMY

# 1 Why startup ecosystems matter



### 1.1 A thriving startup ecosystem

Victoria has an impressive history of innovation from the electric drill in 1889, the black box flight recorder in 1958 and the bionic ear in the 1970s.

Such innovation has proven to increase global standards of living and the output and makeup of economies.

Today, innovation and its impact in Victoria is no different. But as we enter a new decade in 2020, innovation is not born in isolation and in unforeseen circumstances. Nor is it born in the crucible of large organisations – rather, increasingly, it is the makeup and activity of startup ecosystems and their actors that are shaping innovation.

And it is this innovation that is shaping economies.

The inherent innovative nature, and the agile and adaptive business models of startups, gives them an advantage over rigid structures that tend to occupy larger businesses and incumbents. But the process of developing, testing and scaling innovation to support a trajectory of sustainable and productive economic growth cannot be undertaken by a startup in isolation. It requires the support of a wide range of actors across the value chain and startup ecosystem.

It is the dynamic interactions and collaboration between innovation actors/stakeholders that underpins the constant feedback within startup ecosystems that drives innovation to fuel the long-term cycle of productivity gains, the demand for services in that highly productive economy and the creation of high-value adding employment.

This economic growth trajectory is not a given, or a constant – and productivity is not an accident. Nationally, productivity growth has slipped well below its long-term average and Victoria's is beginning to slip at the margins. While this can be perfectly normal as part of economic cycles and the course of structural economic change, the question for Victoria remains: how does productivity growth, employment generation and value-adding innovation become the trend?

### 1.2 This project

Ensuring productivity is not an accident requires strategic vision, coordination of innovation actors/stakeholders and investment of not only financial means, but also time.

Take the computer, as an example. The first digital computer was in operation in 1945. In a congressional committee testimony in 1956, Howard Aitken – one of the pioneers of computers – considered computers to be nothing more than a highly specialised scientific instrument. Today, computers are ever-present in society, culture and the economy – a driving force of productivity.

Over the past three years, LaunchVic has successfully kick started an internationally recognised startup ecosystem, now embedded in the broader Victorian economy. As Victoria's startup ecosystem continues to go from strength to strength, it is important that startup ecosystem stakeholders understand the role and impact of the ecosystem upon the Victorian economy.

It is in this context that Deloitte Access Economics has been engaged to provide LaunchVic, the Victorian Government and industry with key information on the type of economic activity and jobs that is supported by startups directly and indirectly – the economic impact of Victoria's startup ecosystem. As part of this work, Deloitte Access Economics has considered the productivity effects on industries and regions that use the outputs of Victoria's startup ecosystem – as well as the potential trajectory of the startup ecosystem in Victoria, including 'what-if' scenarios, such as varying levels of government support, high global startup ecosystem growth scenarios and broader economic growth scenarios.

### 1.3 Innovation 101

The term innovation can relate to an activity, the outcome of an activity or the process of innovation. But, if it relates to an activity, the innovative activity must be applied – it must be put to work.

The OECD's Oslo Manual for measuring innovation provides the following general definition of innovation:

> "An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)."[1]

Innovation can also be distinguished by whether it is incremental or disruptive:[2]

- **Incremental**: Small-scale improvements made to products and/or services to increase the competitiveness of the firm by gradually increasing the size of the customer base and the share of the market.
- **Disruptive**: New ideas begin as small entrants to the market – usually in a much simpler form – and grow sufficiently to disrupt the existing market by taking market share and fuelling a creative destruction process.

Existing firms mainly produce incremental innovations, leveraging existing products and processes. Startups, however, tend to exploit knowledge spillovers to produce disruptive innovations.[3]

### The process of innovation

The process of innovation is complex, uncertain and highly non-linear, involving many participants facing different incentives. However, for simplification of the narrative, the process is typically depicted as the steps between basic knowledge and research, commercialisation and diffusion of the innovation into the wider economy (Figure 1.1).

In the short run, rapid economic progress can be made by the application of the existing knowledge – diffusion of an existing innovation through the economy.

However, in the long run, the process of innovation relies on the flow of new scientific ideas, inventions and innovations. Experimentation, research and development activities are a small proportion of the broader information/knowledge economy, but they are at the heart of the complex process of innovation. It is in this part of the economy that most of the new and improved materials, products, processes and systems originate.

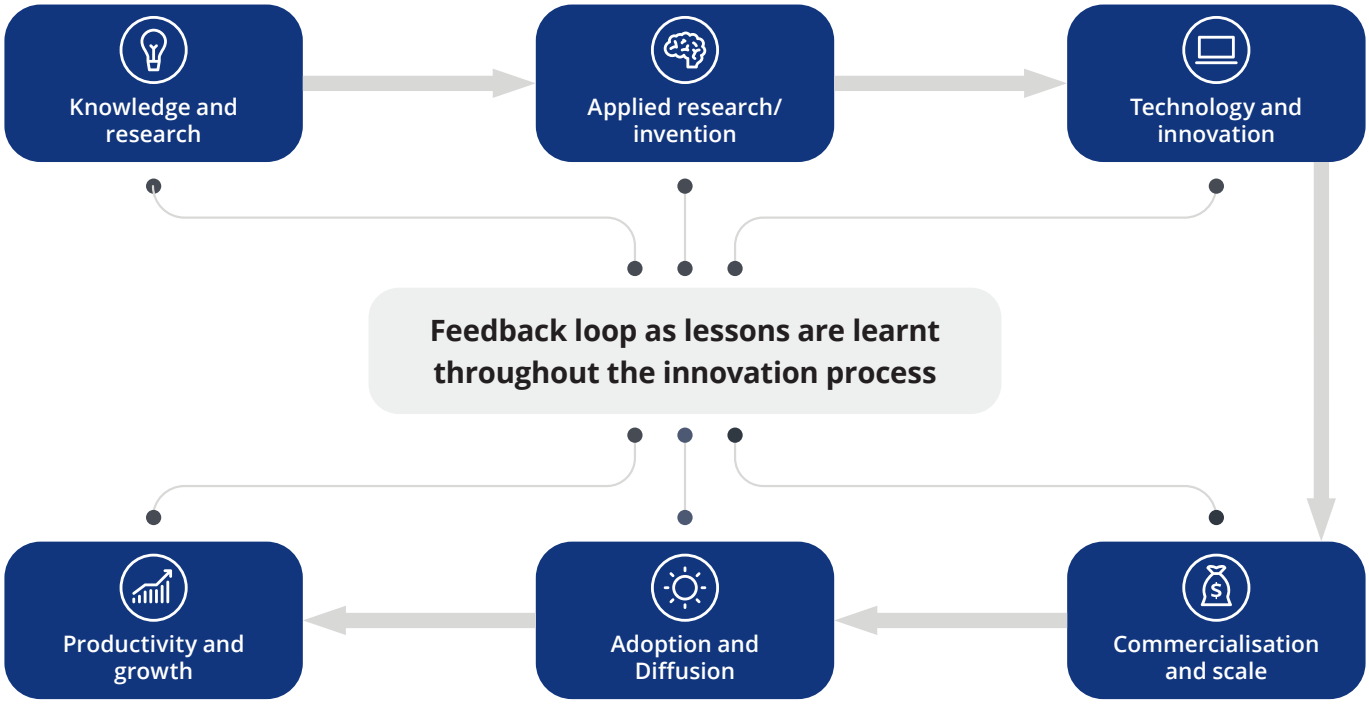
However, these ideas about new materials, products and processes mean nothing unless they are taken to markets, commercialised, scaled and diffused through the economy. This is where entrepreneurs play a key role: exploiting innovative opportunities and commercialising the outputs in markets.

**Productivity and economic growth rely on all these components within the innovation process.**

Firms and markets do not operate in a vacuum; rather, they are part of a complex, global economy. This also means that the innovation process is not undertaken in a closed environment. It is the dynamic interactions and collaboration between innovation actors/stakeholders within an *ecosystem* that underpins the constant feedback within the innovation process.

Most of the innovation we see today is born out of startup ecosystems.

Figure 1.1 The innovation process




Source: Deloitte Access Economics adapted from: Brookings Institution and the Chumir Foundation

## 1.4 What is a startup ecosystem?

When defining a startup ecosystem, we naturally start with startups. LaunchVic defines a startup as a business with high impact potential that uses innovation and/or addresses scalable markets. These firms are in the early stages of formation, are developing an idea into a functioning business model that meets market needs and can grow.

Startup companies are relatively new to the market with the intent to pursue a disruptive new idea or a product, usually leveraging technology. Successful ideas and products pave the way for the startup to grow and expand into various lines of business that offer them the ability to scale up operations.

Startups are vastly different to small-medium enterprises (SMEs). SMEs establish operations involving known products and services mainly for local markets and often retain the same organisational and operational structure over their lifetime. These businesses are owned and operated independently for profit and differ further from startups in terms of general functions and modes of funding.

Startups operate with a different business psychology to SMEs and, therefore, have varying measures of success. A startup aims to access large funding rounds to support their rapid growth, whereas SMEs generally maintain the same structure, grow slower or stay the same size over a long period of time.

Shown in Figure 1.2, startups follow a value chain towards success that includes a number of stages including ideation/ prototyping, incubation where the concept is validated, transition to scale where the business model is validated, and finally, scaling – with the rate of progress varying greatly between startups.

Some startups would still be classified as startups 5 years into their inception, whilst others achieve scaleup status within a year.[4]

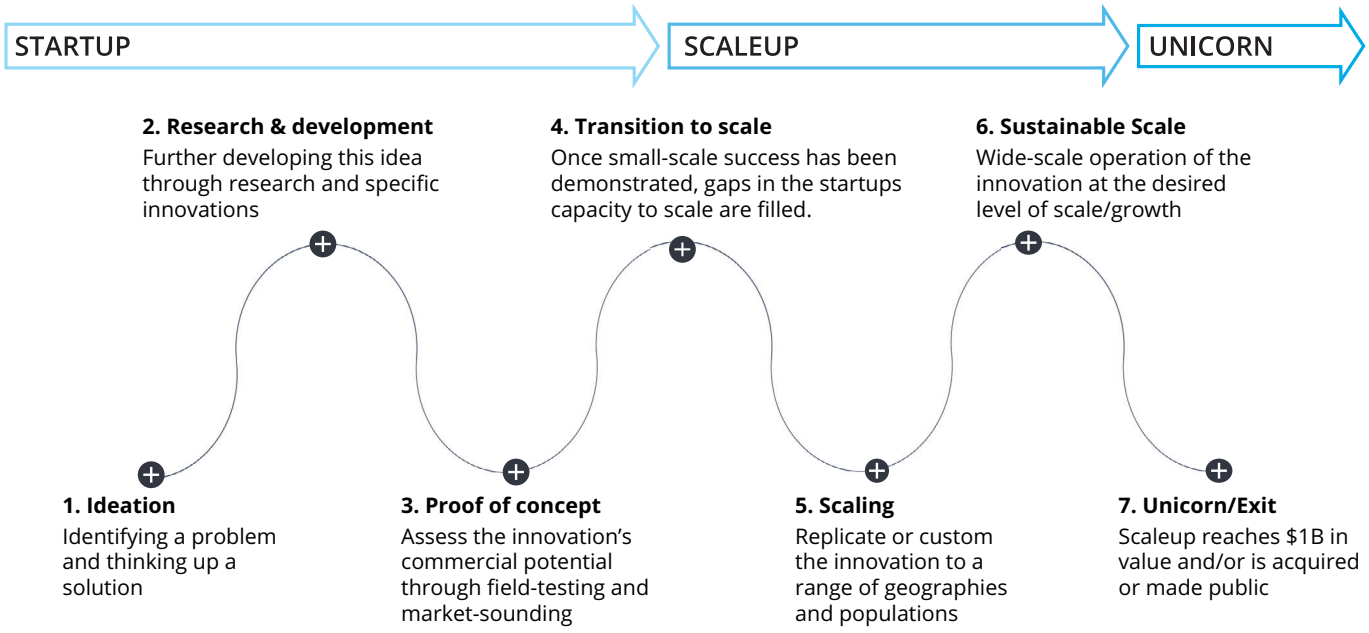
As startups move along this value chain they may draw from a wide range of actors. These actors create the ecosystem which allows startups – and their economic contribution – to flourish.

### An ecosystem is the best of both worlds

A startup ecosystem is a function of an economy and all the key actors that make it – it is neither private nor public. A startup ecosystem is the best of both economic worlds.

A long-held view is that at best, governments merely facilitate the economic dynamism of the private sector and innovation; at worst, government's heavy-handed and bureaucratic institutions actively inhibit it. By contrast, the agile, risk-loving and ground-breaking private sector is what drives the productivity and innovation that creates economic growth.

Figure 1.2: Startup growth trajectory/value chain




Source: International Development Innovation Alliance (n.d)

In this view, the government can intervene in the economy to fix market failures or create a level playing field. Government can regulate the private sector and it can invest in public goods, such as scientific research or the development of medical processes with limited market potential. But government cannot directly attempt to create and shape markets.

Startup ecosystems and the true nature of innovation fly in the face of this long-held view.

Innovation systems theory emphasises that innovation is not a linear, sequential process; rather, it involves many interactions and feedbacks in knowledge creation and use – that is both public and private in nature.

The learning process is crucial to innovation – it is not a case of building on a single input but drawing on multiple inputs and constant problem solving. It takes more than just one knowledge area (or discipline) to develop a true innovation – multidisciplinary approaches are required throughout the innovation process.

In this way, ecosystems are made of complex relationships that are formed between actors or entities whose functional goal is to enable technology development and innovation. An ecosystem is made up of physical capital (funds, equipment, facilities, etc.) and human capital (students, staff, researchers, entrepreneurs, policy makers, investors etc.). Together, these actors make up the institutional entities that participate in the ecosystem, such as startups, universities, corporations, funding agencies and government.[i]

Figure 1.3 depicts a visual representation of these key actors in a startup ecosystem and how they interact with one another to enable innovation. In an innovative and productive economy, **economic value creating** actors include research institutions, government, investors and corporations. **Enabling factors** include regulation, capital, labour and land.

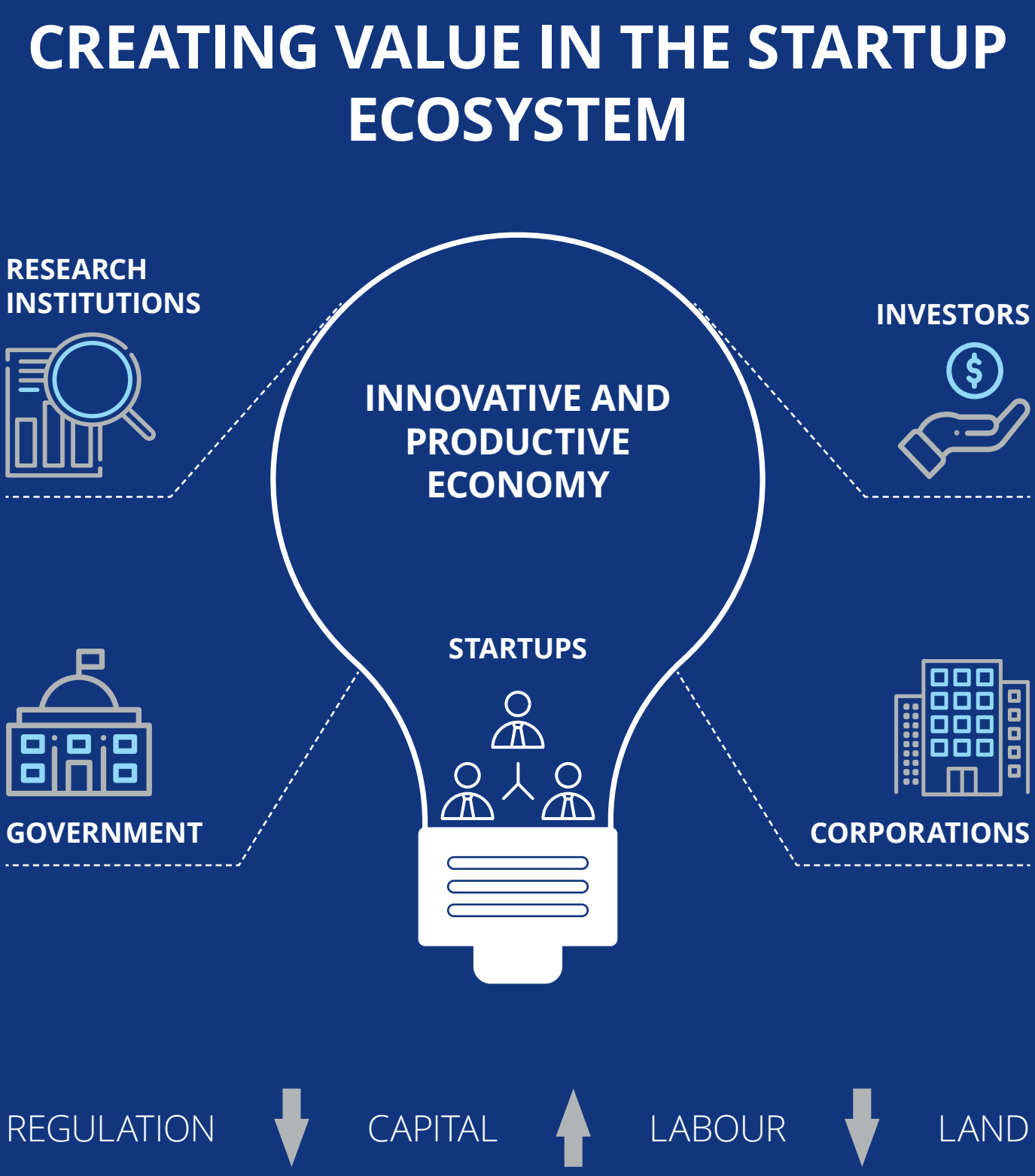
Where there have been significant developments in the notional understanding of the process of knowledge creation, creativity, innovation, productivity and growth; the lived experience of the innovation process has, at the same time, provided insights for policy makers on the nature and role of government is supporting startups and innovation ecosystems.

### Key insights and developments in understanding startup and innovation ecosystems:

1. The endogenous nature of innovation.
2. The non-linear and non-probabilistic nature of creativity and innovation.
3. That ideas and techniques can flow across disciplines and sectors.
4. That a good idea is a necessary, but not sufficient condition for success in the market.
5. That access to services and being exposed to a vibrant culture can be an attractor of people and ideas with synergies expressed in an understanding of agglomeration effects and the role of precincts.
6. That creativity can produce success and feedback flows can generate virtuous cycles.
7. That there is complex relationship between co-operation and competition in the understanding of the innovation process.
8. A startup ecosystem is a function of an economy, and all the key actors that make it – it is neither private or public.
9. That a high level maturity cycle of startups to scale ups to unicorns can provide a policy framework for understanding the economic and commercial process of innovation.
10. That individual businesses follow a cycle of ideation and product/process development, to commercialisation and market growth, before exit and a renewal of the process as a lifecycle model of startup development.
11. That critical to the adoption of innovation in existing organisations and the diffusion of innovation through markets and economies is neither cheap not easy (as innovation and adoption require one to be at or near the knowledge frontier).

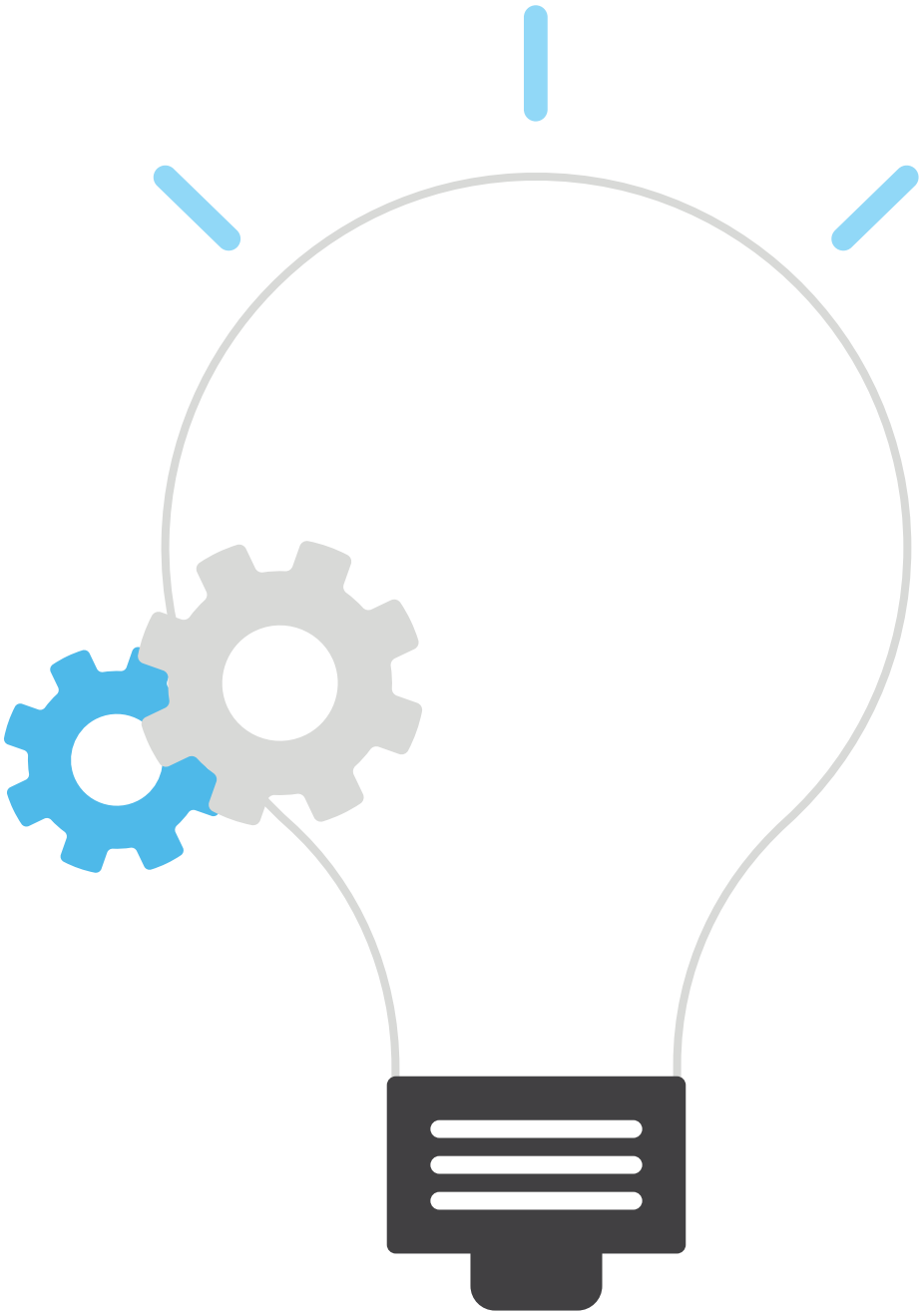
i. Jackson, D. J. (2011). What is an innovation ecosystem?. National Science Foundation, 1.

Figure 1.3: Startup ecosystem




Source: Deloitte Access Economics; Adapted from defintions in Jackson (2011) and MIT REAP (2018).

# 2 The economics of a startup ecosystem



## 2.1 Growth is not a given

Economic growth is not something that just simply occurs; growth in an economy is the result of a multitude of factors (and actors), with increasing **productivity** being one of the most critical.

Fundamentally, there are two ways of increasing the output and growth of the economy:

1. **More production** – by increasing the number of inputs that go into the productive process; or
2. **Getting productive** – by coming up with new ways to get more output from the same number of inputs.

This chapter presents a summary of the economics of a startup ecosystem. Refer to Appendix A for a full technical discussion.

## 2.2 Why productivity matters

Today, almost every second headline seems to refer to productivity. Indeed, economists care greatly about whether productivity is increasing or decreasing overtime. But why?

Economics tells us that continual improvements in productivity drives economic growth, which in turn supports increasing living standards (Figure 2.1).[ii] Importantly, innovation plays a role in kick-starting this process – where growth in living standards is a dividend of innovation.

In reality, of course, the links between investments in innovation and economic outcomes are complex.

The production function dictates that output depends on the amounts of inputs employed – you get out what you put in, depending on the mix. That mix of capital and people power (labour), the efficiency with which they are used, and the total factor productivity (effects of factors other than people and capital on total output) is key.

Broadly, the factors that cause productivity to change can be classified as either improvements *embodied* in the capital and labour inputs in production, or *disembodied* changes that boost productivity in more general ways.

Embodied productivity improvements increase the *quality of labour and capital*. For labour, this includes areas of focus for policy makers such as education, training and health, which means that the quality of a one-hour unit of labour today is higher than it was 50 years ago. Similarly, technological advancements such as the all-pervasive rise in computers have substantially improved the efficiency of the production process.

Disembodied productivity improvements typify the idea of "working smarter, not harder". These productivity improvements include *better production processes, substitution of cheaper materials and faster rates of commercialisation*. Typically, this also includes publicly funded capital such as infrastructure which are not included in private production functions.

A cursory study of the history of technological change highlights the complexity of the process of innovation – with the concurrent emphasis on experimentation and serendipity on the one hand, with systemic investment in R&D on the other; the diffusion of innovation in the short run spurring the process of disruption in the longer run; the cost of imitation in the short run being as significant as the investment of knowledge in the process of innovation in the longer run.

Where innovation spurs improvements in productivity which, in turn, supports economic growth – but how does this relationship work and what is a role of startups?

Figure 2.1 The stylised link between innovation and living standards


ii. The relationship between economic growth and standards of living is not discussed further. This chapter takes as a given that when output grows faster than the population, the standard of living rises. The inclusiveness of this growth and subsequent rise in the standard of living is not discussed here, but is an important consideration for policy makers.

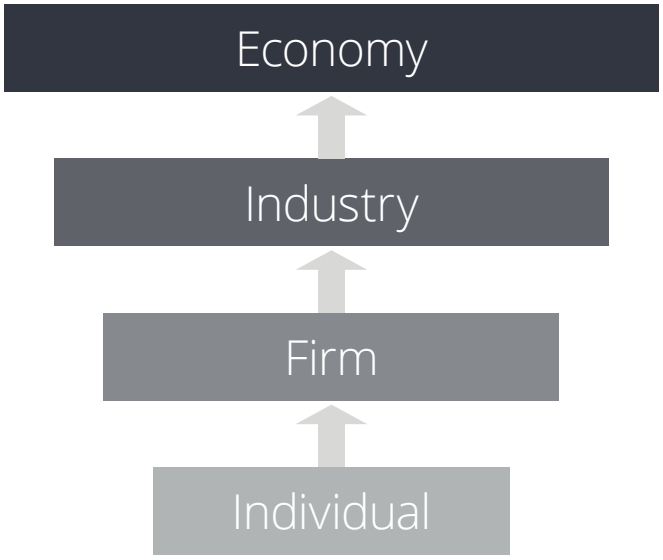
## 2.3 Do startups influence economic growth?

**Yes, they do**

To explain the dynamics of this relationship, we split the total economy into its building blocks – the individual (i.e. the entrepreneur), the firm (here, we focus on new businesses and startups), the wider industry in which the firm operates and then the broader economy. This allows us to trace the effects of the original innovation through the economy, demonstrating that at the individual firm level (and startup level), actions can, and do, have implications for the wider (aggregate) economy.

Decisions about innovation are primarily made at the individual and firm level, from idea generation, to testing, to implementation. When such innovation decisions are combined across industries and markets, this translates into economy-wide innovation, knowledge spillovers and dividends from it.

Figure 2.2 How the impact of innovation flows through the economy




**Influence at the individual level...**

The individual, or the entrepreneur, is the foundation and the first building block in the dynamic relationship between innovation and economic growth.

Entrepreneurs look for opportunities and identify, commercialise and scale them, often for economic gains.[5] They have a pivotal role in the innovation process, giving spark to economic activities through their decision-making – exploiting innovative opportunities and acting as a catalyst for economic growth.[6] Ideas about new materials, products and processes mean nothing unless they are taken to markets, commercialised, scaled and diffused through the economy.

Without the individual (think Bill Gates, Steve Jobs, Mark Zuckerberg, Pierre Omidyar and Arianna Huffington), we wouldn't have the technologies and digital platforms such as Microsoft, Apple, Facebook, ebay or Huffington Post, which permeate our everyday lives.

**Influence at the firm level...**

As startups enter markets, they cause disruption. This disruption can be felt directly and indirectly.

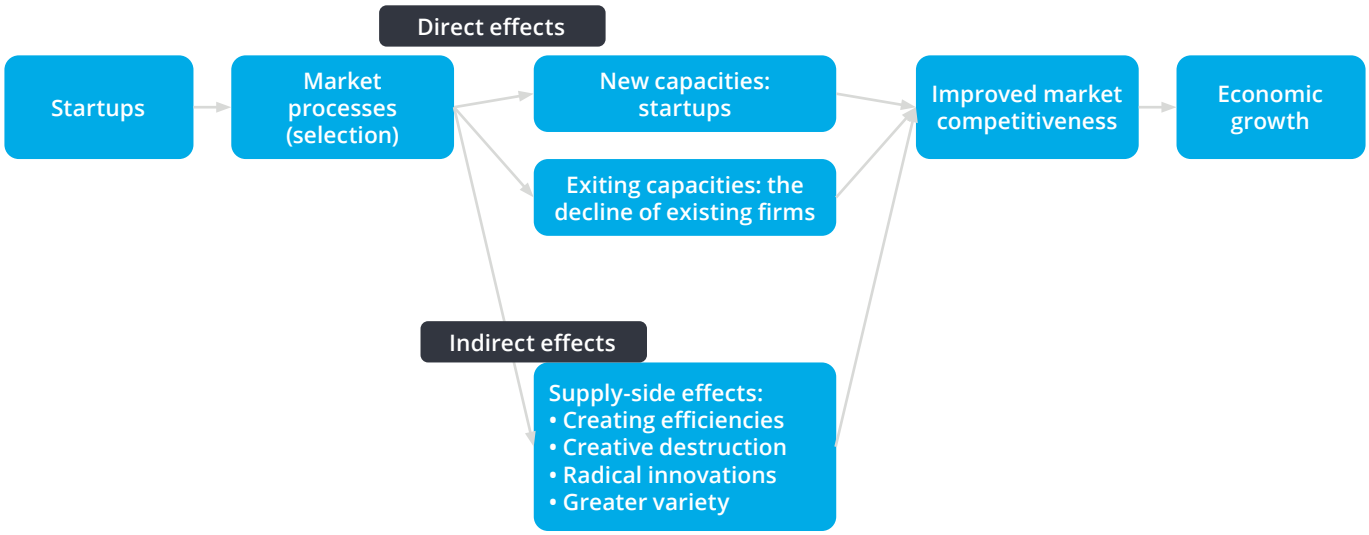
Directly, startups bring new capacities to the markets, and the disruption felt within the market can also result in the exiting of capacities from markets. Whether this is from startups failing and exiting the market, or through a *crowding out effect* resulting in existing firms losing market shares or leaving the market all together.[7]

Indirectly, startups entering markets bring about increased competition from the supply-side:[8]

- **Creating efficiencies:** by disrupting established market positions, startups can bring about efficiencies in the market from within their own operations, but also by inducing existing firms to behave more efficiently.
- **Creative destruction:** structural change occurs with a turnover of economic players i.e. startups bring disruptive technologies and those who do not adapt in time, fail. Joseph Schumpeter called this concept *creative destruction*, defined below.
- **Radical innovations:** particularly in the creation of new, dynamic markets. Startups tend to bring about more radical innovations, as opposed to incremental innovations by existing firms.
- **Greater varieties:** may lead to a greater variety of products and a greater variety of solutions to problems.

The competitiveness of an economy, industry or region is enhanced through these supply-side effects of startups. In this *indirect* way, startups stimulate economic growth.

Figure 2.3 Startups and the market process




Adapted from: Fritsch, M.; 7 Mueller, P (2004), Effects of New Business Formation on Regional Development over Time

**Disruptive technology and creative destruction**

Creative destruction is the concept which describes the efficiencies of new firms displacing and revolutionising both existing firms and markets. The success of Netflix is a great example of *creative destruction*. Almost 15 years ago, Netflix started as a predominantly DVD subscription service. Today, Netflix has taken advantage of rapidly evolving mobile technology and ever-improving internet speeds to become one of the largest video distribution networks on the planet.[9]

Innovations can be *disruptive* or *incremental*.[10] Is it the disruptive and radical innovations which embody the concept of creative destruction.

Startups have an advantage (and therefore play a vital role) in creating *new economic opportunities* for radical innovations. Startups, in their infancy, are independent of markets and they do not have an existing customer base. They have an advantage therefore, over existing firms, to innovate and commercialise for a whole new market and set of customers.[11]

**Influence at an industry level...**

Industries are the aggregation of firms (including startups) that produce similar goods and/or services. It stands to reason, then, that as an innovation in one firm is adopted by firms of a similar nature, the benefits begin to accumulate at the industry-wide level.

At the industry level, productivity growth is the result of different combinations of:[iii]

1. Productivity gains within existing firms (as a result of firm level investments in innovation);
2. Increases in the market-share of high-productivity firms (when those firms that innovated capture more and more of the total market); and
3. The entry of startups that displace less productive existing firms ("*creative destruction*").

As such, the dynamic benefits from innovation are realised at the industry level through these changes in market shares and the reallocation of resources from declining firms to growing firms.

**Influence at an economy wide level...**

By definition, productivity improvements at the firm and industry level have implications for aggregate economic growth, as the macroeconomy is merely the combination of all firms/industries. However, this level has a particular importance as it is at this level that policy makers typically look for the impacts of innovation in headline macroeconomic statistics, such as Gross Domestic Product, and discuss the societal benefits of innovation.

Much like the industry level, the impact of innovation on the macroeconomy is dynamic. Depending on the diffusion of innovations through the economy, the outcomes of disruptive technologies and the impact of broader patterns of creative destruction, innovation can have a minor impact right the way through to a transformative impact on the macroeconomy.

iii. In reality, the interactions between these three factors can be just as important as any one factor; for example, the entry of a new highly productive firm can incentivise incumbents to invest in, or adopt, innovative practices to maintain market share.

### The evolution in economic thinking about how economies grow

Our understanding of innovation, the role of startups, their innovative activity and productivity in an economy has developed alongside the evolution in economic thinking about how economies grow. Economics is not a fixed science; rather, ideas and models about how the economy works, which have changed over time.

This is important when considering the economics of a startup ecosystem as it is in the most recent iterations of economic growth models and theories that innovation and spillovers has gained prominence, reflecting and reinforcing the increased distinction given to innovation in economic policy.

Where technological progress (or innovation) was once an afterthought in trying to understand growth and economic progress, it is now central to growth models. Innovation, knowledge, entrepreneurs, startups and existing innovative firms are now considered to be central drivers of economic growth and development.

### The importance of spillovers and proximity

***Spillovers*** of knowledge occurs when people or firms other than the original creators of the knowledge benefit from the knowledge. We call this the *spillover effect*.

Firms can't effectively appropriate all knowledge generated as the result of their innovation efforts. Knowledge spillovers (across firms and throughout an economy) largely occurs as a result of a firm's own investment in R&D. By a firm investing in knowledge, not only are they increasing their own level of knowledge, they are also contributing to the *aggregate stock of knowledge* within the economy.[12]

Knowledge can be exchanged between *people or firms*. Knowledge, whether purposefully or not, is embedded within an individual, accumulated from their own personal experiences. Firms would like to prevent knowledge loss, but (tacit) knowledge follows wherever an individual may go. Spillovers can also occur between firms located within a close proximity, or can happen as a result of these companies doing business together.

***Location*** is increasingly playing a large role in the relationship between knowledge spillovers and economic growth. When people who are similar in their passion for creativity and disruption, but come from all different walks of life; with different backgrounds, different specialisations and skill sets, different opinions and different interests are located near each other – they talk, they share and they collaborate.

The clustering effect of such like-minded people working, socialising and even living within a close proximity of each other only intensifies and snowballs the spillover effect of knowledge, creating human capital synergies – this is why startup ecosystems matter. This is how knowledge can transfer from one sector to another.

***Intra-industry knowledge spillovers*** happen as a result of industry specialisation, where knowledge accumulated by one firm tends to help the development of technologically close firms. Industries that are geographically concentrated benefit most from the exchange of knowledge within the industry and should, therefore, grow at a more rapid pace.[13]

***Inter-industry knowledge spillovers*** happen as a result of the diversity and variety of knowledge between complementary industries or customers and suppliers that service each other. The diversity of industries in an area may lead one sector to adopt a technological solution that has worked for another.[14]

### But what is the exact role of startups?

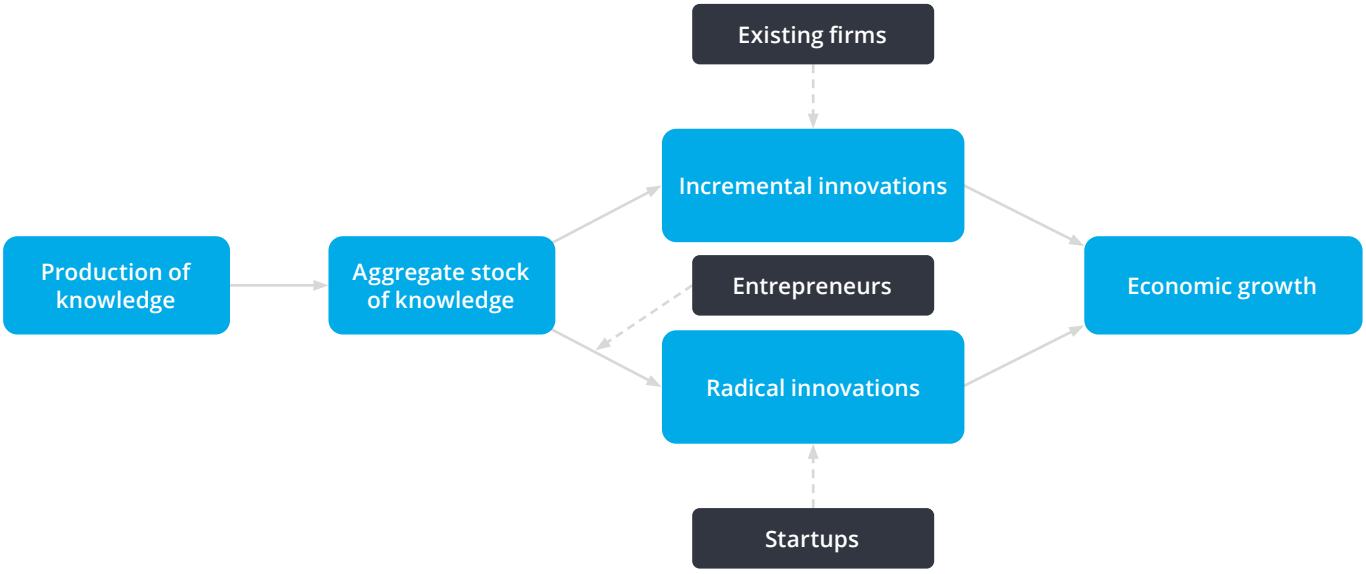
Both existing firms and startups can exploit spillovers, drawing from the *aggregate stock of knowledge* to develop innovations. Startups, however, tend to exploit knowledge spillovers to produce radical innovations. Existing firms, in contrast, mainly produce incremental innovations, leveraging existing products instead.[15]

Startups and their radical innovations commercialised in markets, or new markets created, lead to a greater variety of products and/or services and a greater variety of answers to problems.[16]

More variety means a higher probability of finding a supply which better matches customers' preferences than the supply available before. More variety, more market competition, and more markets can stimulate an intensified division of labour, as well as follow-up innovations. All combined, this can generate economic growth.[17]

From a policy perspective, promoting the production of new knowledge (e.g. R&D subsidies or university education) is not sufficient if the goal is economic growth. There needs to be both a strong presence of entrepreneurs to exploit innovative opportunities and of startups to create markets and commercialise innovation embedded in new products. If left unexploited, or under-exploited, profits and economic rents will not flow back into the economy, we will see the leakage of entrepreneurs to other startup ecosystems, and economic growth will not reach its full potential.

Figure 2.4 The relationship between knowledge, innovation and economic growth




Adapted from Block, J.; Thurik, R.; & Zhou, H. (2012), What turns knowledge into innovative products? The role of entrepreneurship and knowledge spillovers. J Evol Econ, 23:693-718

## 2.4 Do startups create jobs?

**Yes, they do**

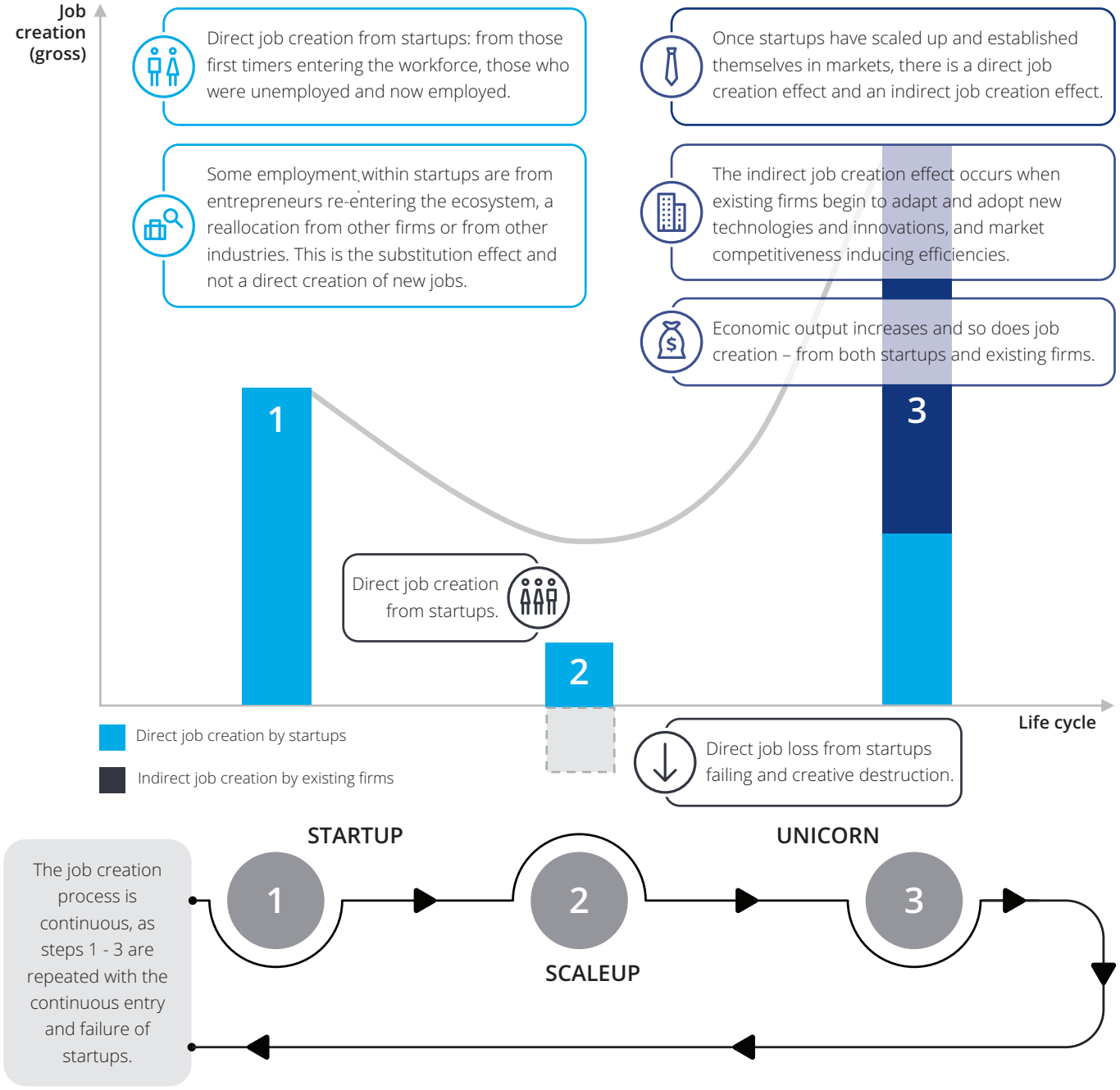
Startups create jobs; however, the relationship between startups and increasing overall jobs in an economy is more complex than just: more businesses, more jobs.

The relationship between job creation within an economy and the life cycle of a startup reflects a u-shape (Figure 2.5).

Overall, the impact of startups on job creation is a net increase overtime, with contributions *directly* from startups throughout their life cycle, and *indirectly* from existing firms due to induced market competitiveness and efficiencies.

We can break this down into the specific phases of a startups life cycle to look at these direct and indirect effects.

Figure 2.5 A conceptual model of startup job creation, over the startup life cycle




Source: Deloitte Access Economics

### Startup

This is what we will call *modest* direct job creation from startups in their infancy.[18] Startups can be created by a range of people: 1) those who are entering the workforce for the first time (i.e. school leavers or university graduates), 2) those who have previously lost jobs and were unemployed and are re-entering the workforce, 3) those who are re-entering the startup ecosystem and those who are relocating from other employment (a reallocation within the same industry or from another).[19] The latter is called a *substitution effect* within the workforce and does not actually create *new* employment in the economy.

### Scaling

Two things can happen after the initial start-up phase. The startup may fail and exit the market, therefore some jobs initially created are lost. Or, the startup may begin to scaleup and establish/embed itself within markets. If it's the latter, what may occur is a *crowding out* effect where existing firms lose market share to the startup and reduce output and employment, or leave the market all together. This crowding out can lead to a reduction in the number of jobs created at the economy-wide level.

### Unicorn/exit

Once startups have scaled up and established themselves within markets, existing firms in these markets begin to fully adapt to the market disruptions, and adopt innovations and technologies commercialised by startups.

Employment creation in this phase is two-fold and driven by market forces. Strong competition in markets and labour productivity increases, induce further efficiencies within existing firms *and* the now- 'unicorn[iv] startup, leading to further competitiveness in markets, more startups entering and higher economic output. Economic output increases and so does job creation – from both startups and existing firms.

### A snowball effect

Placing this all together, *over the lifecycle of startups*, job creation is largely driven by increased economic growth induced by improved efficiencies, caused by competitive pressures of startups – *the indirect effect*.[20] The employment created directly by startups is from those which survive a long enough period (in excess of four years, empirically) – *the direct effect.*

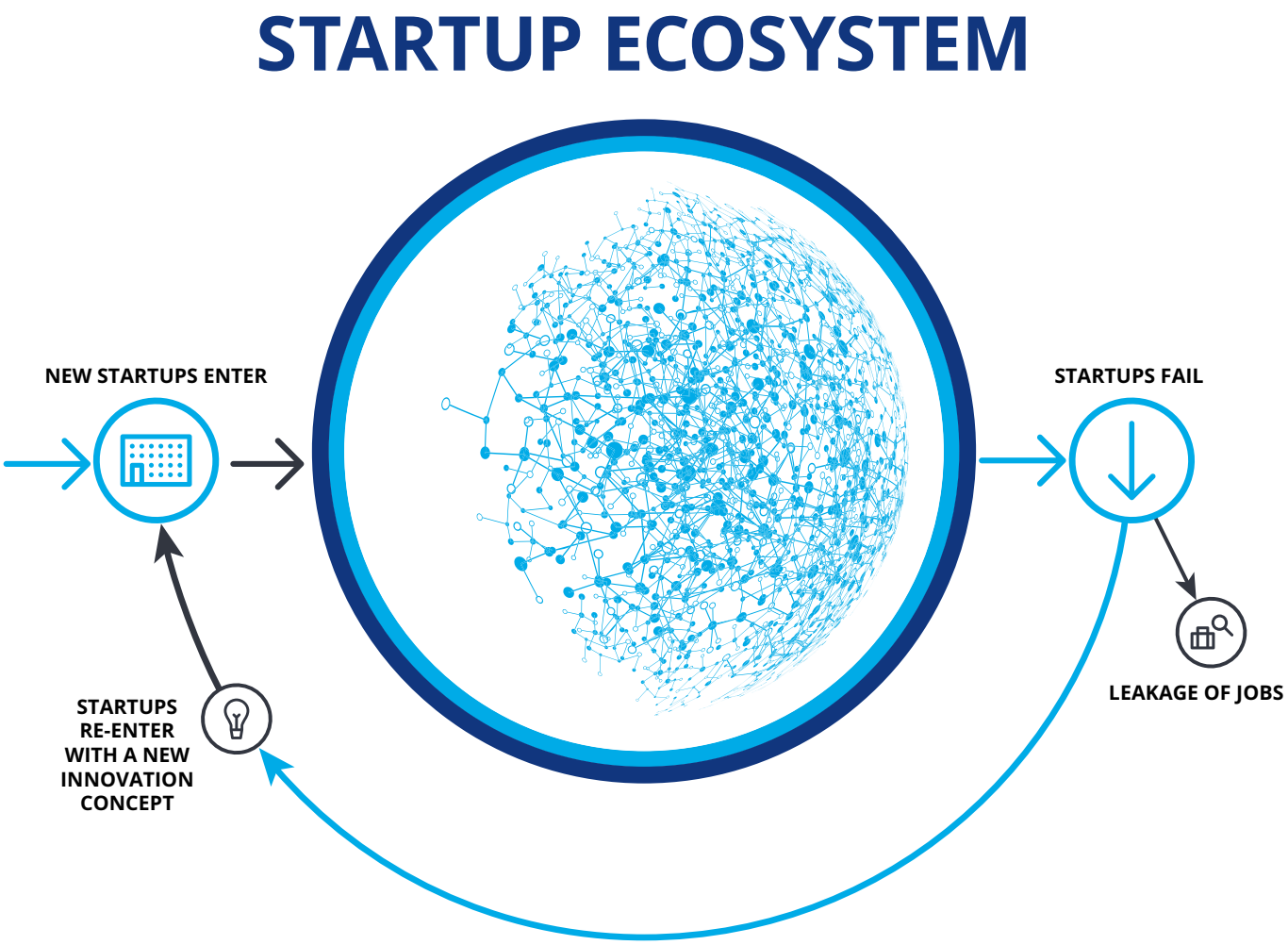
This process of job creation over the lifecycle of the startup – from startup to unicorn phase – is continually repeated as new startups enter the ecosystem, and as existing startups fail (resulting in some leakage of jobs from the ecosystem but also the recycling of jobs back into the ecosystem). Throughout this process, (a net increase of) jobs are continually added to the economy – *like a snowball effect*.

Where **startups are clustered**, a snowball effect generates an attractive pull, making that region more attractive for further knowledge-intensive companies and workers.[21]

The magnitude of job creation growth, however, should depend on **quality** of startups and market processes, and not the **quantity** of startups. Quality refers to their competitiveness, and therefore the challenge they bring to existing firms in markets.

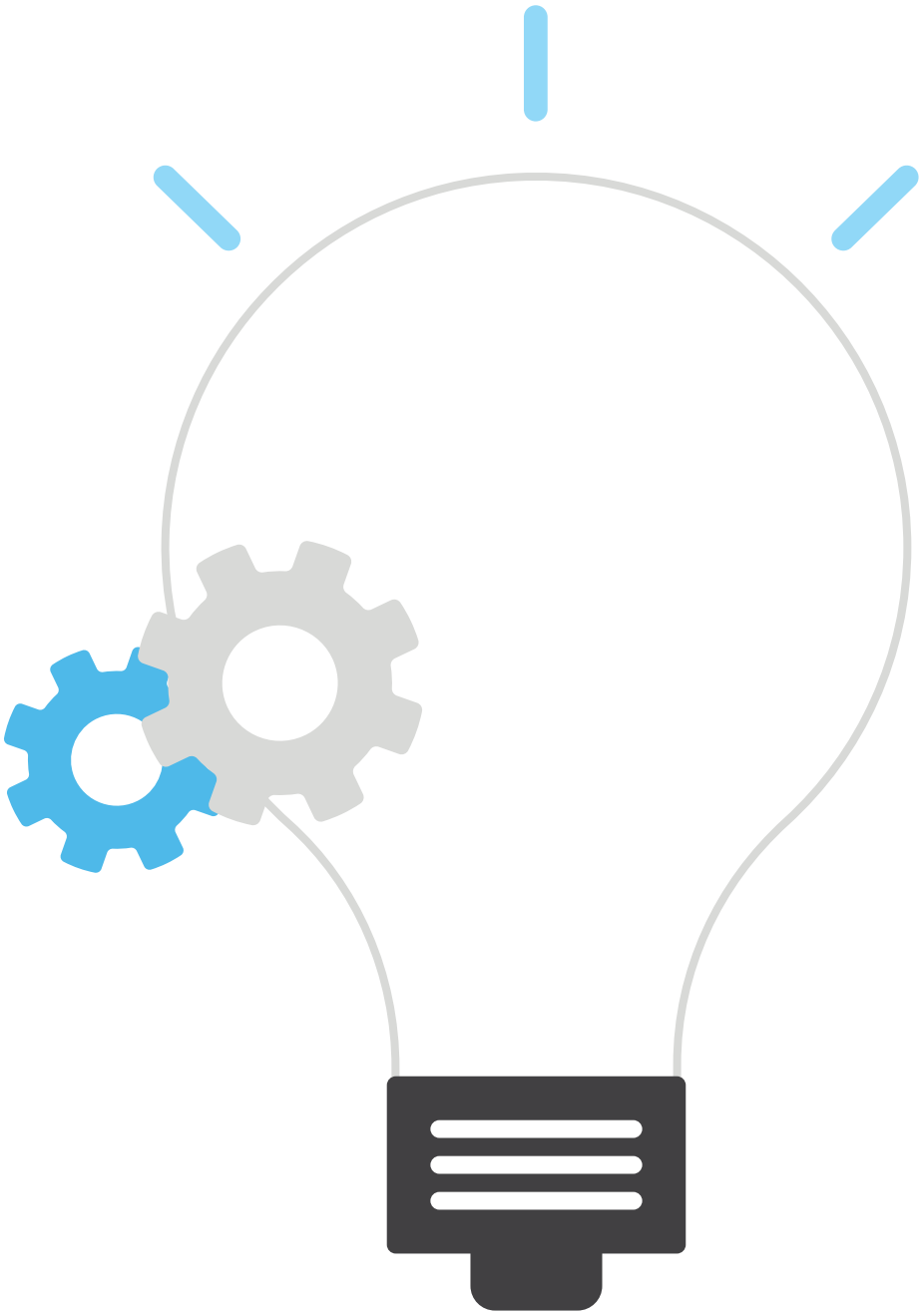
iv. The term unicorn is used to describe these companies because they are valued upward of $1 billion in private markets, with a business model that is deemed magical and elusive. Unicorns are an important part of the Victorian startup ecosystem as they add significant value and employment to the economy. This impact is further discussed in Chapter 5.

Figure 2.6 The cycle of startup entries and exits to the startup ecosystem




Source: Deloitte Access Economics

# 3 Startups and the rest of the world



### 3.1 Startups and the global economy

Despite the global financial crisis being behind us, many economies are still finding their new normal and face a range of complexities; fiscal consolidation in times of weak growth, fiscal spending cuts with high unemployment levels, and promoting world trade and investment flows while trying to retain local jobs.

The only way to address these delicate trade-offs is to discover new sources of growth, with innovation and the adoption of innovations being part of the answer.

A new wave of growth is powered by the entry and scaling of new startups, by the most adaptive small and medium enterprises, and by our need to develop efficient solutions to some of society's most complex public problems.

In this context, the global startup economy is growing at an exceptional rate. Between 2016 and 2018, startups globally created $2.8 trillion in market value, which was a 20.6% increase from the previous period.[22]

This growth has been supported by a decade-high venture capital investment of $220 billion in 2018. The demand for new technology has led to startups everywhere experimenting with new business models to reinvent traditional industries or create entirely new ones.

Silicon Valley, London and New York City continues to lead all ecosystems in terms of size and performance within the global startup economy – but for smaller geographies, technology has made it possible for regions to specialise in different startup sub-sectors, such as sports-tech, artificial intelligence and life sciences depending on their market structure.[23]

### 3.2 Global startup ecosystems

Startup Genome's core function is to monitor the performance of startup ecosystems, allowing them to assess how they are tracking among other ecosystems – Startup Genome's coverage of global ecosystems now expands to 150 ecosystems and they rank the top 30 global startup ecosystems based on their database.

To no surprise, Silicon Valley has been ranked the #1 global startup ecosystem in 2019, a position it has held since 2012. Followed by New York City, London, Beijing and Boston — with Beijing and London tied for #3.[24]

As well as rankings, Startup Genome also compares ecosystems in terms of exit, output and funding growth within their Ecosystem Lifecycle Model. Identifying which developmental phase an ecosystem is in helps provide the missing focus for decision makers, which enhances the impact of their actions.

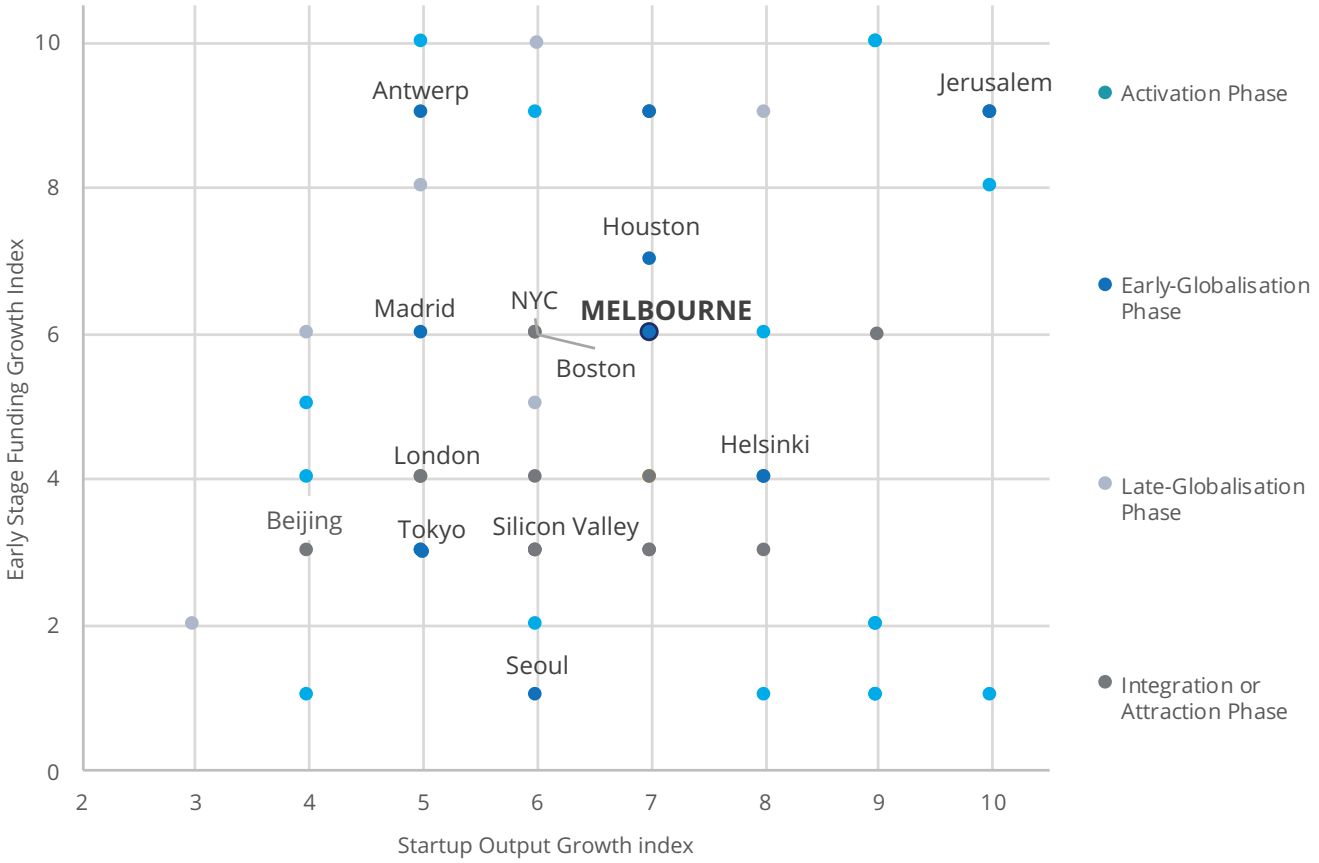
At each phase of the Ecosystem Lifecycle — Activation, Globalisation, Expansion and Integration — different priorities are necessary and different actions need to be taken to accelerate further growth. The key priority areas for Early-Globalisation Phase Ecosystems is Global Connectedness and Early-Stage Funding per Startup.

**The Melbourne startup ecosystem is one of the top 5 ecosystems within the early-globalisation phase in terms of global connectedness** but is yet to make the top 5 for early-stage funding per Startup. Currently, Melbourne Startups are receiving, on average, $155,000 in early-stage funding, which is below early-globalisation average of $284,000 (ratings are discussed in further detail in Section 3.3).[v]

Figure 3.1 shows where the Victorian ecosystem sits in comparison to other ecosystems. Note, only the top global startup ecosystems and startup ecosystems within the early-globalisation phase have been labelled – the remaining points on the map represent startup ecosystems in the Activation Phase and the Late-Globalisation Phase.

v. Early-stage funding is the sum of Seed and Series A funding.

Figure 3.1: Global ecosystems in the Ecosystem Lifecycle




Source: Startup Genome. (2019). A Global Startup Ecosystem Report 2019

### AMSTERDAM

Amsterdam-StartupDelta is currently in the attraction ecosystem phase and is ranked 15 as a global innovation ecosystem. Employment within the startup space makes up 13% of total occupations, and it is currently the leading job creator in Amsterdam with 13,000 jobs created from 2016-18.

Approximately 54% of jobs within this space are from domestic startups, and approximately 61% of these jobs derive from scaleups and grownups (where grownups are firms which have exited or are considered highly profitable). Together, they make up approximately 24% of employment growth within Amsterdam. Importantly, 44% of new jobs from home-grown firms are created by firms aged 5 and under, though employment growth is not always sustained in the long-run.

This further emphasises not only the value of developing a startup ecosystem for its impact upon employment, but also the importance of providing resources to facilitate these startups so that more are able to mature, scaleup, and exit.

### UNITED KINGDOM

There is a large body of literature that explores the impact of high growth firms (which we define as scaleups in this report) on job creation in the UK. The research tracks the growth performance of cohorts of startups, with results showing that a small number of job-creating firms are responsible for a significant amount of job creation in the UK.

Over the 2010-13 period, scaleups (defined by the OECD as high-growth firms) contributed around 18% (840,000 jobs) of all job generation within that period, despite only accounting for about 1% of all job-creating firms.

The same analysis was undertaken for each three-year periods from 1998 to 2008, which showed that in the periods up to 2005-08 the job creation figure was more than 1 million. Some of the reduction in job generation could be related to the impacts of the global financial crisis, which caused the UK economy to go into recession in 2009.

The significant employment growth observed within the UK demonstrates the potential of a startup ecosystem in sustaining economic performance and job creation, even during a recession.

Source: Startup Amsterdam (2019) Employment in Amsterdam's tech ecosystem; Anyadike-Danes, M., Bonner, Hart & Mason (2009). Measuring Business Growth: High-growth firms and their contribution to employment in the UK; Anyadike-Danes, M., Hart, M., & Du, J. (2015). Firm dynamics and job creation in the United Kingdom: 1998–2013. International small business journal, 33(1), 12-27.; Deloitte UK (2014) The Scale-up challenge.

### 3.3 Australia's relationship with startups

Australian, and especially Victorian startups compete in global, competitive markets. In order to elevate the Australian startups in the international market, the Australian Government offers a number of incentives to support research and development (R&D) and attract talent to Australia, such as R&D tax offsets and Global Talent Visas.

However, the Australian Government has not centrally driven the creation of a national startup ecosystem, this has been managed at the state government level, with, the Australian Government focused on supporting innovation more broadly through four key pillars :[25]

1. "**Taking the leap**: backing Australian entrepreneurs by opening up new sources of finance, embracing risk, taking on innovative ideas, and making more of our public research.
2. **Working together**: increasing collaboration between industry and researchers to find solutions to real world problems and to create jobs and growth.
3. **Best and brightest**: developing and attracting world-class talent for the jobs of the future.
4. **Leading by example**: the Australian Government will lead by example; embracing innovation and agility in the way we do business."

Each state in Australia has its own startup/innovation agencies (i.e. LaunchVic, Startup WA, Advance Queensland etc.) that have an objective to establish a sophisticated startup ecosystem and/or to drive innovation and R&D more broadly. The success of startups in these ecosystems is largely driven by their access to talent, capital and customers. This is something that the startups compete for at a state level, as well as internationally.

As such, each startup/innovation agency has a number of policies and initiatives that supports innovation in their state. A high-level comparison of Queensland, NSW and Victorian agencies are shown in Table 3.1.

Sydney has the most mature startup ecosystem within Australia. According to Startup Genome, the Sydney Startup Ecosystem is in the late-globalisation phase and is ranked 23 in the top 30 global startup ecosystems.

As shown in Figure 3.2, **Victoria's startup experience is on the cusp of globalisation**. Startup Genome estimates that the Victorian startup ecosystem size is lower than phase average and is below phase levels for funding. However, the Victorian ecosystem exceeding phase levels on access to experienced technical talent.

The Melbourne startup ecosystem[vi] did not make it into Startup Genome's top 30 global startup ecosystems 2019 list. However, Startup Genome has predicted future movements in the top 30 and has **identified Melbourne as a rapidly growing ecosystem that has potential to make the top 30 within five years**. The Melbourne startup ecosystem's performance in comparison to the averages of other ecosystems is provided in Figure 3.3.

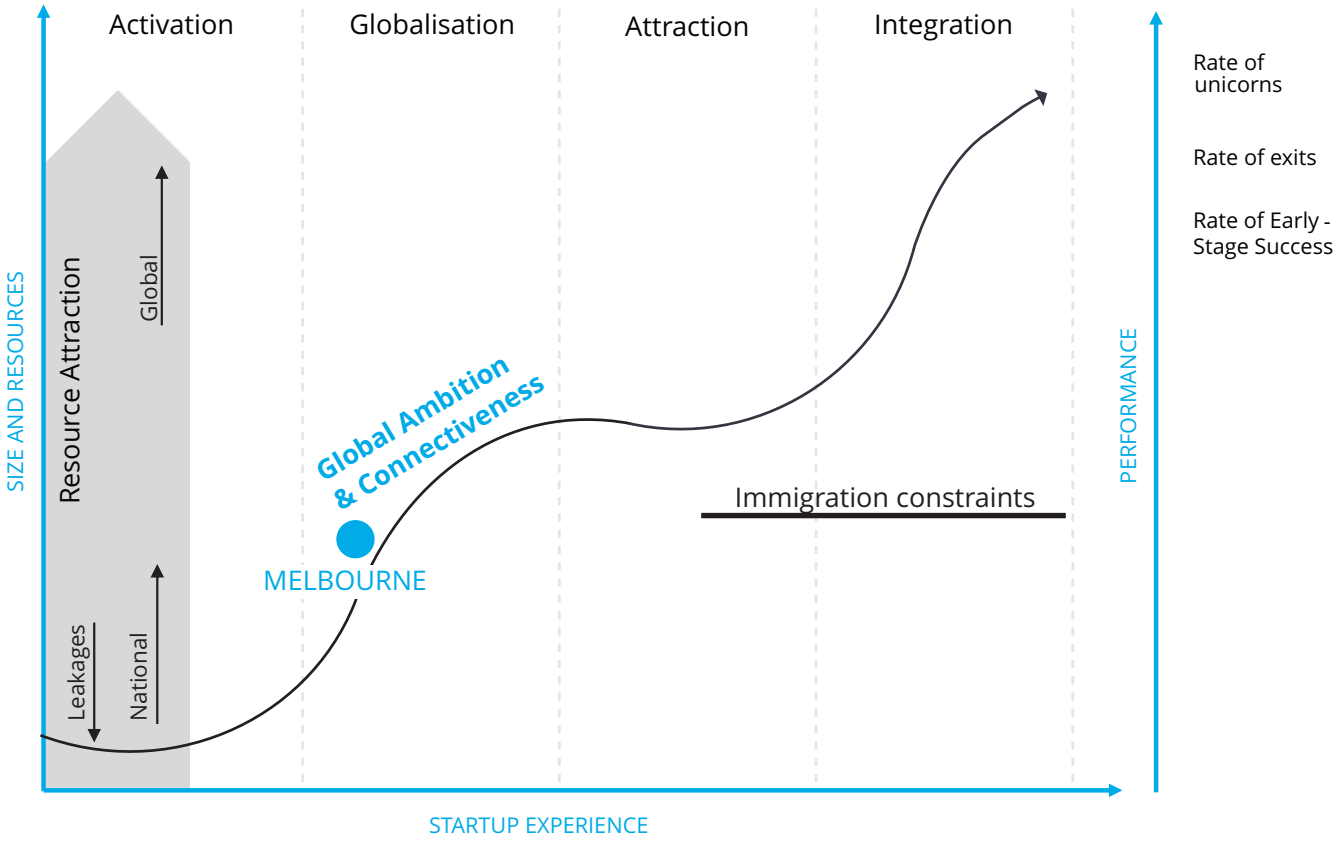
vi. Note: Startup Genome refers to startup ecosystems at the city level.

Table 3.1: Inter-jurisdictional summary of startup/innovation agencies

| | Funding | Policy types |
|---|---|---|
| **LaunchVic** | $70 million<br>(over 5 years to 2020-21) | • **Support programs** that build founder, startup and investor capability and connectedness, including **accelerators**<br>• Undertakes **research to better understand the Victorian startup ecosystem** and inform policy interventions<br>• Supports and runs **events that connect the ecosystem**<br>• Communicates, promotes and advocates on behalf of the sector |
| **Advance QLD** | $180 million | • **Grants** for business development, R&D and industry attraction for startups, business relocation and support for regional startups and SMEs<br>• **Co-investment for startups** developing innovative products<br>• **Mentoring, networking and training courses** for startups, SMEs and entrepreneurs in the Life Sciences sector |
| **Jobs for NSW** | $190 million<br>(over 4 years to 2019) | • Grants for startups to develop a minimum viable product or to acquire customers or channel to market<br>• Grants and **loans for emerging fast-growth SMEs** and for business owners who relocate to regional New South Wales<br>• **Infrastructure** (including $35 million to establish the Sydney Startup Hub) |

Source: LaunchVic (2019), Advance QLD (2019) and Jobs for NSW (2019)

Figure 3.2: Global Ecosystem lifecycle model




Source: Deloitte Access Economics; Startup Genome (2019). Accelerating the Success of the Melbourne Startup Ecosystem.

Figure 3.3: Melbourne global rankings snapshot

**Ecosystem Value:** **$3.2 bn** → *Global average: $7.3 bn*

**Software Startup Output:** **$1.4K – 2K** → *Global median: $1,470K*

**3** on the Exit Growth Index

**6** on the Funding Growth Index

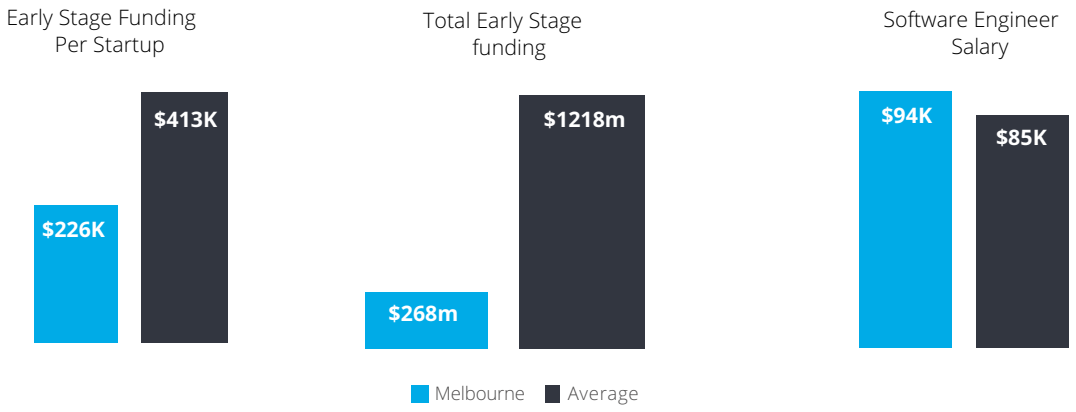
**7** on the Output Growth Index

**CONNECTEDNESS**
Top 20 Global Ecosystems

**TALENT**
Top 25 Global Ecosystems

**INCLUSION**
20% - International founders
2% - Indigenous founders

**TECH PRESENCE**
Strong access to global technology companies

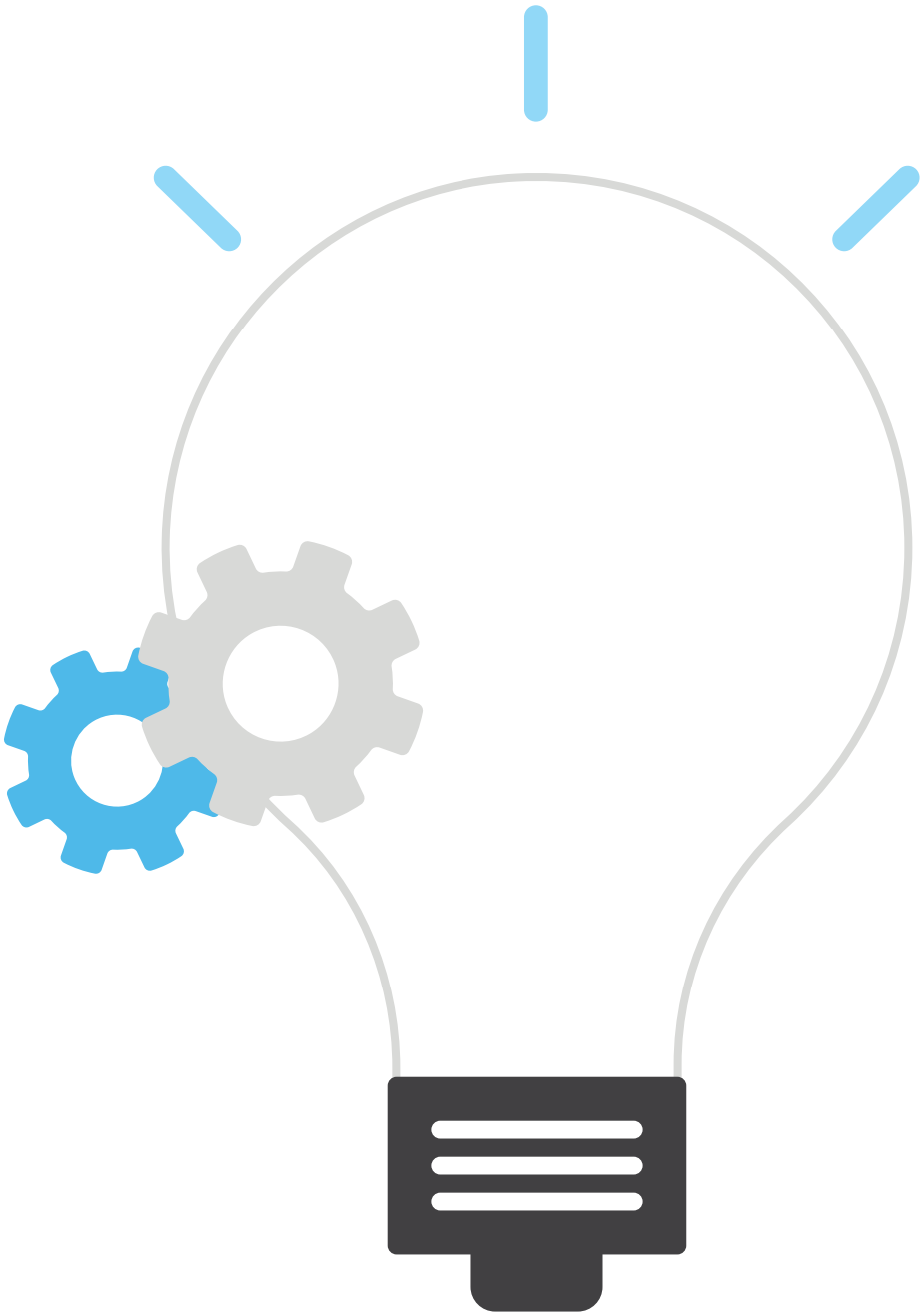



Source: Startup Genome (2019).
Note: All figures have been converted to AUD. Startup Genome defines the following terms as: Exit index, an index of growth in tech startup exits in the ecosystem from 2015 to 2016 to 2017 to 2018; Funding growth index, an index of growth in early-stage funding (Seed and Series A) in tech startups in the ecosystem from 2014 to 2015 to 2016 to 2017; Output growth index, an index of growth in total startup creation in the ecosystem, calculated in an annualized growth rate from 2014 to 2018; Ecosystem Value, value of exits and startup valuations over 2016, 2017 and the first half of 2018. It must be noted that this measure of ecosystem value is a different measure of ecosystem output to what is described in the remainder of this report.

# Part II

## VICTORIA'S STARTUP ECOSYSTEM

# 4 Victoria's startup ecosystem



### 4.1 Setting the scene

The new wave of economic growth is being driven by the establishment of niche markets, agglomeration, structural realignment of business investment and the transformation of value chains.

This has resulted in Victoria's economy experiencing a broad decline in their traditional economic base of large-scale manufacturing and logistics towards a highly-skilled and sophisticated, knowledge economy.

The density of Melbourne as a city, combined with both its physical and network assets, has allowed for the formation of a **globally recognised startup ecosystem.**

To date, it typically takes a startup ecosystem over 15 years to mature, with all global leading startup ecosystems (including Silicon Valley) catalysed with initial government support and a long-term funding commitment – for example, the government investments into the Singapore and Tel Aviv startup ecosystems over the last 20 years has been substantial, but reaped billions of dollars of dividends into the economy – both in terms of employment generated, the type and nature of employment and the value-added to the economy overtime.[26]

The challenge for Victoria is maintaining the momentum in its startup ecosystem, to ensure it can scale into an ever greater globally competitive ecosystem.

### 4.2 The Victorian ecosystem

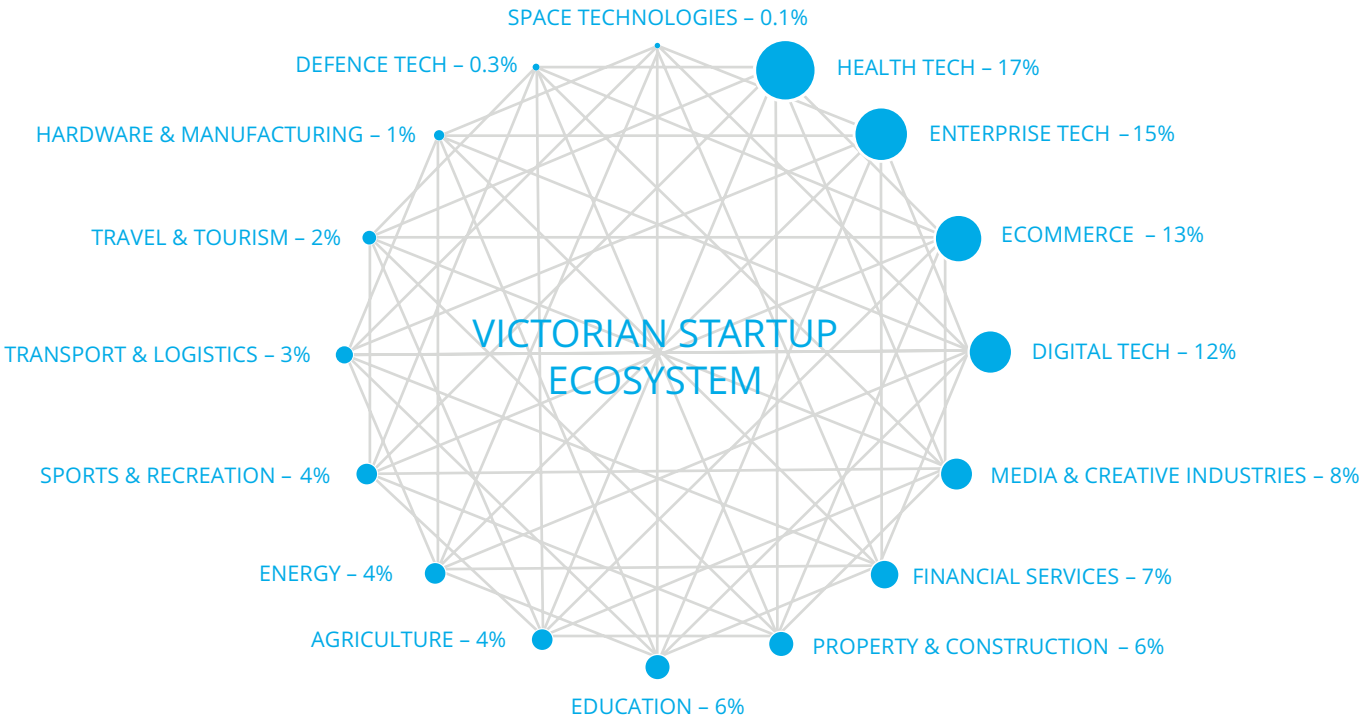
The Victorian startup ecosystem is diverse, with **startups in 16 different subsectors – with over half of Victoria's startups in Health Tech, Enterprise Tech, eCommerce and Digital Tech** (approximately 55%).

The **majority of Victoria's unicorn companies (a market valuation of over $1 billion) are also in these sectors**, with three in Health Tech (Mesoblast, Clinuvel Pharmaceuticals and Polynovo), three in eCommerce (Envato, REA and CarSales), three in Enterprise Tech (SEEK, Culture Amp and MYOB) and three in financial services (Judo Capital, AirWallex and Afterpay).[27]

**Where are the startups located?**

Location is increasingly playing a large role in the dynamic relationship of startup ecosystems. If startups and employees are located within a close proximity from each other, they benefit from collaboration with like-minded colleagues, employees and firms surrounding them, and broader spillover benefits from the agglomeration of economic activity.

Figure 4.1 Subsector breakdown of the Victorian startup ecosystem




Source: LaunchVic Database (2019)

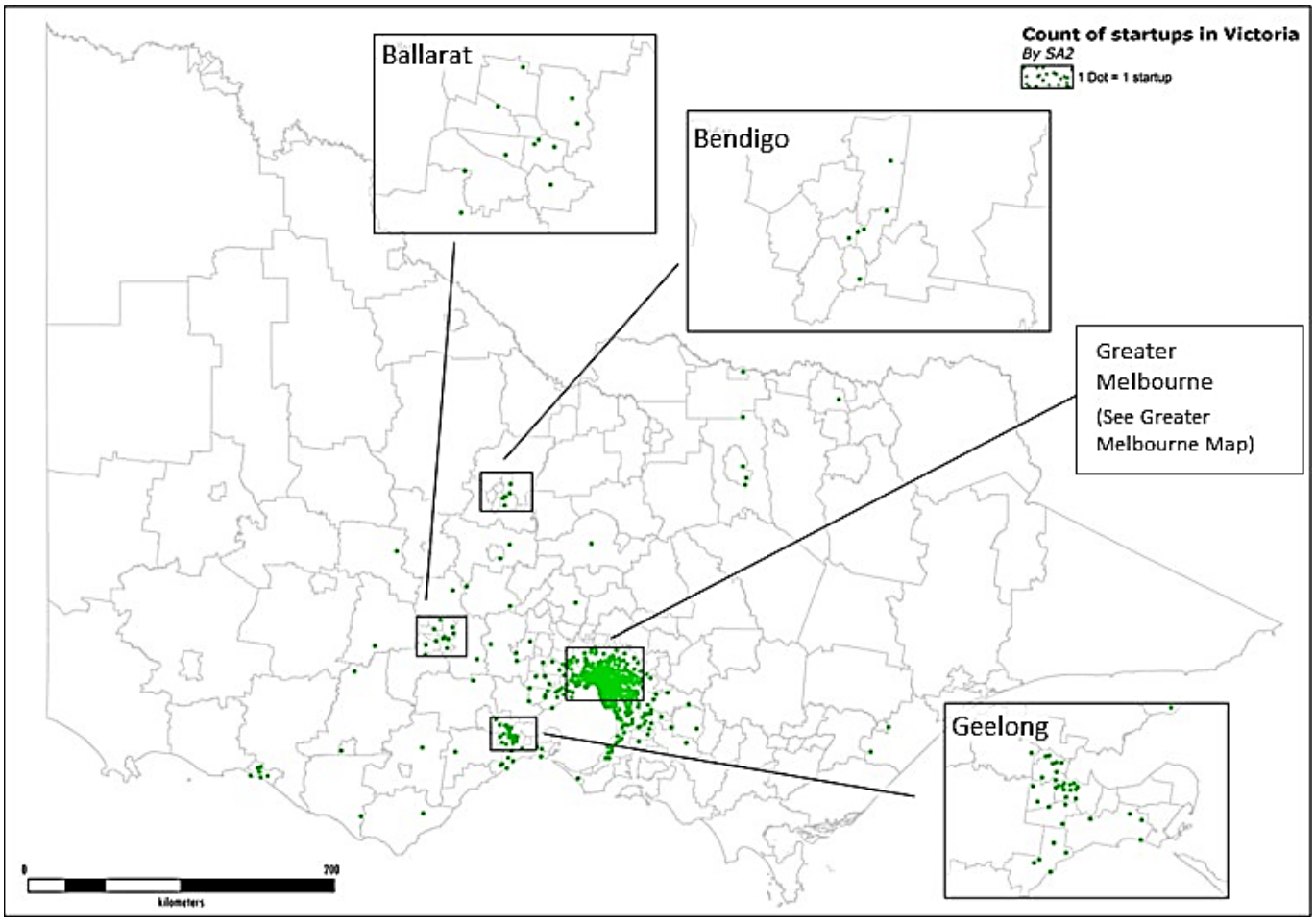
**MAPPING VICTORIA'S ECOSYSTEM**

Victoria is shown in Figure 4.2 – and subsequent figures unless specified otherwise – broken down to the ABS Statistical Area Level 2 (SA2) region. SA2's are medium-sized general purpose areas and represent a community that interacts together socially and economically – this area is smaller than a local government area, for example. The SA2 level is used for the remainder of the analysis in Chapter 4 – and noting that in all figures with green dots, **one green dot represents one startup.**

The economics of agglomeration plays out in Victoria as expected, with **startups primarily located in and around the Greater Melbourne area** – with a few startups also situated in the north-eastern and south-western regions of Victoria. In particular, there is a visible **cluster of startups in Warrnambool.**

The area surrounding **Geelong** has a relatively large number of startups, as do other regions such as **Bendigo, Ballarat and Warrnambool**. Startups in rural areas are more sparse, with many rural SA2s not containing startups. However, it is notable that **North East Victoria** has a marginally higher count of startups to South East Victoria.

Figure 4.2 Zooming out: count of startups in Victoria



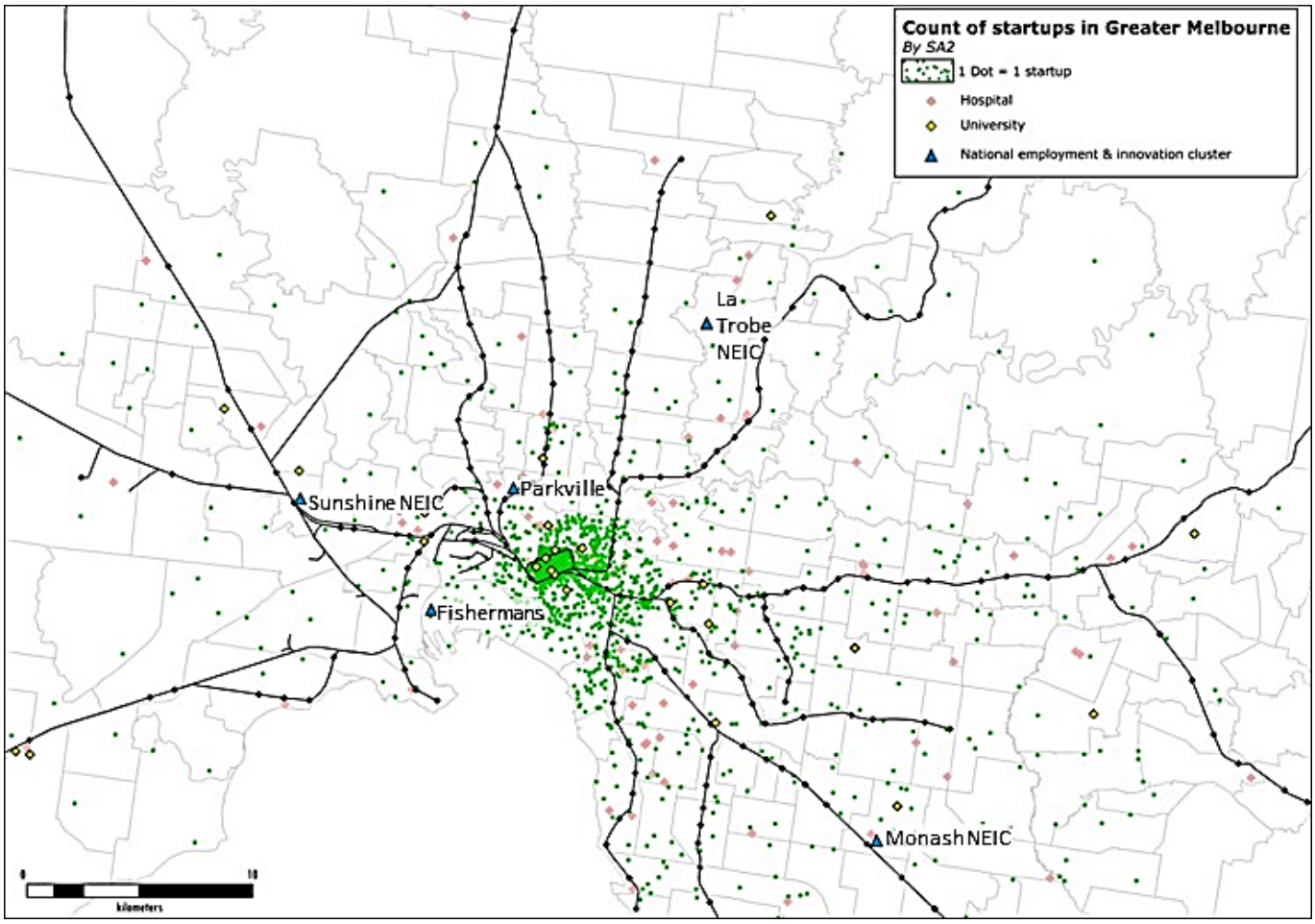

Source: Deloitte Access Economics, LaunchVic Database, ABS Census data 2016, Plan Melbourne 2017-2050

When looking more closely at the Greater Melbourne area (Figure 4.3), **startups are located closely within 2 kilometres of the Central Business District** (CBD). A strong concentration of startups extends from the CBD south towards the **Mornington Peninsula**, and east towards **Richmond**, north towards **Carlton**, and west towards **Docklands**. Making the CBD the hub of startup activity, with the count of startups higher than anywhere else in Victoria.

Figure 4.3 below highlights that **startups tend to be in areas which are serviced by public transport**, with startups located in close proximities to train lines – with no large clusters appearing around the National Employment & Innovation clusters (NEIC).

The CBD remains the key hub of startup activity given the ease of access to public transport and the diverse amenities offered within the city, such as coworking spaces, cafes and restaurants, and even more broadly, the culture.

Figure 4.3 Zooming in: count of startups in the Greater Melbourne area




Source: Deloitte Access Economics, LaunchVic Database, ABS Census data 2016, Plan Melbourne 2017-2050

**Startups are particularly concentrated within and around the City Loop** (public transport loop within the inner city). This concentrated level of activity is significant. Startups are choosing to locate themselves based on accessibility.

Within the CBD, startups can better access and take advantage of key elements of the startup ecosystem: shared working spaces, networking opportunities with like-minded peers, events and meetups, and access to other goods or services (e.g. legal, technological or financing advice) required for their development and scaling purposes.

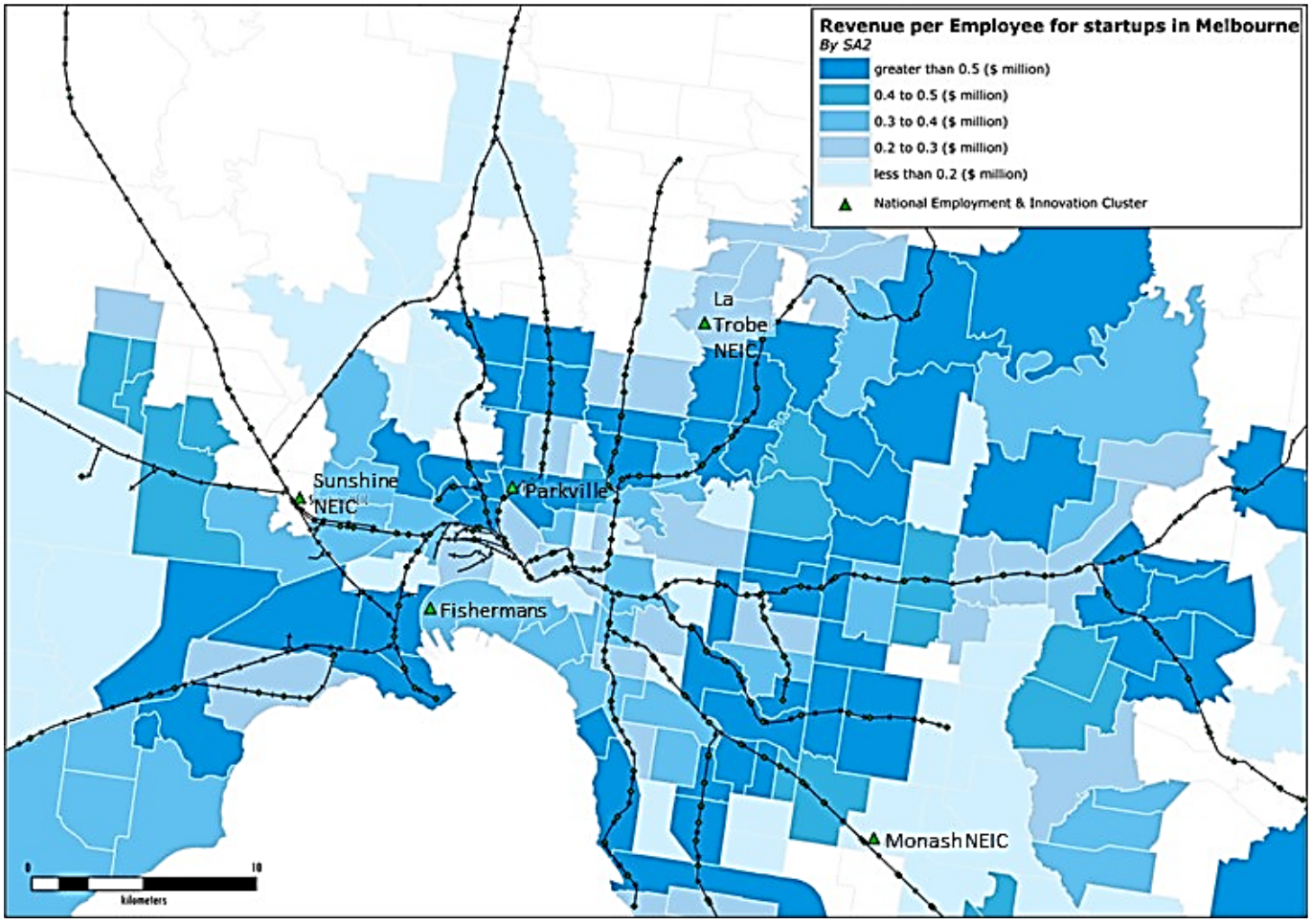
There are also university campuses located within in and around the CBD (such as the University of Melbourne Victoria University campus, La Trobe University City Campus and RMIT University) and hospitals located close to the City Loop (St Vincent's Hospital Melbourne and Epworth Richmond Hospital).

Literature suggests that **proximity to universities is a key catalyst for startup generation**, however this agglomeration activity is not explicitly shown through density within Inner (or Greater) Melbourne. Even in the Parkville area, just north of the CBD and City Loop, where both the University of Melbourne and the Royal Melbourne Hospital are located, there is not a significant clustering of startups that is distinct from the continuation of the CBD.

A CBD, such as **the Melbourne CBD, provides the optimal conditions to support a startup ecosystem**. It appears that startups recognise these conditions and are using location to optimise their own opportunities, as opposed to clustering around existing NEIC's, universities or hospitals.

Figure 4.4 shows that despite the higher concentration of startups located in Melbourne CBD and the inner suburbs, the **revenue per employee count of startups is greater in the outer suburbs of Melbourne.**

Figure 4.4 Revenue per employee of startups in Greater Melbourne




Source: Deloitte Access Economics, LaunchVic Database, ABS Census data 2016, Plan Melbourne 2017-2050

It is *likely* that the startups agglomerated within inner Melbourne and the CBD are in their early stages of the startup life cycle and are not generating high revenue. The startups may be less productive in these stages; possibly in product development, market seeking or market trial stages, with lower revenue streams as opposed to scaling up and growing. These startups benefit from being located within the inner Melbourne area where they have better access to the startup ecosystem networks and services.

In the outer suburbs of Melbourne, particularly to the west and south-east corner, there are areas with high revenue per employee of startups. It's *likely* that these areas have a small number of more mature startups, with greater revenue, who have established themselves as market competitors and generating growth.

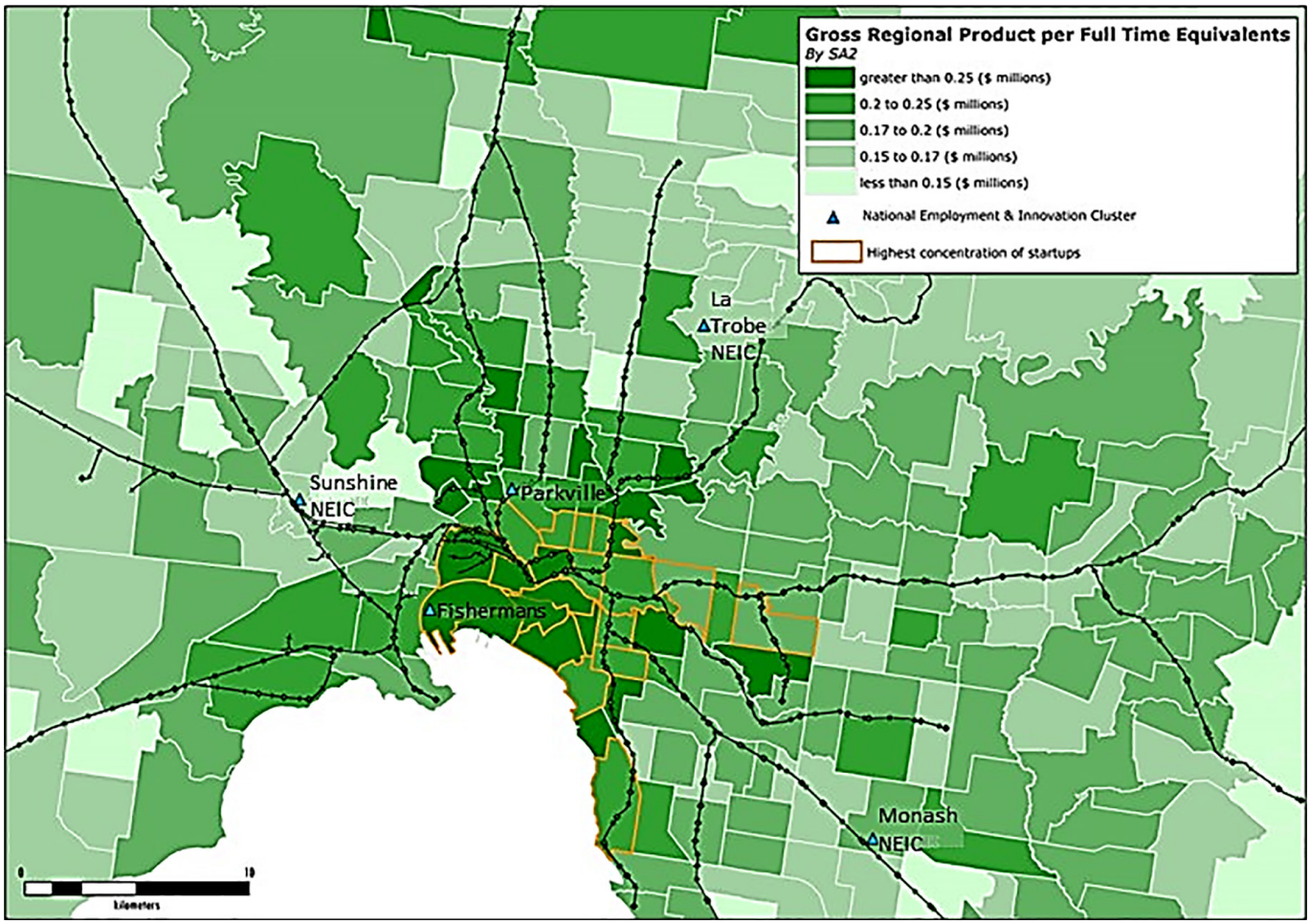
It is important to note that rent within the inner city of Melbourne can be expensive relative to other regions in Greater Melbourne and Victoria. When the operation of a startup begins to expand, particularly if they require more space for more employees, these rental expenses can become unaffordable for the startup.

When startups experience this expansion, they may choose to leave the inner city and head north (for example to Brunswick East, Brunswick West or Northcote) where rent may be cheaper; but they are still located within the inner Melbourne area, connected to ecosystem networking opportunities and services.

It is also noted that regions with higher revenue per employee for startups broadly tracks the train lines in Greater Melbourne.

Gross regional product (GRP) per employee within Greater Melbourne can be used as a *proxy measure for productivity* at the SA2 level. On this basis, there is a **higher amount of productive activity within the inner city (and surrounds), which corresponds to the highest concentration of startups** (Figure 4.5).

Figure 4.5 Gross Regional Product per employee (FTE) in Greater Melbourne




Source: Deloitte Access Economics, LaunchVic Database, ABS Census data 2016, Plan Melbourne 2017-2050

There appears to be an outer ring, just outside of the CBD, extending from Parkville, Carlton, Fitzroy and down to St Kilda, where productivity is likely to be slightly lower given that the area hosts more residential buildings and a higher concentration of lower (implied) productivity businesses i.e. retail and cafes. In these suburbs, while there are office/working locations, the drivers of output are not the same as within the CBD. There is more life-style focused employment and output within these areas, which may be reducing the average productivity level.

It's *likely*, however, that some startup activity within these areas will spillover to benefit such life-style businesses and cafes – that is, startups support the businesses in the area just by being there.

Brighton and Camberwell also have lower levels of productivity, compared to the inner city/CBD. It's likely that the startups located in these areas are more mature or more decentralised tech-based startups who no longer rely on inner-city support networks (i.e. accelerators or incubators).

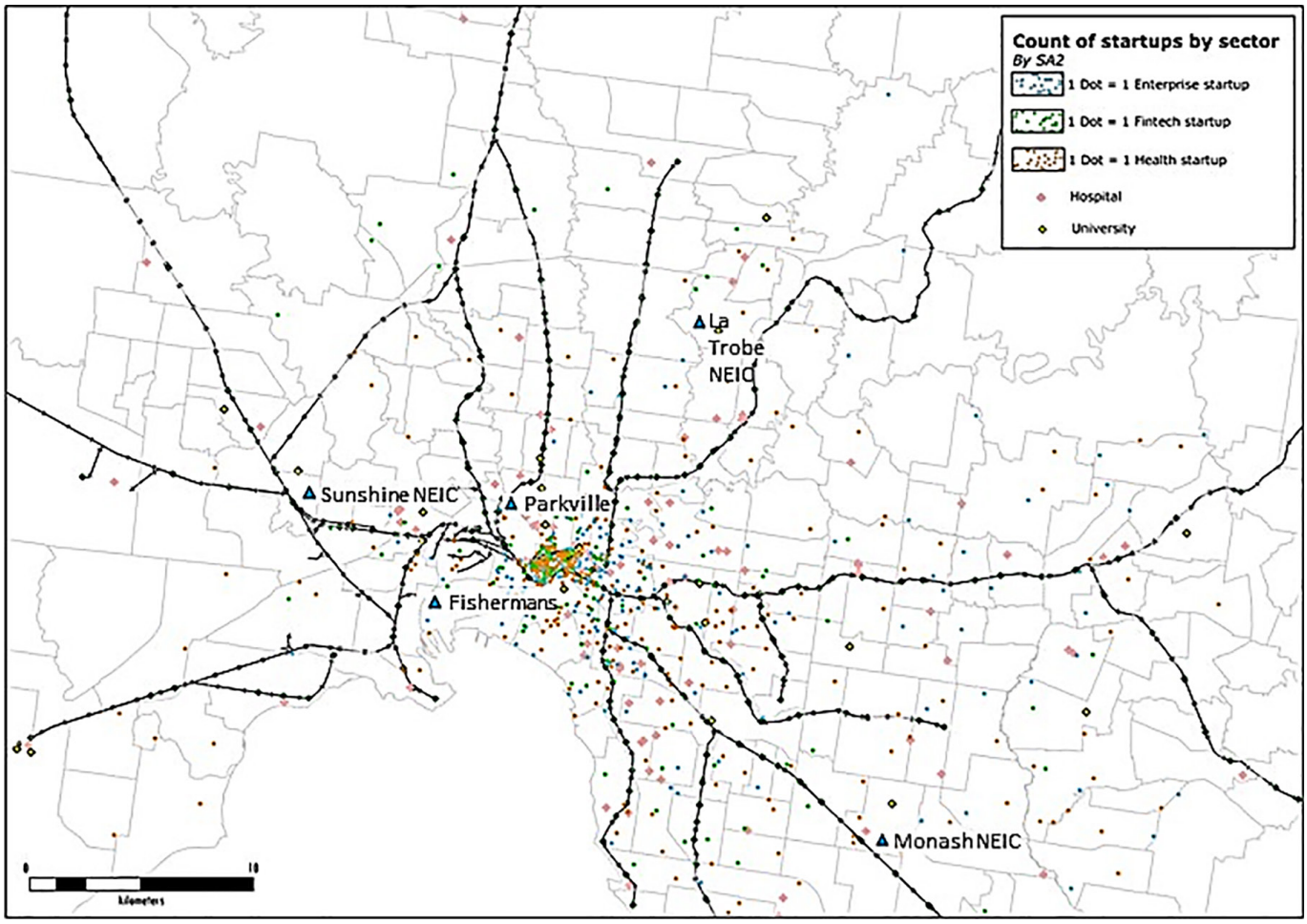
Such startups could have the ability to work from any location such as their own home and/or they don't require the networking and a high density of professional services (e.g. legal advice, financial services and central meeting points for networking).

At this stage of Victoria's ecosystem development, **startups are not clustering by sector**. Figure 4.6 shows, as in the figures above, the clustering of startups within Greater Melbourne is occurring within the Inner Melbourne area, particularly within the CBD.

When taking a closer look at Inner Melbourne, there doesn't appear to be agglomeration within sectors. The startups are concentrated within the CBD but are spread in terms of whether they fall into the health, enterprise, or fintech sectors (Figure 4.6).

The health startups also don't appear to be clustering around hospitals. There are some health startups located within a close proximity to universities, but again, the concentration is low.

Figure 4.6 Agglomeration Counter in Greater Melbourne




Source: Deloitte Access Economics, LaunchVic Database, ABS Census data 2016, Plan Melbourne 2017-2050

**What this tells us is that startups are taking advantage of the benefits of the local Melbourne startup ecosystem, having access to transport, resources, services and networking opportunities, as opposed to situating their startup next to another startup in the same sector.**

Developing and implementing an overarching precinct strategy, focussing on sector collaboration, could see an increase in sector agglomeration, however the diverse spread of startup locations can have positive externalities. Being within a similar location to a startup in another sector may have additional benefits in learning from those who may be closely aligned but have different methods, different skill sets and different ideas: *spillovers of all kinds*. This can have synergistic effects flowing between sectors.

It's important for a startup ecosystem to have an array of different sectors and different specialisations, as this is how productivity spill from one industry to another, resulting in economic growth.

### 4.3 Capturing and measuring the startup industry

This section presents the analysis of startups and scaleups in Victoria, referred to as the 'startup industry' which is a unique 'carve out' of the economic activity associated with the startup ecosystem – much like health, education and manufacturing industries are all individual sectors. It is noted that this is referred to as the 'startup industry' rather than 'startup sector' for the purposes of the modelling.

The startup industry, as defined by LaunchVic's ecosystem sectors, has been captured and mapped across to Australia and New Zealand Standard Industry Classification (ANZSIC) 2006 industries. This has been done for both analytical and modelling purposes. This has allowed for an estimation of the current size of the startup industry in terms of revenue, value added and employment across Victoria.

Revenue is measured as the sales and services income earned by businesses through sales of products and services to customers. Value added measures the value added by businesses using labour and capital. Importantly, value added is a measure of economic contribution and summed across all industries (plus taxes less subsidies) aggregates to gross state product.

A comprehensive database detailing close to 1,670 startups[vii] (classified according to Startup Genome definitions) across Victoria was provided by LaunchVic, which informs the size of the startup industry.

The database categorises the startups into different sectors and includes revenue and employment estimates – albeit not for all startups (and scaleups). Consequently, as revenue and employment data is not available for the entire cohort of startups, this is extrapolated based on average revenue and employment for each industry. Where data is provided, **the *average* revenue and employment across the startups is around $3.6 million and 14 employees respectively** in 2019. More detail on the database and this approach is outlined in Appendix B.

#### THE LAUNCHVIC DATABASE

Deloitte Access Economics used LaunchVic's database to estimate the size of the Victorian startup industry in 2019. This database was first constructed by Dandolopartners in 2017 through their independent survey, which reached 1,137 Victorian startups. This database was subsequently updated by Dandolopartners in 2018, resulting in 2,770 startups. In 2019, Deloitte Access Economics, in collaboration with LaunchVic, adopted a modified process to update the database, which builds on previous work, while refining the classification of startups/scaleups and employment and revenue attributable to the Victorian startup ecosystem.

Specifically, the identified large startup/scaleups (>100 employees) which either had been acquired or were founded before 1995 were removed from the database for the purposes of this report and analysis.

Due to data limitations in relation to select startups in the database, Deloitte Access Economics apportioned the economic activity (revenue and employment) of Victorian startups/scaleups using the following assumptions:

- For startups, all economic activity recorded in the database was deemed attributable to Victoria
- For scaleups, economic activity was apportioned using the Victorian industries (mapped to ANZSIC codes) share of the national industry in value added terms.

The resulting database is expected to be a conservative reflection of the direct economic activity induced by the Victorian startup ecosystem.

**See Appendix B for a more detailed breakdown of the assumptions and data cleaning process.**

vii. It is worth noting that the number of startups in Victoria, which was previously estimated at 2,770, was revised down by LaunchVic since the Victorian Startup Ecosystem Mapping Report (Dandolopartners, 2018).

Based on these calculations, **the revenue of the Victorian startup industry is estimated to be in the order of $4.6 billion in 2019.**

Using ABS Australian Industry Data, **the value added of the Victorian startup industry is estimated to be $2.4 billion in 2019.** The startup industry contributes around 0.6% to the Victorian economy – for context, the arts and recreation services industry in Victoria represents around $4.6 billion in value added, or around 1.1% of the Victorian economy in 2018.

Consistent with findings in the literature, the startup industry supports many jobs. Specifically, **it is estimated that the startup industry in Victoria employed around 18,900 people in 2019**, representing around 0.7% of Victorian employment.

Analysis of the key ANZSIC industries highlights that, in terms of revenue, **most of the startup activity is concentrated in professional, scientific and technical services (18%) and health care and social assistance (17%) industries** (see Chart 4.1).

The other **key industries contributing to revenue include retail trade, information media and telecommunications and financial and insurance services.**

## MAPPING THE LAUNCHVIC SECTORS TO ANZSIC INDUSTRIES

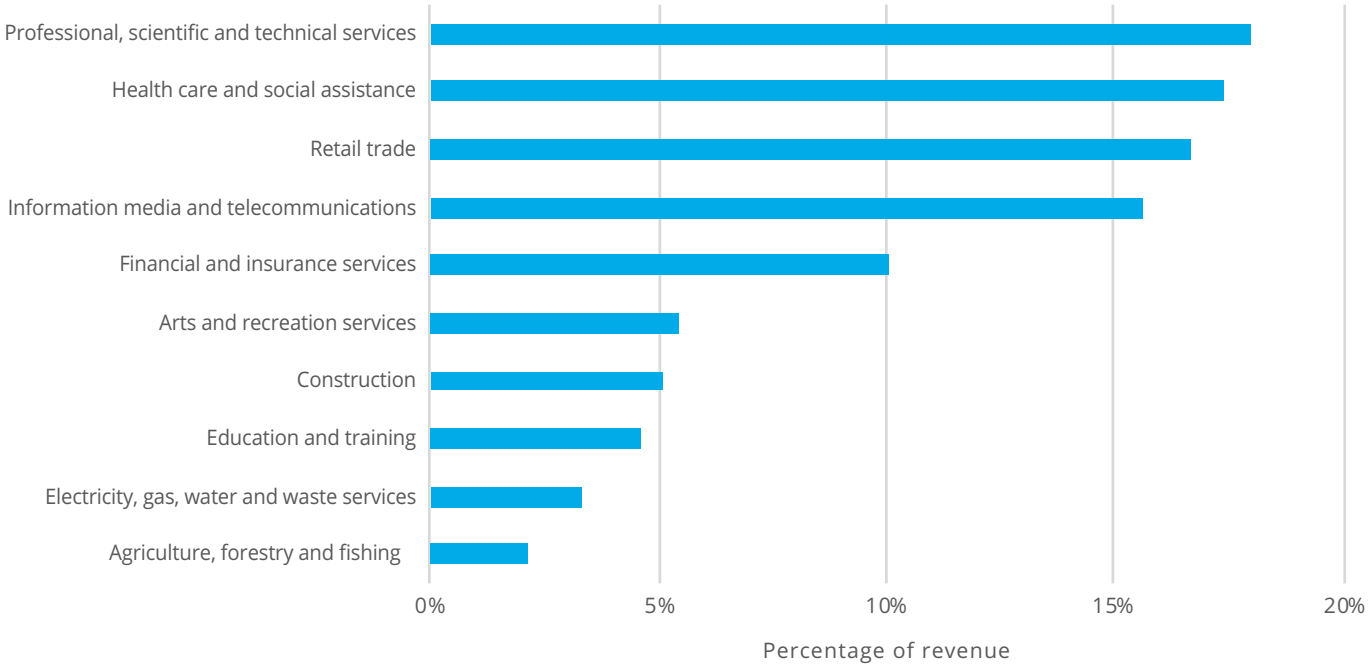
For the purposes of identifying the startup industry in the model, it was necessary to map the LaunchVic sectors (described in Chapter 4.1) to ANZSIC 2006 industries at the 1 Digit level.

This exercise was undertaken at the sector level, where the most appropriate ANZSIC industry representing the sector was selected. It should be noted that while in some cases the LaunchVic startup sectors include activity from a number of ANZSIC industries, the approach simplifies this to select the primary industry, or the industry that is considered to be the most representative of the activity undertaken.

As a result, there may be some under or overrepresentation of certain industries. However, it is noted that the results of the mapping appear to be reasonable based on a priori expectations considering the composition of industries and any under or overrepresentation would likely net off at this scale.

See Appendix B for additional detail on the approach to mapping the LaunchVic sectors to the ANZSIC industries.

Chart 4.1 Percentage of revenue by top 10 industries (startup industry)

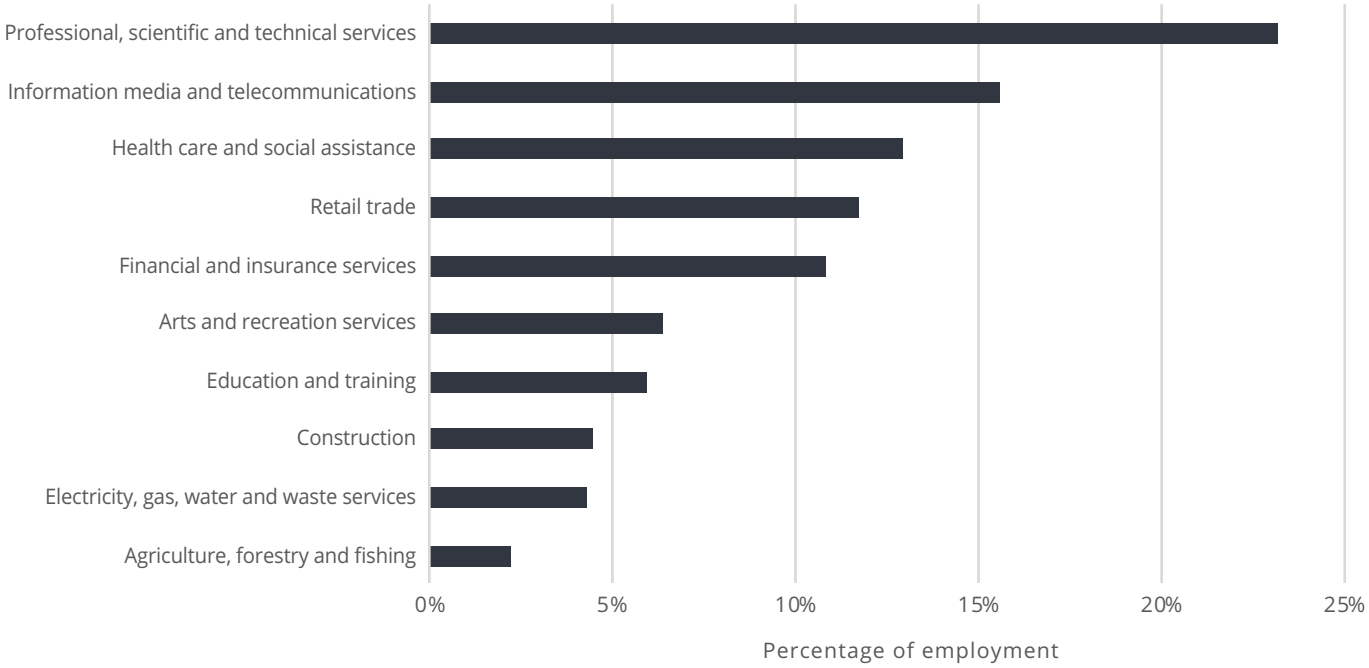



Source: Deloitte Access Economics estimates
Note: Percentage of revenue excluding those startups that were not categorised under a sector

The employment profile of the startup industry is slightly different, with the **top industries for employment identified as professional, scientific and technical services (23%) and information media and telecommunications (16%)** (see Chart 4.2).

The higher employment in these sectors reflects the more labour-intensive nature of these services industries. The **other major employing industries include health care and social assistance, retail trade, and financial and insurance services.**

Chart 4.2: Percentage of employment by top 10 industries (startup industry)




Source: Deloitte Access Economics estimates
Note: Percentage of revenue excluding those startups that were not categorised under a sector

## GOOD NEWS STORIES: 2019 EXITS

Victoria also has a track record of generating big exits. In the last year alone, there have been three acquisitions valued at over $100 million each, including the $230 million sale of Catch.com,au to Wesfarmers. These acquisitions build on a growing number of recent $100 million+ exits including CrownBet, Aconex and Click Energy in 2018. A list of large ($30 million+) 2019 acquisitions are listed below:

- EDGE LOYALTY SYSTEMS ACQUIRED BY BLACKHAWK NETWORK ($32.3 million) - AUG 29, 2019 (PENDING)
- CONNECTIVE ACQUIRED BY AUSTRALIAN FINANCE GROUP ($120 million) - AUG 12, 2019 (PENDING)
- CRESO PHARMA ACQUIRED BY PHARMACIELO ($122 million) - JUL 12, 2019 (PENDING)
- BIO-E ACQUIRED BY STAR COMBO PHARMA ($60 million) - JUL 4, 2019 (COMPLETE)
- CATCH.COM.AU ACQUIRED BY WESFARMERS ($230 million) - JUN 12, 2019 (COMPLETE)
- CONTAINERCHAIN ACQUIRED BY WISETECH GLOBAL ($65.8 million) - FEB 25, 2019 (PENDING)

Although these acquisitions mark the departure of some firms from what we define as the Victorian startup ecosystem, they are a reflection of the maturity if the ecosystem and its significant economic impact. For example, Startup Genome estimates that since Carsales.com, Seek and REA Group went public in the 2000s, the three firms have together created more than $10 billion in additional economic value.

Source: CrunchBase database (2019); Dandolopartners (2018); Startup Genome (2018).
Note: Only acquisitions where the price was disclosed is included in the box

## 4.4 Startups playing to Victoria's competitive advantage

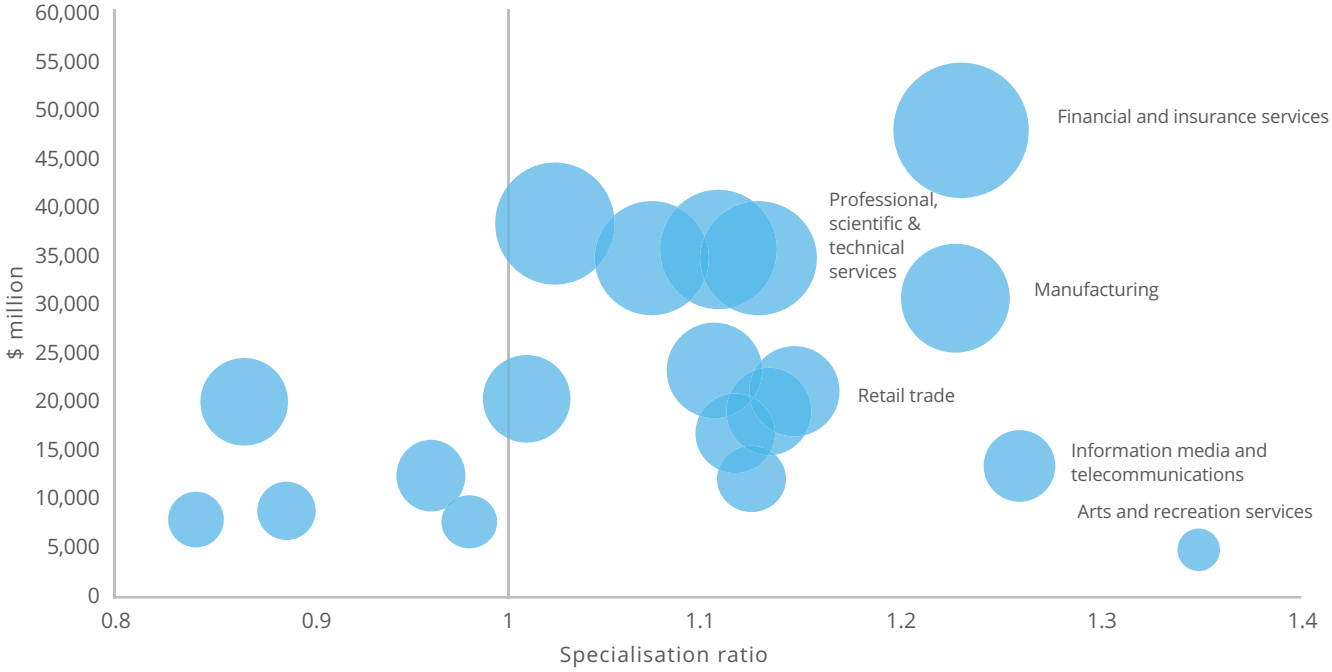
Innovation enables success in global competition and increases Victoria's economic performance, growth and contribution to national economic development. In this context, the Victorian startup ecosystem can be viewed as an essential element of competitive advantage.

Firms have two avenues to choose in order to survive in a competitive market – follow closely and adopt innovations or be innovative themselves. Startups are the innovators, which provide the platforms for other firms to innovate in line with or above internationally competitive firms – making the Victorian startup ecosystem foundational to the economy's overall competitive advantage, complexity and diversity.

Chart 4.3 illustrates Victoria's competitive advantages, measured by each sector's specialisation ratio. The specialisation ratio indicates the concentration of output in Victorian industries relative to the Australian total. A ratio greater than one indicates that the industry in Victoria is specialised relative to Australia as a whole.

Victoria drives national economic growth through many industries, such as Financial and Insurance Services, Manufacturing, Information and Telecommunications and Arts and Recreation Services. Table 4.1, displays the density of startups within each sector – where Victoria's startup ecosystem is more likely to be competitive in areas where they have historically held a specialisation.

Chart 4.3: Victoria's competitive advantages, by sector value-added



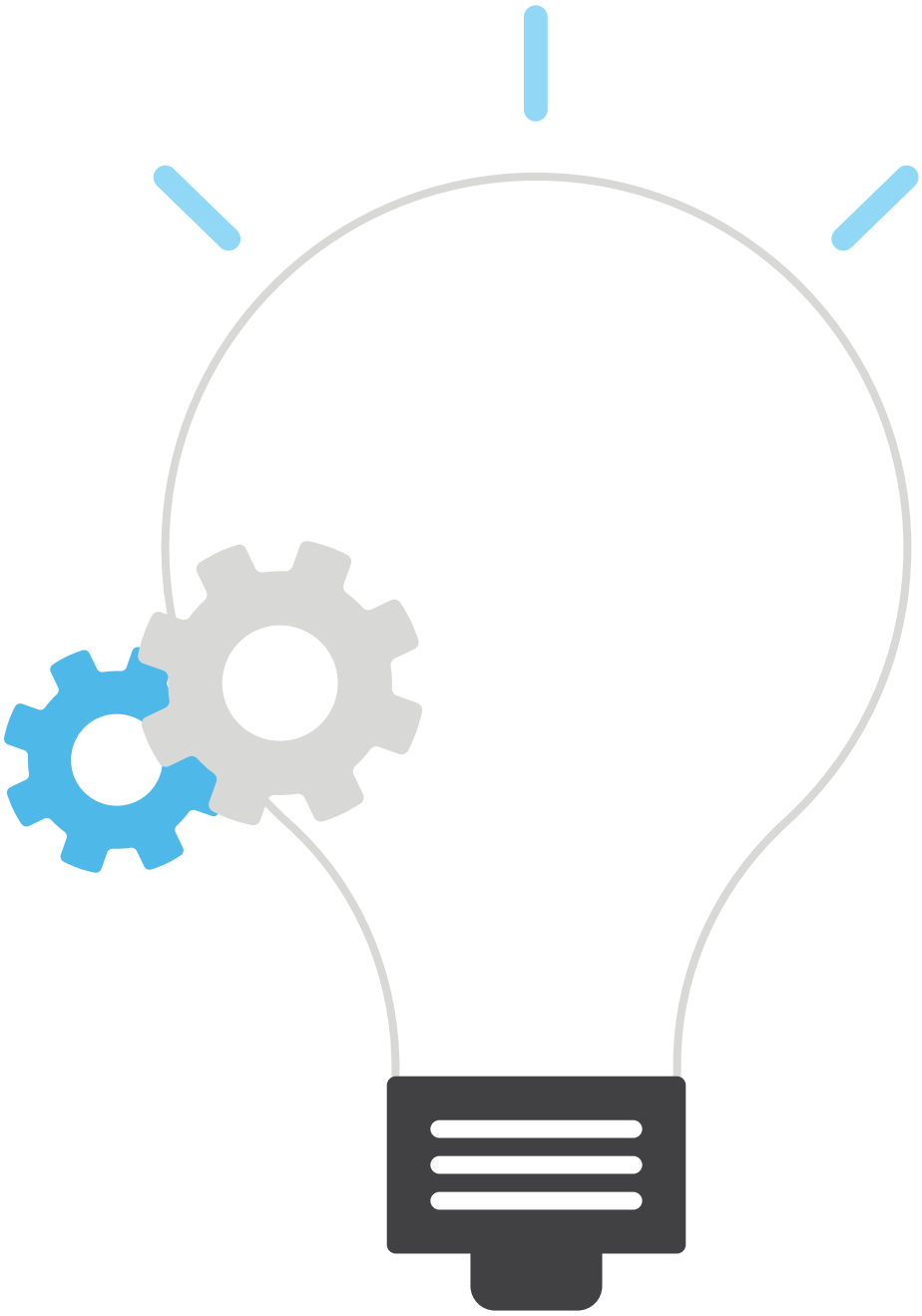

Source: Deloitte; Access Economics (2019); ABS Cat no. 5220.0 - Australian National Accounts: State Accounts, 2018-19.
Note: The mining sector, which has a specialisation ratio of 0.14, is not included in the above chart.

Table 4.1: Specialisation ratio and startup concentration by sector

| Sector | Specialisation ratio | % of startups |
|---|---|---|
| Arts and recreation services | 1.3 | 5.7% |
| **Information media and telecommunications** | **1.3** | **19.1%** |
| Financial and insurance services | 1.2 | 7.3% |
| Manufacturing | 1.2 | 1.2% |
| **Retail trade** | **1.1** | **12.6%** |
| Wholesale trade | 1.1 | - |
| **Professional, scientific and technical services** | **1.1** | **14.5%** |
| Electricity, gas, water and waste services | 1.1 | 3.8% |
| Administrative and support services | 1.1 | - |
| **Health care and social assistance** | **1.1** | **16.9%** |
| Education and training | 1.1 | 5.6% |
| Construction | 1.1 | 5.5% |
| Transport, postal and warehousing | 1.0 | 3.0% |
| Other services | 1.0 | - |
| Rental, hiring and real estate services | 1.0 | - |
| Accommodation and food services | 0.9 | - |
| Public administration and safety | 0.9 | 0.3% |
| Agriculture, forestry and fishing | 0.8 | 4.4% |
| Mining | 0.1 | - |

Source: Deloitte; Access Economics (2019); ABS Cat no. 5220.0 - Australian National Accounts: State Accounts, 2018-19; LaunchVIc (2019).

# 5 Job creation and employment in Victoria's startup ecosystem



## 5.1 Jobs in Victoria's startup ecosystem

The past thirty years have seen a profound restructuring of the Victorian economy. The Melbourne City area has transformed from an industrial city into a knowledge intensive economy. This structural change has impacted the composition and location of employment across the state, particularly in central Melbourne.[28]

Melbourne City is an innovation district in its own right – facilitating the creation and commercialisation of new ideas and supporting the economy by growing jobs in ways that leverage the distinct economic attributes of the city, and its people. These attributes are built on the intrinsic qualities of cities: proximity, density and vibrant culture.

As depicted in Chart 5.1, services industries contribute the most to Victorian employment, with this trend set to continue over the next 20 years.

Innovation, by its very nature, is complex with the probability of success maximised by the conditions created for success – that is, the ecosystem for innovation. As such, there are certain conditions in which an ecosystem can be structured, which maximises job creation within the broader economy.

Startup Genome (2019) suggests that the economic impact of an ecosystem is maximised when there is the perfect habitat for the number of startups to increase, and for their survival rate to grow (Figure 5.1).

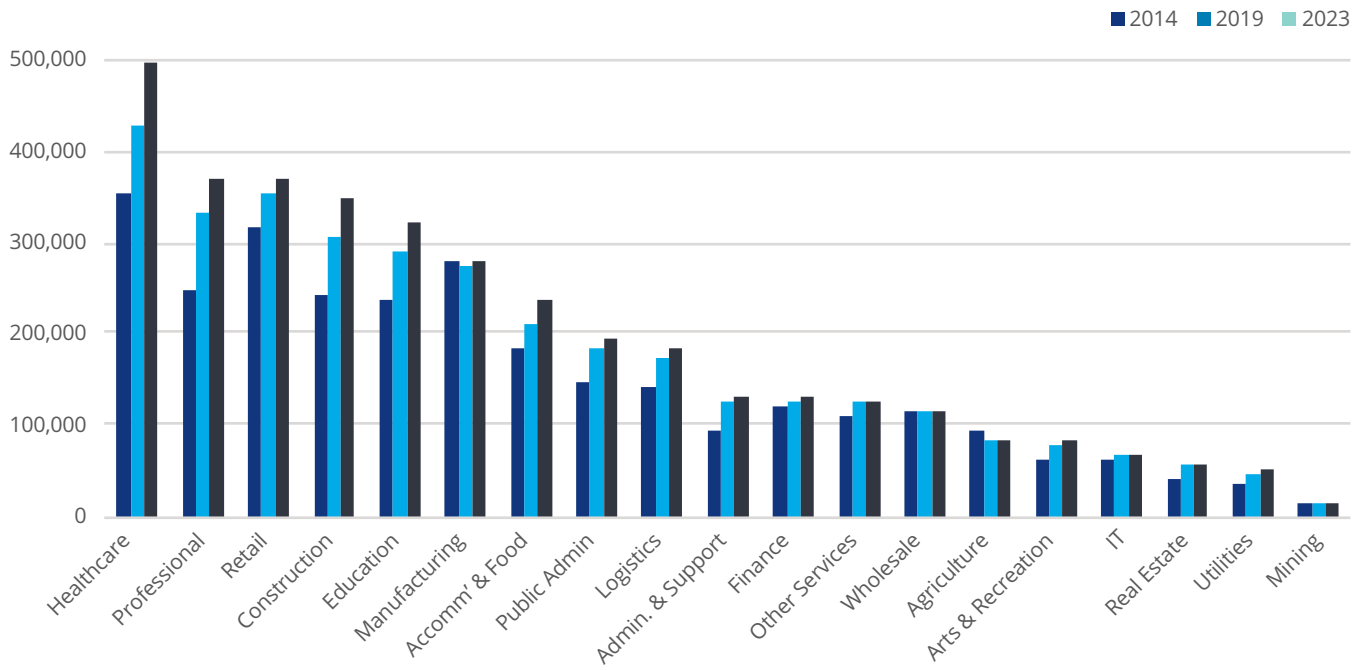
As the number of startups entering the ecosystem increases, so does the number startup jobs. A key measure to test how well an ecosystem is "growing the startup funnel" is its density – or the number of startups per 1 million people (i.e. per 1 million of the population of the geography being measured).

**Currently, the Victorian ecosystem has a startup density of 330 startups per 1 million people, based on the LaunchVic database.** For context, this density sits below Sydney, which has 358 per 1 million (see Section 6.1 for an international comparison).[viii]

As startups commercialise their innovation and scale up their business, they hire more workers, changing the shape of the 'employment funnel'. Almost a fourth of the Victorian startup ecosystem is made up of startups that have successfully scaled up their operations. These scaleups support 40 per cent of the employment within the *ecosystem*.

As the innovation is commercialised, it has the power to improve capital and labour efficiencies in other sectors of the *economy*, creating a sustainable economic impact through productivity gains overtime. This process increases the economic value-add of the *ecosystem* to the broader *economy* (see Box 3 in Figure 5.1).

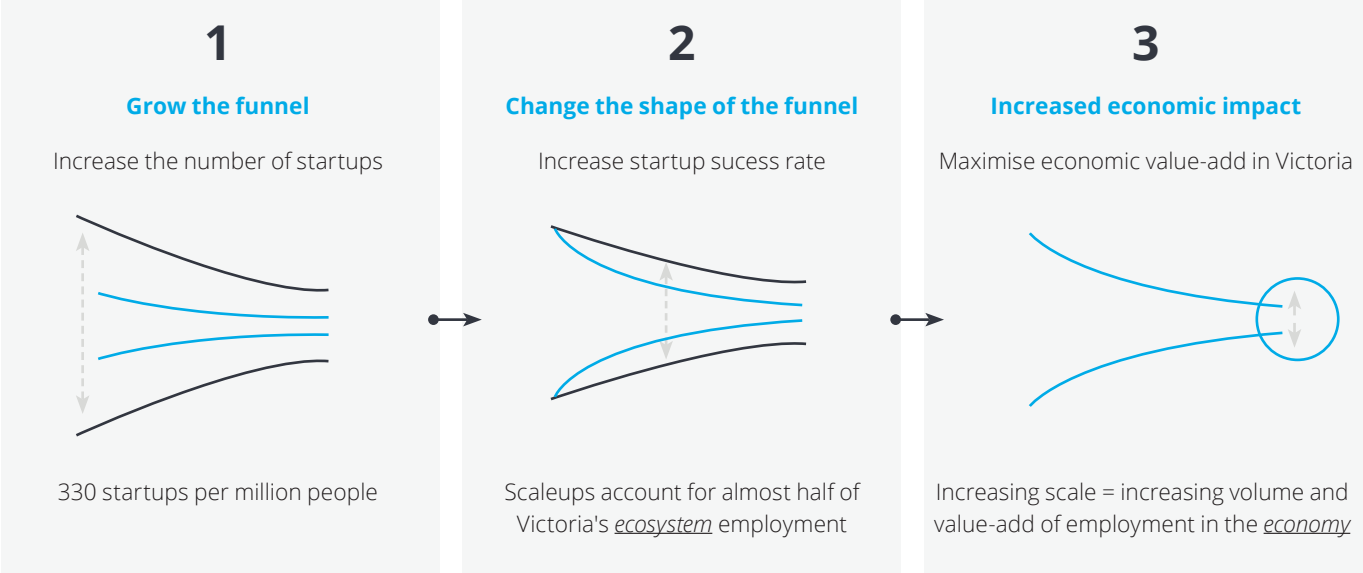
Chart 5.1: Victorian sector employment 2014 ,2019, 2023




Source: Deloitte Access Economics, 2019; Australian Government, Labour Market Information Portal.

viii. It should be noted that the startup density figure for Melbourne (~330) deviates from the startup density presented in Startup Genome (242).

Figure 5.1: Victoria's startup ecosystem employment development model




Source: Deloitte Access Economics using LaunchVic data; adapted from the Startup Genome (2019) Startup Genome's Startup Ecosystem Development Model.

In 2015, the Department of Industry and Science released '*The employment dynamics of Australian entrepreneurship*', a research report that examined employment and productivity growth dynamics in Australian firms. What they found emphasises **the central role of startups[ix] in Australian job creation**, despite employing a relatively smaller fraction of the workforce (approximately 15%).[29]

Consistent with Startup Genome's model explained above, this research report estimated that between 2006 and 2011, 1.04 million full-time equivalent (FTE) jobs were added (net) to the economy – with 1.44 million jobs *created* by firms less than 3 years of age, and 400,000 *lost* by 'older' firms (businesses aged 3+ years).[30]

Most startups (with employee numbers of 0-9 employees) are found to either exit or achieve very little growth (96.8 %) – with a small fraction – the remainder at 3.2% - of startups experiencing high growth over five years post-entry. It is these firms which account for the majority (77%) of total post-entry job creation of all startups. These high growth startups are found in all sectors of the economy, and across varying occupation types and skill sets.

This cements the importance of 'changing the shape of the funnel' in Victoria's startup ecosystem to maximise job creation and the economic value-added – supporting sustainable economic growth and employment generation in the long-term.

**Tech vs non-tech jobs**

A common perception is that the majority of startup jobs require science, technology, engineering and mathematics (STEM) skills. However, the results from the most recent Startup Muster survey challenges this.

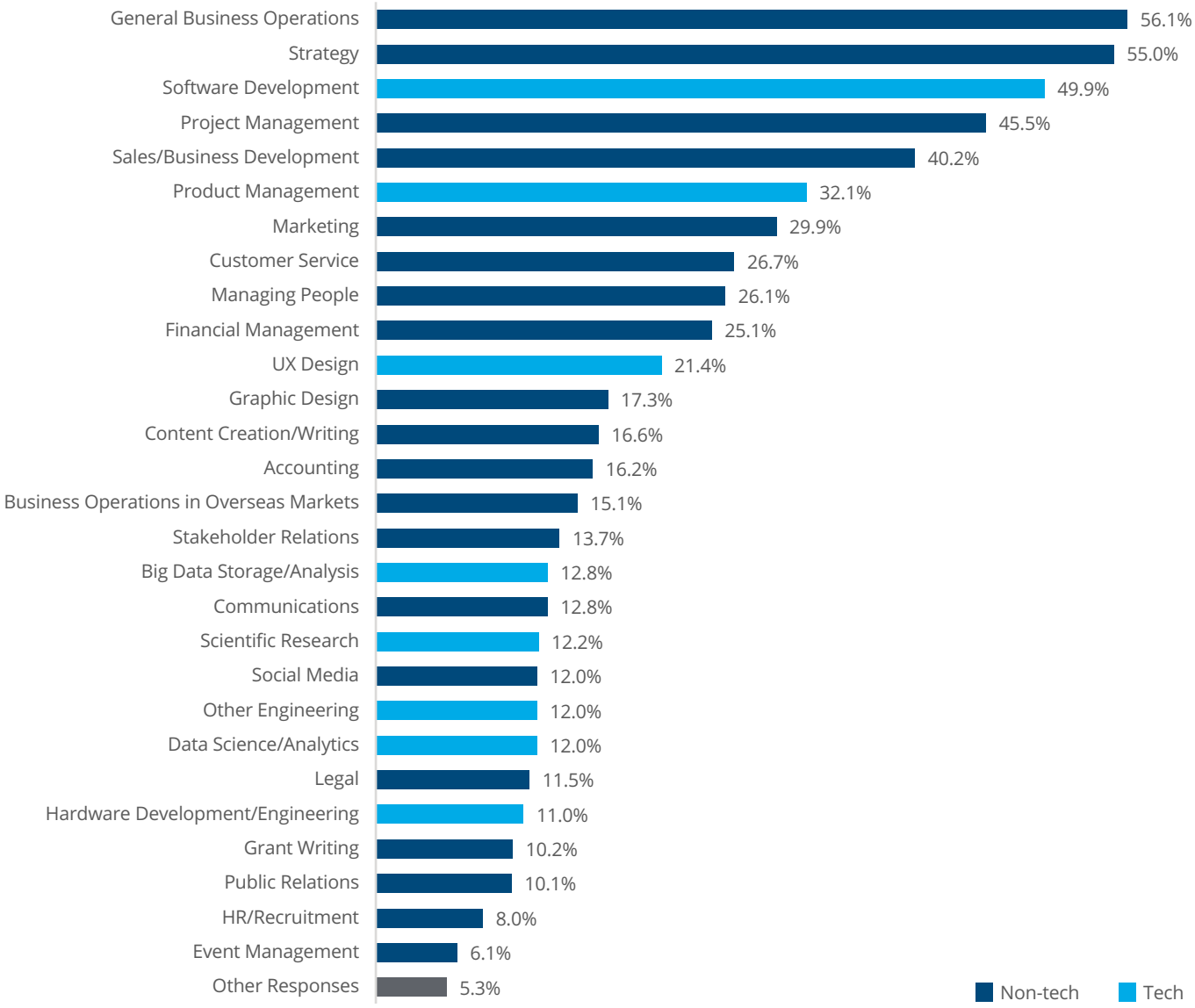
Shown in Chart 5.2, **the majority of skills required within the Australian startups sampled are non-tech** (dark blue in chart) and broadly in line with the skill mix of typical corporations, such as those that general business operations and marketing through to legal knowledge and HR/recruitment.[x]

Highlighting that although a number of roles within startups require technical qualifications, there are also a number of roles within a startups that require highly transferable skills.

ix. Noting the Department of Industry and Science's definition of a startup is broader than the one used within this report.

x. The final statistical sample for the 2018 report consists of 777 verified startup founders, 321 future startup founders and 654 startup supporters.

Chart 5.2: Skills mix within startups




Source: Startup Muster (2018). 2018 Startup Muster Annual Report.

## THE GIG ECONOMY AND SKILLS

Since the GFC, we have seen a significant rise in the amount of independent, contract, temporary and freelance work – or *the gig economy*. This independent workforce has always been there, with some industries taking advantage of it more than others; meeting short-term labour shortages or accessing specialist skills. However, the more traditional *permanent* and *full-time workforce* has always taken precedence. We are seeing this radically shift.

Digital platforms are disrupting the more traditional workforce models, creating large-scale, efficient marketplaces where independent workers connect with buyers of services across all industries and for **both the low-skill and high-skill workforce.**

Firms such as Uber, Task Rabbit and Deliveroo have been some of the key drivers of the recent rise in the gig economy and have driven an **increase in jobs created for *low skilled workers*** by creating a marketplace for low skilled workers to access temporary employment. Take for example: Uber. Here in Australia we are the beneficiaries of this innovation, benefiting from the mass addition of what is typically categorised as low-skill jobs in driving and food delivery. At the same time, Uber corporate offices in Australia are generating higher-skilled employment across a range of skillsets (i.e. software development/ engineering, strategic business development, product management, financial management, data analysis, public relations etc.) – noting **most of the high-skilled employment still sits overseas** at Uber HQ in California, US.

This highlights **the importance of being on the frontier of innovation; not just the purchasers of someone else's innovation.** But Melbourne is making its mark and seeing digital platforms extend beyond the low-skill jobs. Victorian digital recruitment platforms, such as Sidekicker and Weploy, are simplifying short-term staff hiring by providing businesses with an on-demand workforce through its platform where customers request, manage, pay and rate temporary workers.

*Sidekicker*, backed by SEEK, is Australia and New Zealand's largest online staffing platform, using technology to radically improve how businesses hire and manage casual and temporary staff. This scaleup employs 10,000 pre-screened 'Sidekicks', connecting them with hundreds of shifts daily across hospitality, events, business support, warehousing, promotions and healthcare.

Source: Deloitte Access Economics, adapted from: EY (2018), Is the gig economy a fleeting fad, or an enduring legacy; McKinsey & Company (2016), Independent work: Choice, necessity, and the gig economy; Forbes (2019), Is the gig economy more highly skilled than we think?

## 5.2 Spotlight: Victoria's startup sectors and job creation

The Victorian startup ecosystem crosses over a range of sectors, however, **employment within the ecosystem is dominated by five main sectors; Health; Ecommerce; Financial Services, Enterprise and IT/Digital.**

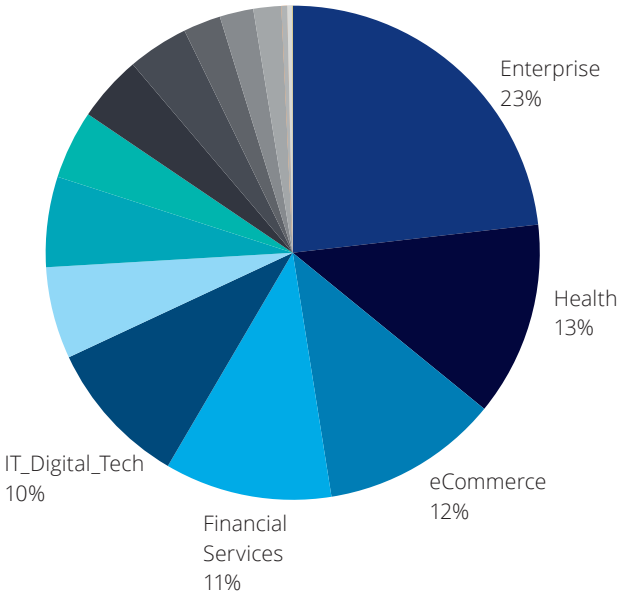
Together, these **sectors account for over two-thirds of the ecosystem's employment** (Chart 5.3).

As these sectors also hold a large proportion of the ecosystem's scaleups, a large proportion of the job generation in these sectors is driven by the scaleups and unicorns (Chart 5.4).

To fully understand the impact Victorian startups have on job generation, we have put the spotlight on three of the sectors that significantly support startup employment: Health, Financial Services and Enterprise Tech, and the unicorns within these sectors.

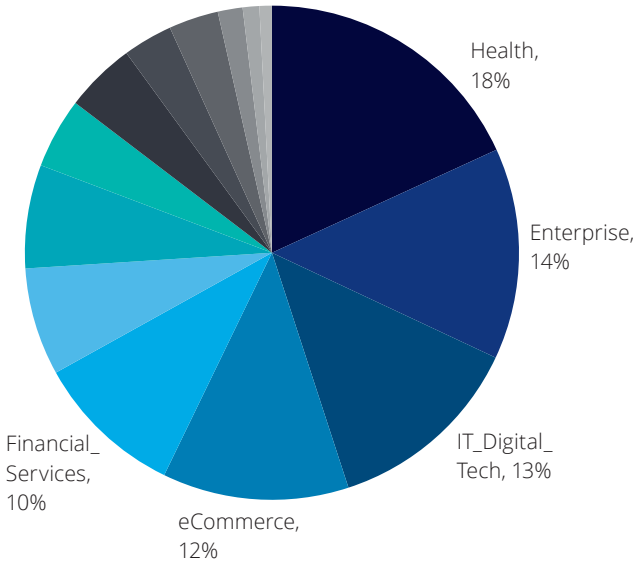
The case studies of unicorns within each sector have uncovered spillover benefits, such as increased labour productivity and angel investing, which helps accelerate new growth in the economy.

Chart 5.3: Division of employment in the Victorian Startup Ecosystem




Source: Deloitte Access Economic; LaunchVic data.
Note: only sectors that have at least 10% of employment have been displayed.

Chart 5.4: Division of scaleups in the Victorian Startup Ecosystem




Source: Deloitte Access Economic; LaunchVic data.
Note: Only sectors that have at least 10% of all scaleups have been displayed.

**Health**

In 2017 LaunchVic commissioned Dandolopartners to research the extent of healthtech activities and opportunities in Victoria, identify and build alignment of key ecosystem players, and identify opportunities to accelerate growth of the health startup community in Victoria.

The report, *State of HealthTech Victoria*, contained a number of recommendations, which led to the announcement of LaunchVic's eighth Grant Round. Through the $4.8 million grant round, LaunchVic funded organisations to deliver accelerator and education programs to further drive Victoria's strengths and help position the State as a leading health startup hub in the Asia-Pacific region.

Today, the **health sector is the largest within Victoria's startup ecosystem and is internationally recognised**, with Startup Genome identifying life sciences as one of Melbourne's key strengths.

The startup health sector is the second biggest employer in the Victorian ecosystem (13%) and is made up of a number of subsectors, such as Biotech, Digital Health, Pharmaceuticals, MedTech, Health Insurance and Wellbeing Tech.

Figure 5.2 provides a breakdown **on the top three job generating firms within these sub-sectors**, as well as the technology, products and services and the key external industry links of the sector. One of these firms is the Unified Healthcare Group, who have over 200 employees across Victoria.

Figure 5.2 also presents the key products and services that are delivered by the sector, using technologies such as Genomics and Lifesciences and Advance Materials.

These emerging technologies and processes are then dispersed throughout the economy through healthcare professionals, other startups and entrepreneurs, health tech specialists, innovation leaders, government stakeholders, regulators and business leaders.

The products and services of health startups are often used within the broader health sector to develop efficiencies and address ongoing health challenges. The innovation within health startups also flows through to external industries such as retail, professional and science and technical services – the spillovers are almost as important as the direct sub-sector impact.

### UNIFIED HEALTHCARE GROUP (UHG) – medEbridge

Unified Healthcare Group established an online platform that connects businesses with healthcare providers for a more streamlined and secure system of procuring health services and information.

After being founded in Melbourne in 1997, the startup now employs over 800 staff members across it's offices.

The startup's medEbridge platform facilitates the procurement of over 210,000 healthcare services in Australia each year from over 50,000 healthcare providers including general practitioners, medical specialists, nurses and allied health professionals.

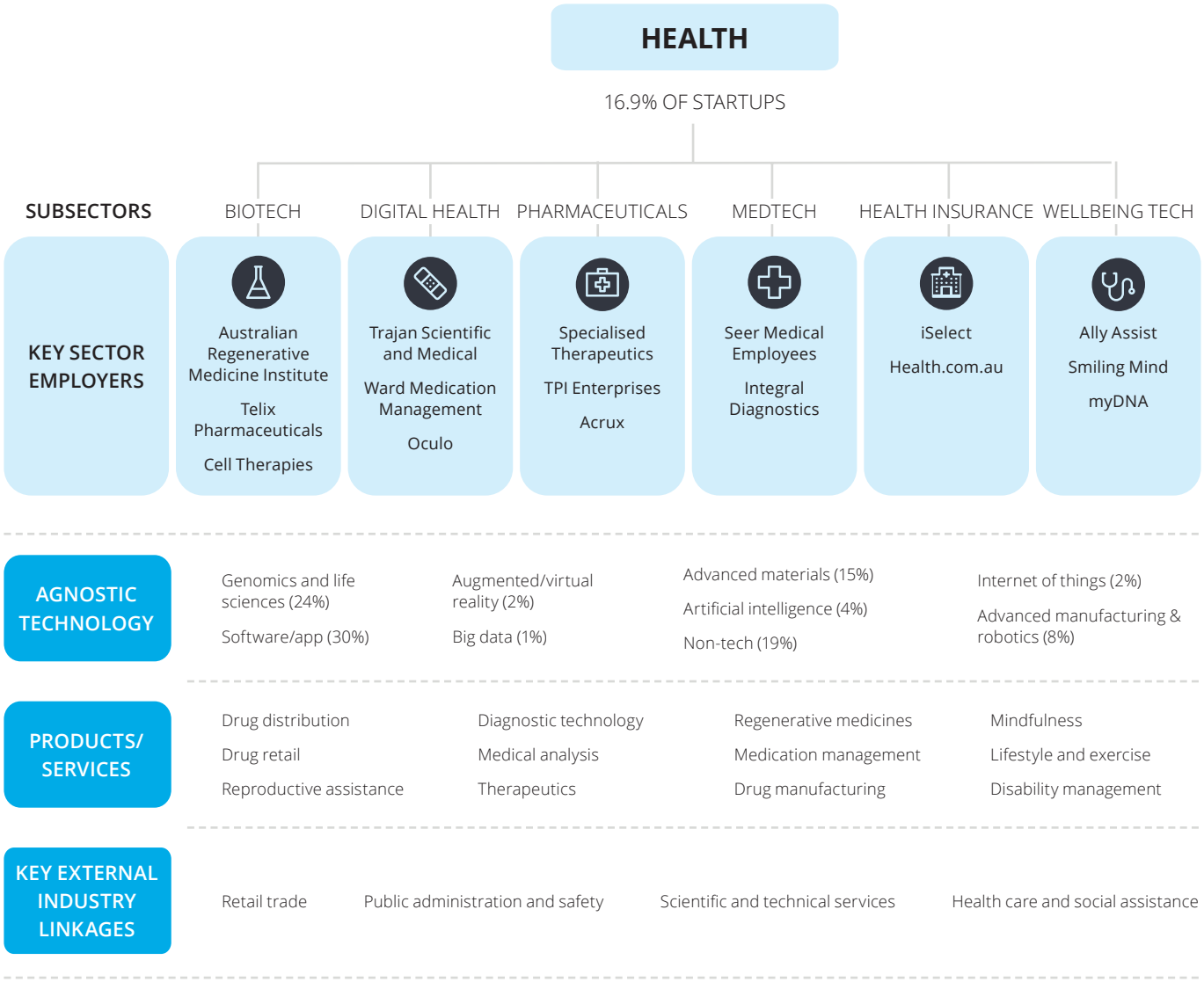
By streamlining the procurement process, the platform has helped healthcare providers achieve better communication with their business customers, reduce the processing time for each customer request, generate higher income and reduce the security risks associated with sharing health information.

The startup also helps over 9,500 business users including law firms, employers, insurance companies and government agencies to procure healthcare services through a faster, more flexible and highly secure process. This helps businesses reduce security risks, improve their operational efficiency, reduce costs and provide more time effective services to their own customers.

In early 2019, MedHealth, an Australian provider of healthcare and employment services, acquired UHG. The joining of forces has allowed for both companies to deliver even greater value for customers.

Source: UHG Website (2019); LaunchVic database (2019)

Figure 5.2: Snapshot of the Victoria Health startup sector



**Enterprise Tech**

Enterprise tech represents 14.5% of all startups and scaleups in Victoria and 22% of all startup employment. This sector is home to HR Tech, Legal Tech, Accounting Tech and Sales & Marketing Tech, all of which provide efficiencies to general business operations across all sectors of the economy.

Unicorns like Seek in HR tech have completely revolutionised how businesses recruit new staff. Seek, which was listed on the Australian Securities Exchange (ASX) in 2005, has a significant market reach, allowing the most suitable employee to be recruited out of a large pool of applicants, not only in Victoria but also nationally and internationally. This leads to a more efficient allocation of labour. Another example of a Victorian unicorn that has positively disrupted how businesses manage HR is Culture Amp, which provides services to over 2,500 businesses.

MYOB Group Limited is another successful unicorn, acquired by Kohlberg Kravis Roberts in May 2019, operating within the accounting tech sub-sector. MYOB provides significant direct employment to the Victorian economy and well as efficiencies in how businesses undertake their tax and accounting obligations.

The enterprise sector adopts a vast array of technologies to offer their products and services to their customers. The most common being software/app. This technology allows startups to alter traditional processes to pass on innovation in a way that provides tailored efficiencies to businesses. The Victorian enterprise sector offers recruitment services, performance monitoring, shared online services, cybersecurity and software as a service (SaaS).

The services of the enterprise startup sector are wide-reaching and extends to all sectors of the economy. This sector has key external industry linkages with financial and insurance services, retail, healthcare and media and IT services sectors. The productivity gains from enterprise tech innovation is also felt within the broader professional services sector.

## CULTURE AMP

Culture Amp, a leading People & Culture Platform that helps companies take action to improve employee engagement, retention and performance, is one of Australia's fastest growing technology startups with offices in Melbourne, San Francisco, New York and London.

From humble beginnings in a Melbourne co-working space in 2009, Culture Amp is now one of Victoria's latest tech startups to reach "unicorn" status with a valuation of over $1 billon.

Headquartered in Richmond, Melbourne, Culture Amp employs over 200 Victorians. Almost two-thirds of these employees are within the product team, which is made up of employees with technical skills in engineering, product management, design and data/people science. This team works to further develop Culture Amp's platform and implement the product strategy.

The remainder of Culture Amp's Victorian workforce is made up of customer/sales teams, marketing, finance, human resources, legal and administration, all supporting operations and the promotion of the Culture Amp brand globally.

In their 10 years of operation, Culture Amp has distributed over 31,000 surveys and currently helps more than 2,650 organisations increase the engagement and performance of their workforce.

Through their employee feedback and analytics platform, they offer solutions to: reduce employee turnover, guide employees through mergers and acquisitions, support employees through major changes in technology, workforce or business models, guide a company's culture through rapid growth, and build a diverse and inclusive workplace.

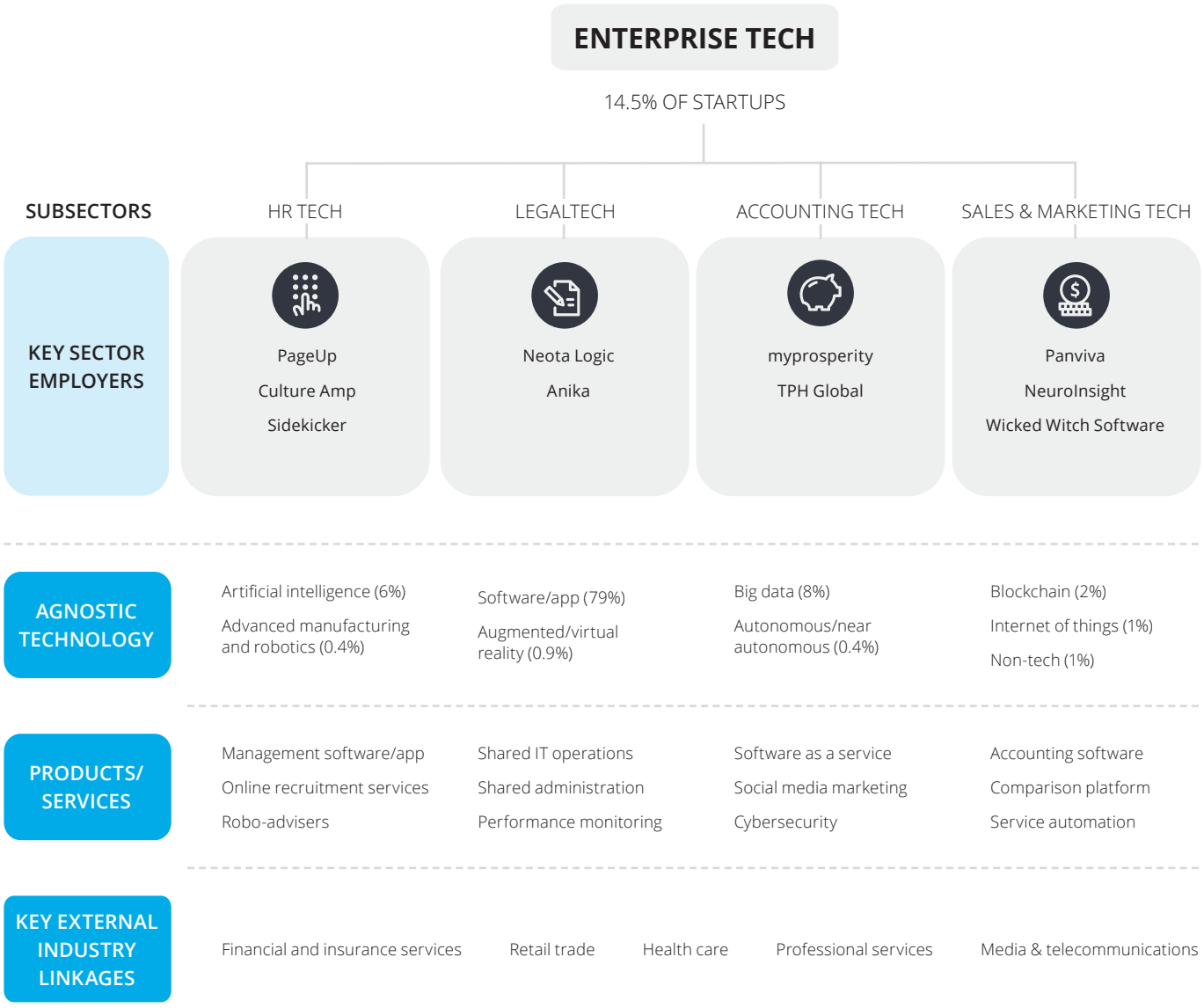
These solutions offer significant spillover benefits to their thousands of customers. Having insights into employee engagement can help an employer motivate their employees and unlock their potential, leading to significant productivity benefits.

Further, employee turnover comes at a high cost for employers, with recent research estimating that replacing an employee who hasn't retired costs between 16% and 213% of their salary. Helping companies identify those at risk of leaving and provide the likely reasons why, based on data collected globally and across industries, can help them implement strategies to reduce employee turnover.

One of Culture Amp's customers, Autotrader, an online marketplace for car purchasers and sellers, has said that Culture Amp's platform has been critical in helping them reduce their employee turnover by nearly 50%.

Source Culture Amp (2019); Boushey, H., & Glynn, S. J. (2012). There are significant business costs to replacing employees. Center for American Progress, 16.

Figure 5.3: Snapshot of the Victoria Enterprise startup sector



**Financial services**

Startups within the financial services sector represent 7.3% of the Victorian startup ecosystem and supports 11% of all startup employment. The sector is dominated the Fintech sub-sector, which offers key service/products such as: Peer-to-peer lending, unsecured finance, Robo-advice, Cryptocurrency Digital wallets, and Stock-Trading and Budgeting Apps to name a few.

Despite only having 7.3% of total startups (including scaleups), the sector holds a large proportion of total scaleups (10%). This includes job generating unicorns, such as AirWallex and Afterpay.

AirWallex enables customers to create international bank accounts instantly, access interbank exchange rates and send money through local and international clearing networks to more than 130 countries. This increases the ability of businesses to access the inputs they want and reduce costs. As such, the benefits of the AirWallex innovation flows through all sectors of the Victorian economy.

The financial services startup sector also includes Regtech, which uses IT to enhance regulatory processes for businesses. The superannuation portion on the sector mainly offers services which assist individuals in preparing for their retirement. Platforms such as Mclowd have deconstructed old business models to provide a marketplace for trustees and professionals to better manage self-managed super funds (SMSF) at low costs and deliver greater efficiency across society.

The financial services sector is powered by five of the 12 agnostic technologies that have been adopted throughout the Victorian startup ecosystem, with 80% of startups offering a product or service through software or an app.

With this technology, the sector is providing new ways to enhance the customer experience, make service delivery more cost-effective, or improve the efficiency of back-office functions. These core business solutions are rapidly reinventing the value chain and impacting sectors across the economy, particularly professional services and retail, as well as the financial sector more broadly.

### MOULA

Since launching in 2013, Moula has transformed into one of Australia's fastest growing non-bank business lenders.

Moula uses its in-house-built lending platform to provide small businesses with an alternative to the traditional way of acquiring loans. Moula's key point of difference to traditional lending is their focus on the performance of the business and the owner as a person, rather than the value of the owner's personal assets. Moula refers to this as their heads and hearts approach to identifying good business.

Moula uses their proprietary lending platform – the head, also known as Hector – to assess risk and make data-driven lending decisions based on a business' banking and accounting data. Their in-house-built platform utilises both machine learning and artificial intelligence technology to rapidly analyse a business' data, making the application process fast and simple. Alongside Moula's sophisticated algorithms sits a team of compassionate people – the heart, called Jess – which listen to each business' unique needs and their aspirations of growth.

The combination of Hector and Jess has proven to be a recipe for success as Moula has experienced strong growth over the past five years, processing over 20,000 business loan applications and growing its loan book by 124% in 2019.

To support this growth Moula has also been growing its team, which now has around 80 employees, with 95% based in Melbourne. Of these employees, around 40% sit within sales, marketing and credit decisioning with the rest split evenly between their product and technology teams as well as business operations.

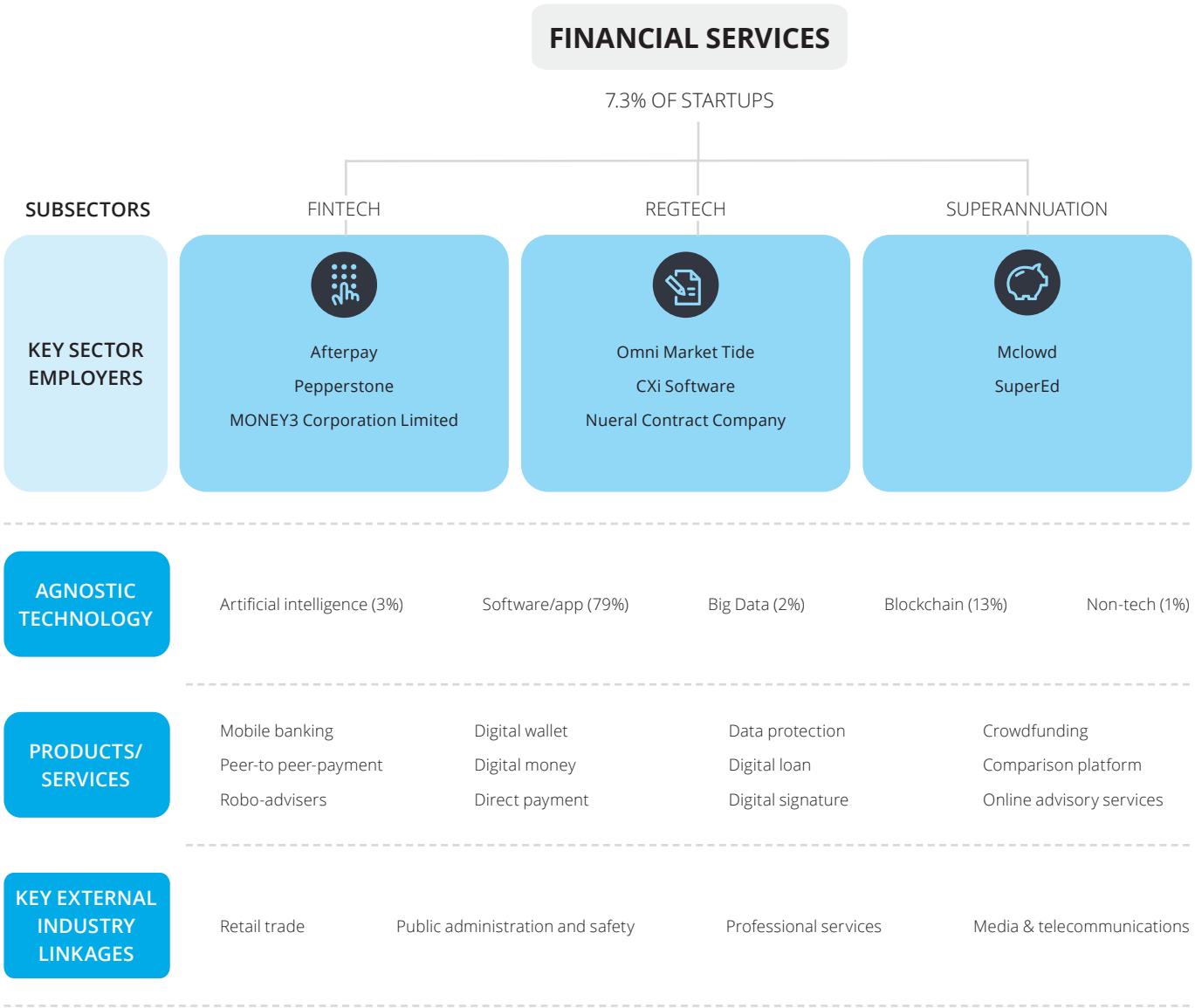
The product and technology teams are largely comprised of technical roles such as software engineers, product specialists and data analysts. Whereas, their business operations team has the roles of traditional business structures, such as administration, finance, credit risk and people/talent.

As one of the most innovative lending platforms in Australia, Moula plays an important role in financing the growth of small and emerging businesses. Moula's balanced approach to risk means that they offer loans to good businesses across all sectors of the economy, which flows through into significant contributions to employment, productivity and innovation outcomes for those businesses.

Having just secured a further $20 million funding to fuel its next phase of growth, Moula is scaling up its business lending capability and providing further investment into people, marketing, technology and product.

Source Moula (2019); AFR (2019), Stellar growth helps Moula close $20 million capital raising, December 2019.

Figure 5.4: Snapshot of the Victoria Financial Services startup sector



### 5.3 Role of LaunchVic in going for growth

Since inception in 2016, LaunchVic has been pivotal in the significant expansion of the Victorian startup ecosystem, supporting the growth and development of early-stage startups and scaleups through programs, events and research.

In 2019, LaunchVic prepared *the Impact Report*, showing that over the last four years **LaunchVic has supported over 320 individual startups to scale and over 4,800 entrepreneurs to upskill.**

To date, LaunchVic has invested over $46 million across 110 programs, providing support through:

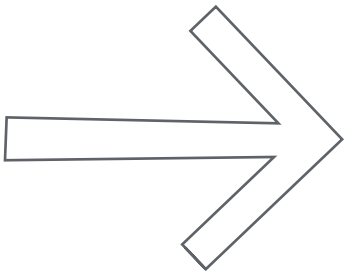
- Support programs that build startup and investor capability and connectedness
- Undertake research to better understand the Victorian startup ecosystem
- Support and run events that connect the ecosystem
- Communicate, promote and advocate on behalf of the sector.

Supporting regional entrepreneurship, LaunchVic has also developed a *Startup Guide and Toolkit* for Local Government, which has helped local governments support and develop their local startup communities. In its first term, LaunchVic supported 15 projects across 26 local government areas in Victoria to foster startup and entrepreneurial activity in local regions, including meetups and events.

This startup activity that LaunchVic supports is foundational to Victoria's startup ecosystem, and the contribution the ecosystem can make overtime to Victoria's economy. LaunchVic is providing a key faciliatory role as funder and a connector to the key factors that define the ecosystem, which supports Victoria's startup ecosystem to grow – and the spillover benefits that come with this.

Figure 5.5 LaunchVic funding rounds

| | | | |
|---|---|---|---|
| **1 Scale, Reach and Impact** | **2 Scale, accessibility and diversity** | **3 Increase Participation** | **4 Accelerator Program** |
| **$6.5m** grants supporting 18 projects. | **$1.9m** funding to large and small initiatives across a number of industries. | **$1.4m** funding to increase migrants and refugees participation in the ecosystem. | **$7m** funding to Australian accelerator programs. |
| **5 Founder Education** | **6 Supporting Local Councils** | **7 Programs for Aboriginal Victorians** | **8 Health Startup Sector** |
| **$2.9m** funding for 16 service providers to run education programs to upskill founders. | **$2.4m** funding to boost access and participation in regional and outer-metro Melbourne. | **$1.4m** funding to strengthen entrepreneurial and startup activity. | **$4.8m** funding to accelerate growth of the health and life sciences sector. |
| **9 Expert-in-Residences for Coworking Spaces** | **10 Supporting Further Growth** | | |
| **$0.5m** funding 15 experts in residence across 14 coworking spaces. | 12 programs received grants connecting startups from a range of disciplines. | | |



Source: LaunchVic Impact Report (2019)

Figure 5.6 Role of LaunchVic in going for growth

## EVENTS AND MEETUPS

LaunchVic has organised:

- 84 meetups
- 55 events
- Ran the 'Yeah Nah Summit' to showcase Victoria's best founders
- Held the 'Thrive Conference' to build a community of best practice for startup leaders in outer metro and regional areas.

**25,350**
people connected through events and meetups

## BOOTCAMPS AND HACKATHONS

**1,150**
entrepreneurs supported across 9 Bootcamps and 25 Hackathons.

## EMPOWERING FOUNDERS

LaunchVic has invested in 23 founder education programs that have improved founder capability. The subject areas included:

- How to access capital
- Marketing
- Leadership and personal development
- Export and growth skills
- Corporate governance.

LaunchVic has supported 15 experts in residence across 14 coworking spaces in Melbourne and Regional Victoria.

**3,700**
entrepreneurs upskilled through founder education, pre-accelerators and mentorships

## ACCELERATORS

The number of Accelerators has increased ten times since LaunchVic was first established.

**18**
Accelerators are supporting 196 startups in Victoria.

**$21.8m**
LaunchVic grants to Accelerators.

**84%**
of startups participating in a LaunchVic supported Accelerator reported that the program contributed to their revenue growth.

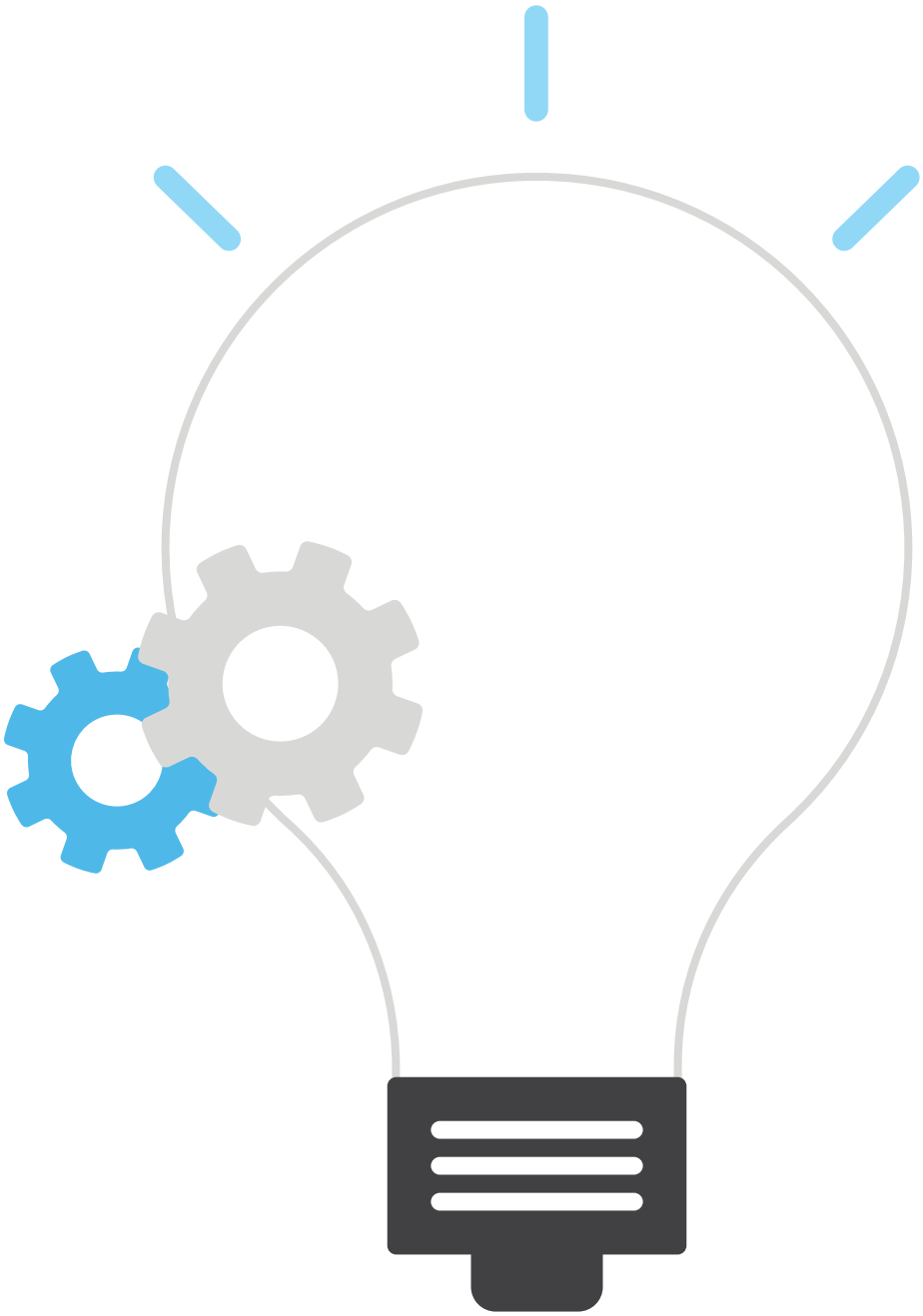
**94%**
of startups participating in a LaunchVic supported Accelerator reported that the program increased their customer acquisition.

Source: LaunchVic Impact Report (2019) using data from Startup Genome (2019) and Dandolo Partners

# Part III

## THE FUTURE OF VICTORIA'S STARTUP ECOSYSTEM + THE ECONOMY

# 6 The economic impact of Victoria's startup ecosystem



### 6.1 Going for growth

Deloitte Access Economics modelled the potential economic impact of the Victorian startup industry over 20 years (to 2038) under two analytical scenarios. Each scenario explores distinct, but plausible, future growth paths of the startup industry in Victoria – and the impact these paths have on Gross State Product and employment.

Further detail on the modelling methodology, including the carving out of the startup industry and model specification, is presented in Appendix B.

The analytical scenarios were developed collaboratively with LaunchVic, drawing on experiences in other startup ecosystems globally and findings from literature. The scenarios include:

- **Business as usual scenario** – no growth in the startup density in Melbourne (i.e. startup density remains at 330 startups per million people) and Victoria follows a business as usual forecast trajectory, based on Deloitte Access Economics estimates, to 2038.
- **Scenario 1** – moderate growth in the startup density in Melbourne, where startup density grows from 330 startups per million people to 500, by 2038.
- **Scenario 2** – high growth in the startup density in Melbourne, where startup density grows from 330 startups per million people to 750, by 2038.

A conceptual summary of the scenarios, including the business as usual scenario, is presented in Figure 6.1, below.

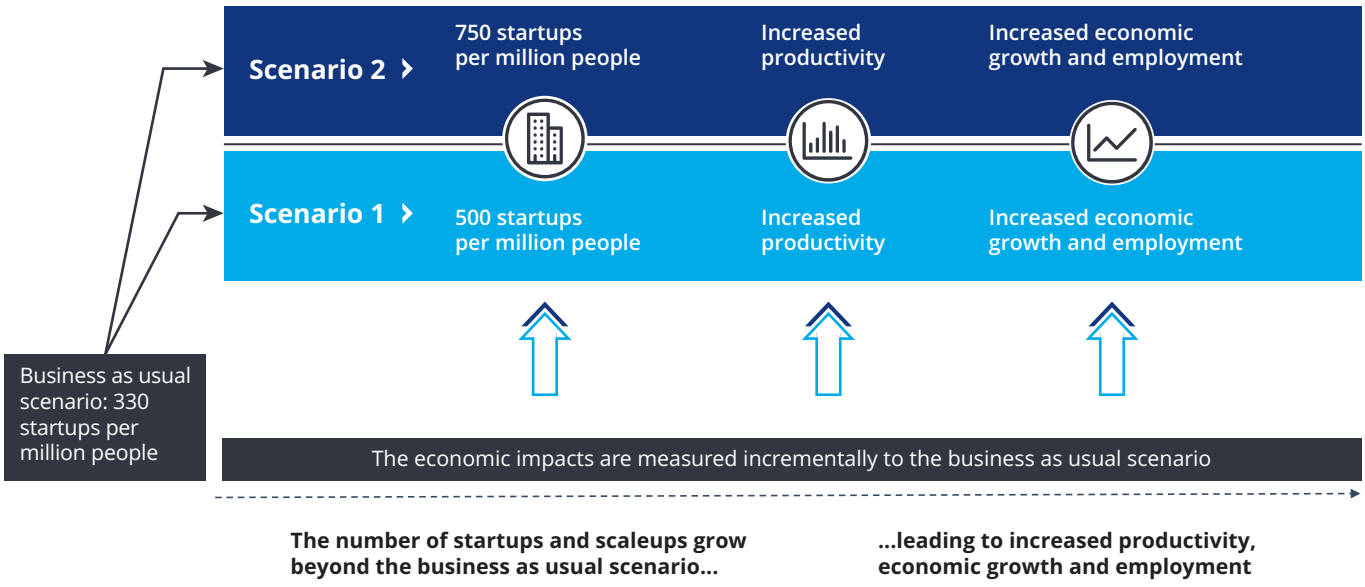
### 6.2 Business as usual scenario

The business as usual scenario details how the startup industry, and broader Victorian economy will grow over the next 20 years in the absence of any intervention. This is not intended to be a forecast scenario; rather, this serves to provide a baseline from which impacts are measured incrementally.

While the startup industry in Victoria has experienced relatively strong growth over the decade, in specifying the potential future growth of the startup industry *in the absence of any further intervention*, it is assumed that the industry will simply grow in line with long term population growth rates, implying a constant startup density over time.

The projected economic growth rates imposed in the model for real gross state product, labour supply and population are similarly based on a combination of data sources including Deloitte Access Economics Business Outlook forecasts, IMF forecasts and other underlying trend growth rates. Other macroeconomic variables (for instance, employment, exports, etc.) are determined by the model.

Figure 6.1 Conceptual overview of the scenarios




Source: Deloitte Access Economics

## 6.3 Analytical scenarios

As described in the business as usual scenario, the startup industry[xi] is expected to experience some level of growth, even in the absence of any intervention. However, this is merely a continuation of the current trend, and Victoria can – and should – do even better than this.

The scenarios outlined in this chapter are based on hypothetical "what if" questions to explore:

- How much could the startup industry grow above and beyond the business as usual scenario – and what are some potential "triggers" to enable this?
- Given this growth, how could this impact productivity, employment and the broader Victorian economy?

### Overview of the scenarios

Bringing this information together, Table 6.1 provides a summary of the key assumptions underpinning the economic modelling scenarios:

- **Scenario 1** – moderate growth explores the impact of 'moderate growth' in the number of startups on productivity and the flow on effects to the broader Victorian economy including the impacts on industries, who are end users of new innovation.
- **Scenario 2** – high growth estimates how these potential economic impacts could change by achieving a *higher startup density sooner*, whereby the economic impacts are realised over a shorter timeframe and at a greater magnitude.

Table 6.1 Summary of key assumptions underpinning the economic modelling scenarios, incremental to the business as usual scenario

| Scenario | Summary of key assumptions |
|---|---|
| **Scenario 1 – moderate growth in density** | ***Growth in startups***<br>• The startup density in Melbourne grows from 330 startups per million people to reach a density of 500 by 2038. This change results in an additional 1,200 startups by 2038 (incrementally to the business as usual scenario) and a higher scaleup success rate of up to 0.5% (compared to 0.33% in the business as usual scenario).<br><br>***Impact on productivity***<br>• There is an increase in the level of TFP[xii] for new startups of up to 1.7 ppts annually by 2027 associated with collaboration. There are also some spillover benefits to other industries through the commercial applications of the innovation. |
| **Scenario 2 – high growth in density** | ***Growth in startups***<br>• The startup density in Melbourne grows from 330 startups per million people to reach a density of 750 by 2038. This change results in an additional 3,000 startups by 2038 (incrementally to the business as usual scenario) and a higher scaleup success rate of up to 0.75% (compared to 0.33% in the business as usual scenario).<br><br>***Impact on productivity***<br>• There is similarly an increase in the level of TFP for new startups of up to 1.7 ppts annually, but this occurs earlier by 2022. Again, there are also some spillover benefits to other industries through the commercial applications of the innovation. |

xi. In interpreting the results, it should be noted that the startup industry is carved out from existing industries in the Victorian economy.

xii. In the modelling it is assumed that all factors of production in the industry on average becomes more productive (rather than a specific factor of production) and results in a reduction in industry costs to proxy the effect of learning by doing, collaboration and spillovers.

**How could the startup industry grow?**

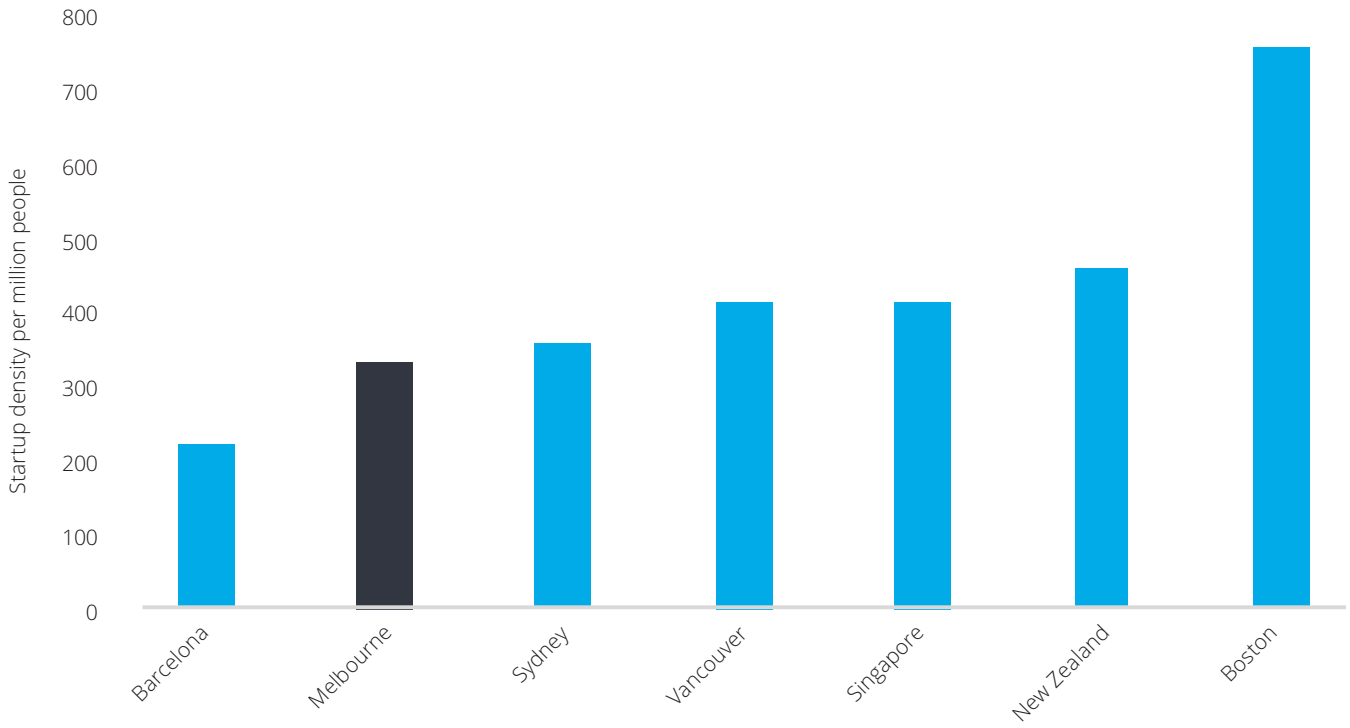
Growing the startup industry involves increasing the number of startups, as well as the rate at which startups can scale up and produce greater output, employment and ultimately economic growth.

Startup density is a measure of the size of the startup industry and is defined as the number of startups divided by the population. Although the Victorian ecosystem has experienced strong growth, the startup density is still relatively low compared to other national and international jurisdictions, with approximately 330 startups per million people in 2019[xiii] (see Chart 6.1).

The economic modelling considers two potential growth paths, where the startup density grows above and beyond the business as usual scenario[xiv] to reach different targets in line with other jurisdictions over time:

- **Scenario 1 – moderate growth:** the startup density grows linearly to reach 500 startups per million people by 2038 (relative to 330 startups per million people in the business as usual scenario). This would see Melbourne's density exceed the current densities associated with other peers including Sydney, Vancouver, Singapore and New Zealand
- **Scenario 2 – high growth:** the startup density grows linearly to reach 750 startups per million people by 2038 (relative to 330 startups per million people in the business as usual scenario). This would bring Melbourne's density in line with Boston's current density and would 'likely place Melbourne in the top 20 ecosystems globally, positioning it as a leading centre of startup activity in the Asia Pacific.'[31]

Chart 6.1 Startup density by jurisdiction, 2019




Source: Startup Genome (2019); Deloitte Access Economics calculations
Note: The Melbourne density estimate has been updated based on the number of startups identified in the LaunchVic database

xiii. It should be noted that the startup density figure for Melbourne (~330) deviates from the startup density presented in Startup Genome (242). The 330 figure is based on the number of startups (~1,670) from the LaunchVic database divided by the estimated population in Greater Melbourne (~5.1 million) from the Victoria in Future 2019 population projections.

xiv. It is assumed in the business as usual scenario that the startup density remains constant at 330 startups per million people to 2038. In other words, the number of startups in the business as usual scenario grows in line with population.

It is worth noting that, while this represents strong growth, the target densities are still comparatively lower than other larger and established ecosystems such as Seattle, Toronto, Stockholm and Amsterdam, which have been estimated to range from approximately 1,200 to 1,400 startups per million people.[32] These provide longer term growth aspirations for Victoria.

It is also acknowledged that this increase in density does not occur overnight. Rather, these are targets that Victoria needs to work towards over time. For example, other key ecosystems, such as Singapore, have taken around 20 years to grow to where they are now.[33] By contrast, Victoria is still in its earlier stages, with the establishment of LaunchVic in 2016. It is therefore assumed that it will take Victoria a similar timeframe of around 20 years to reach the targets specified above. Given the uncertainty around this assumption, the modelling takes a scenario-based approach to explore how the impacts would differ over these different timescales.

In addition, increasing the rate at which startups are successful in scaling up is vital to effectively developing the ecosystem and maximising productivity and employment. This dynamic is incorporated into the economic modelling and is tied to the startup density, where higher levels of density lead to higher success rates. In particular, the assumptions are based on Startup Genome's Ecosystem Development Model[34], where an ecosystem with a startup density of 1,000 achieves a scaleup rate of 1%.

To derive indicative success rates for Melbourne, these are scaled based on the startup densities:

- In the business as usual scenario, the scaleup success rate is assumed to be 0.33% (based on a startup density of 330 per million people)[xv]
- Scenario 1 – moderate growth, where the startup density reaches 500 by 2038, the scaleup success rate is assumed to reach 0.5%
- Scenario 2 – rapid growth, where the startup density reaches 750 by 2038, the scaleup success rate is assumed to reach 0.75%.

The increase in the number startups and scaleups results in a higher output associated with the startup industry. To estimate the corresponding incremental increase in output associated with this increase, the average revenue from the LaunchVic database for startups and scaleups were used. In particular:

- Scenario 1 – moderate growth leads to an incremental increase in output associated with the growth of startups and scaleups of around $3.3 billion by 2038 (driven by an increase of around 1,200 startups and scaleups by 2038)
- Scenario 2 – high growth leads to an incremental increase in output associated with the growth of startups and scaleups of around $8.1 billion by 2038 (driven by an increase of around 3,000 startups and scaleups by 2038).

This increase output is assumed to be largely driven through increased exports, reflecting the ambition and importance of startups tapping into global markets.

### The potential "triggers"

Clearly, this growth in startup density and scaleup success rates do not just happen by chance. Rather, they are the product of formulated actions to develop the startup ecosystem. This box describes some potential "triggers" that could help in achieving this:

- Increase the ambition of founders and encourage them to target larger markets. Melbourne is currently below the average compared to peer ecosystems.
- Encourage global market reach from early stages of development. Melbourne is currently below the Asia Pacific average in terms of the proportion of foreign customers.
- Develop and build on local competitive advantages. Key strengths in Melbourne have been identified as adtech, biotech and life sciences, and healthtech.
- Address gaps in startup access to financing to allow and enable more scaleups. For example, Melbourne performs below its peers for early stage funding per startup.
- Increase the skills in the economy, including university graduates and those in their early careers. It is identified that Victorian startups are currently facing challenges in finding appropriate employees (including non-technical roles such as business development and marketing).

Source: Startup Genome, 2018[35] Note: It is also noted that the interventions required to achieve higher density and a greater amount of scaleups are not cost free (i.e. there would likely be some costs associated for government). However, given the conceptual nature of the modelling, these costs are not explicitly captured.

xv. The scaleup success rate dictates the rate at which the cohort of startups progress to scaleups each year. The scaleup success rate is a function of density and changes over time to reflect the change in density under each scenario.

**How could this impact the economy?**

Startups play an important role in the economy, as detailed in Chapter 2. In particular, the startup ecosystem drives productivity not only at the firm level (i.e. for the startup industry), but also at the industry level (i.e. end users of the innovation). Ultimately, this has an impact at the economy-wide level, including on economic growth and employment.

A number of authors have found associations between high growth firms (akin to scaleups) and productivity.[36,37] In addition, local spillovers from clustering increases productivity among the ecosystem.[38]

An Australian study considering a panel of approximately 7,000 small to medium sized enterprises (SMEs), a proxy for startups and scaleups,[xvi] found evidence of productivity benefits for innovating firms compared to non-innovating firms over a 5 year period.[39] In particular:

- Firms that introduced new innovation experienced an annual total factor productivity (TFP) increase of 2.7 percentage points (ppts) compared to non-innovating firms
- Firms that accompanied this innovation with Australian-based collaboration saw a TFP increase of 4.4 ppts annually.

These findings are used to inform the assumptions around how startups experience productivity through increased density and clustering (in addition to the increased output discussed previously), as well as the productivity benefits to the end users of the innovation. These are explained in turn.

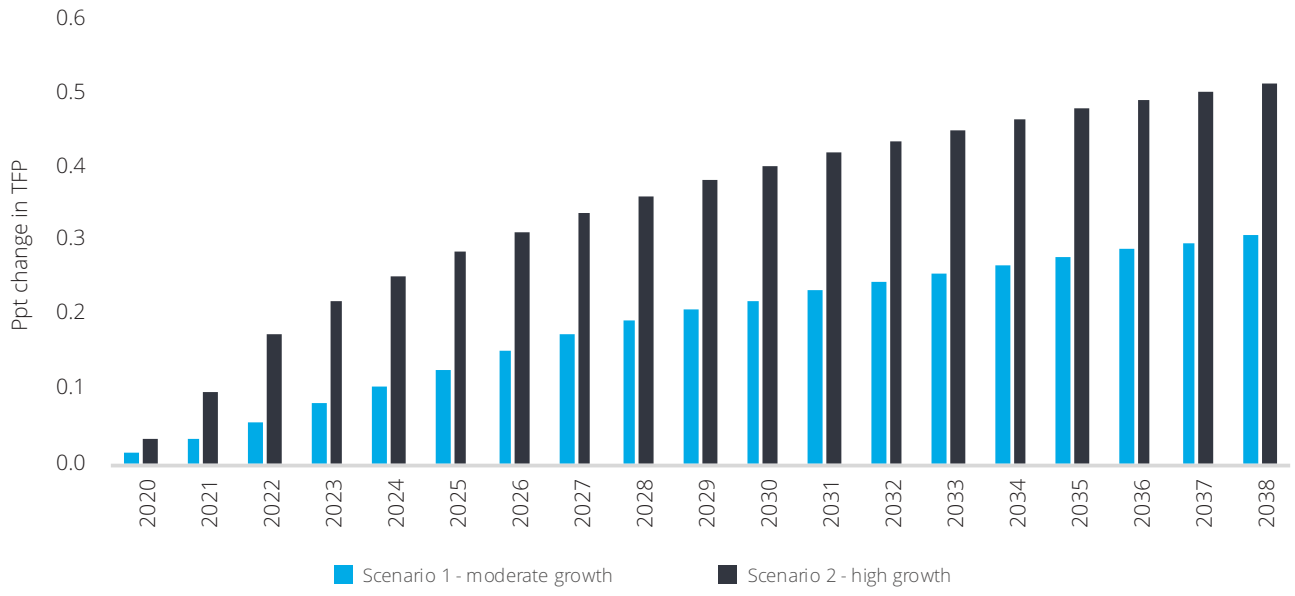
### Productivity impact

The following section describes the approach to applying the productivity impact to Scenario 1, with the same approach applied to Scenario 2.

The **productivity accruing to the startup industry is best represented by the collaboration dividend** (the benefits associated with collaborative arrangements with external parties) which is assumed to be 1.7 ppts annually (i.e. difference between the 4.4 ppt and 2.7 ppt increase). This reflects the fact that these firms have an increased opportunity to collaborate due to their proximity and networks. These *productivity benefits ramp up over time* to reach 1.7 ppts annually by 2027, or when Melbourne reaches a density, or "critical mass", like that in Singapore (i.e. around 410 startups per million people).

The productivity is then assumed to remain at this level over the life of the modelling to 2038. Importantly, this **productivity benefit is scaled in the model to reflect the incremental proportion of startups and scaleups entering the Victorian economy as the density increases**. In other words, the incremental startups and scaleups receive the productivity benefit. It is further assumed that startups only derive half of the full productivity benefits, reflecting the fact that many of these firms are relatively less productive compared to scaleups. The scaled productivity benefit accruing to the startup industry is presented in Chart 6.2.

Chart 6.2 Annual percentage point (ppt) change in TFP in the startup industry, incremental to the business as usual scenario for Scenario 1 and 2




Source: Palangkaraya et al, 2015; Deloitte Access Economics assumptions

xvi. This study is considered to be a reasonable proxy for the potential productivity benefits associated with startups and scaleups, and the cohort considered in the study is broadly similar to the cohort identified in the LaunchVic database (e.g. the average employment in the study was 17 employees while the startups and scaleups in the LaunchVic database averaged 14 employees).

As stated earlier, startups are not the only industry that benefits. There are also **spillover benefits to end users, including industries who adopt the innovation developed by the startup industry**. As the end users are adopters of the innovation, and do not necessarily collaborate during the process, the innovation dividend alone is considered the most appropriate measure and this ramps up similarly over time (i.e. 2.7 ppts) annually.

To appropriately implement this shock into the model, this was scaled by the proportion of firms by industry that adopts startup related innovation. This proportion was approximated using ABS data on the proportion of firms by industry who implement innovation multiplied by the share of startup activity of each industry. Taking health as an example, the data indicates that the industry includes 48% 'innovation-active businesses' and the proportion of startup related activity in health relative to the whole industry in Victoria is around 3%. It follows that an approximation for the proportion of firms experiencing productivity related to startups is the product of these two numbers, or around 1.4% of the Victorian health industry. Applying this proportion to the 2.7 ppt increase in productivity implies an annual increase of up to 0.04 ppts for the Victorian health industry. A similar approach is undertaken for the remaining industries. Following this approach, the key end users benefiting from innovation associated with the startup industry include information media and telecommunications, health and business and professional services (which includes professional, scientific and technical services).

The derivation of the productivity shocks for Scenario 2 – high growth follows the same methodology as Scenario 1 – moderate growth, as described above. The key difference is the rate at which the startup density grows and, as such, the full productivity benefits are realised sooner by 2022. The purpose of this scenario is to (i) account for the inherent uncertainty in the future potential growth in the startup density over the next 20 years and (ii) provide a potential upside if this does occur.

## 6.4 Economic modelling results

The economic modelling indicates that the potential growth in startup density and scaleup success rates as previously described would have a significant impact on productivity, employment and the broader Victorian economy over the next 20 years:

- **Scenario 1** – moderate growth (incremental to the business as usual scenario)
- **Scenario 2** – high growth (incremental to the business as usual scenario).

The economic impacts presented in this section are contingent on achieving the startup density targets and corresponding scaleup success rates as previously described. These could be driven by a range of potential "triggers", some of which form part of LaunchVic activities.

In addition, all results are presented at the state level for Victoria and are incremental to the business as usual scenario. Given that the vast majority (indicatively around 90%) of startups are currently located within Greater Melbourne, it is reasonable to expect that the majority of the impacts will similarly be concentrated within the Greater Melbourne region.

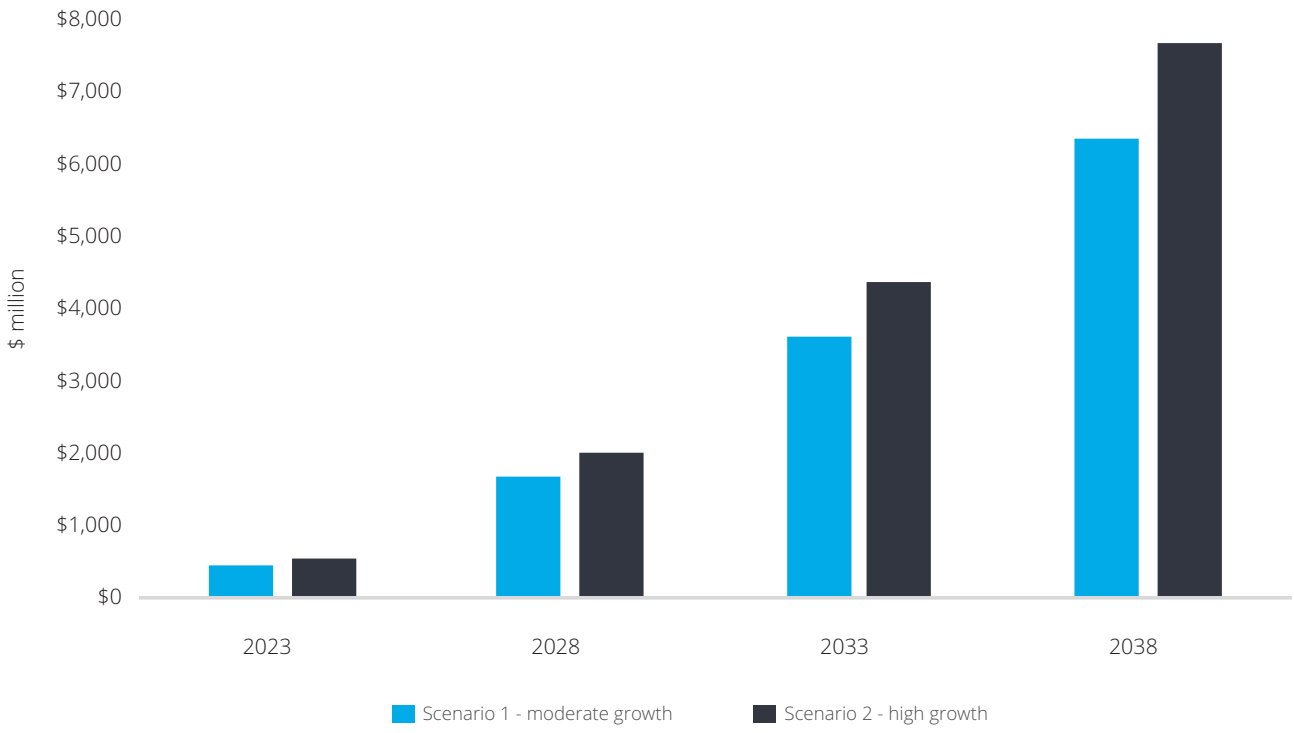
### Gross state product

The higher density leads to an increased level of output in the startup industry. This density and clustering provides increased opportunities for startups to innovate and collaborate with other startups, leading to higher scaleup success rates and productivity dividends additional to the business as usual scenario. The impacts also extend beyond the startup industry. In particular, there are also flow-on impacts to the rest of the economy including key end users (discussed in more detail in the industry impacts).

**The modelling highlights that these direct and flow-on impacts together could increase gross state product (GSP) in the order of between $18.3 billion and $22.0 billion in net present value (NPV) terms over the period 2019-38[xvii] (incrementally to the business as usual scenario)** (see Chart 6.3).

In cumulative terms by 2038 (i.e. the impact relative to the business as usual scenario by 2038), GSP could increase by between $6.3 billion (Scenario 1) and $7.6 billion (Scenario 2). The percentage deviation puts the results in the context of the Victorian economy, highlighting that gross state product could increase by between 0.8% (Scenario 1) and 1.0% (Scenario 2) by 2038.

Chart 6.3 Impact on Gross State Product in Victoria ($m), Scenarios 1 and 2, incremental to business as usual




Source: Deloitte Access Economics estimates

xvii. All NPV figures presented in this Chapter are calculated using a 7% real discount rate over the period 2019-38.

### Aggregate employment

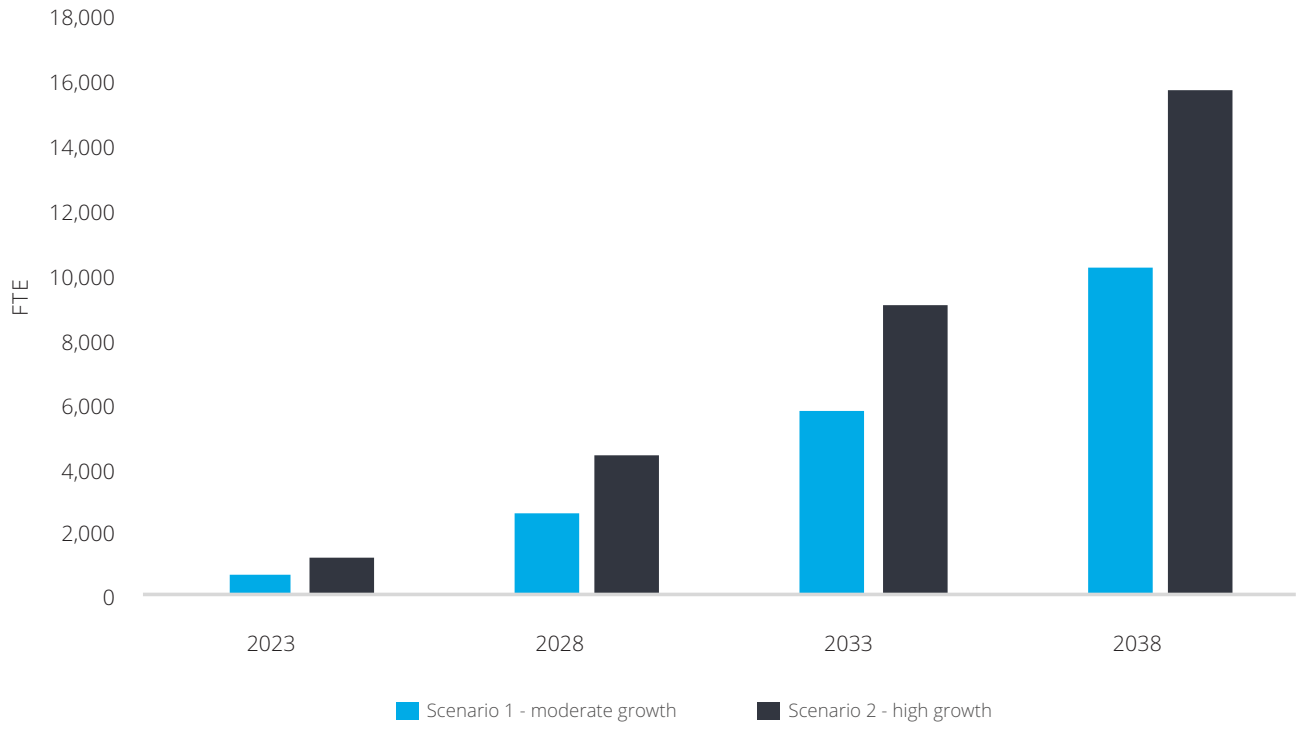
This section considers aggregate employment across all industries in Victoria. The employment impacts by industry are discussed in turn in the industry impacts section. It is also assumed that Victoria is able to draw on a small amount of the rest of Australia's labour supply, reflecting the fact that average **wages across the Victorian economy are increasing, making Victoria a more attractive place to work.**

The modelling highlights that the FTE employment generated by the expansion of startup related activity is between 3,700 (Scenario 1) and 5,800 (Scenario 2) in average annual terms over the period 2019-38 (incrementally to the business as usual scenario) (see Chart 6.4).

**In cumulative terms by 2038, aggregate FTE employment could increase by between 10,200 (Scenario 1) and 15,700 (Scenario 2). In percentage deviation terms, this represents between 0.3% and 0.4% increase in aggregate employment in Victoria.**

While employment follows a similar profile to GSP, the percentage increase in employment is relatively lower compared to the increase in GSP, which is partially explained by the increased productivity of the startup and end user industries over time.

Chart 6.4 Impact on employment in Victoria (FTE), scenarios 1 and 2, incremental to the business as usual scenario




Source: Deloitte Access Economics estimates

**Industry impacts**

While the previous section reported the aggregate results across all industries, this section drills further to explore which industries are driving the impacts by considering the change in value added by industry (see Chart 6.5). As described in Appendix B, the startup sector includes activity across a range of industries. When identifying this in the model, the startup related activity was partitioned out from other industries where relevant. For example, the startup industry includes the economic activity associated with startups in the information media and telecommunications industry, while the remaining activity in the information media and telecommunication industry relates to the non-startup related activity.

The startup industry experiences strong growth driven by the increased output and productivity associated with achieving a higher density and scaleup rate. **Over the period from 2019-38, the value added of the startup industry increases and in cumulative terms by 2038, the startup industry increases by around $2.4 billion (Scenario 1) to $5.5 billion (Scenario 2).**

There are also positive flow-on impacts to other industries, which are the end users of the innovation developed by the startup industry. These include health, information media and telecommunications and other services. The impacts to construction are largely driven by the induced investment in the Victorian economy. **The higher rate of return in the region makes it attractive for investors, resulting in additional investment in the region in the order of between $2.7 billion (Scenario 1) and $3.5 billion (Scenario 2) cumulatively by 2038.**

However, there are some other industries that experience 'crowding out' (where expanding industries take resources, such as labour and capital, away from other industries in the economy), such as manufacturing for example. This, in part, reflects the fact that these industries are not directly targeted in the scenario and therefore are relatively less efficient compared to the key end use industries. In addition, as the key industries become more efficient, they may require fewer inputs, such as primary and intermediate inputs from other industries. This, in turn, could potentially reduce the demand for some upstream industries. In some cases, there may also be a small decrease in some industries which could be considered an end user industry, such as agriculture. This is a function of the general equilibrium modelling framework which accounts for opportunity costs and crowding out (as some traditional export industries experience a reduction in export share), and this is greater than the stimulatory effects associated with the productivity.

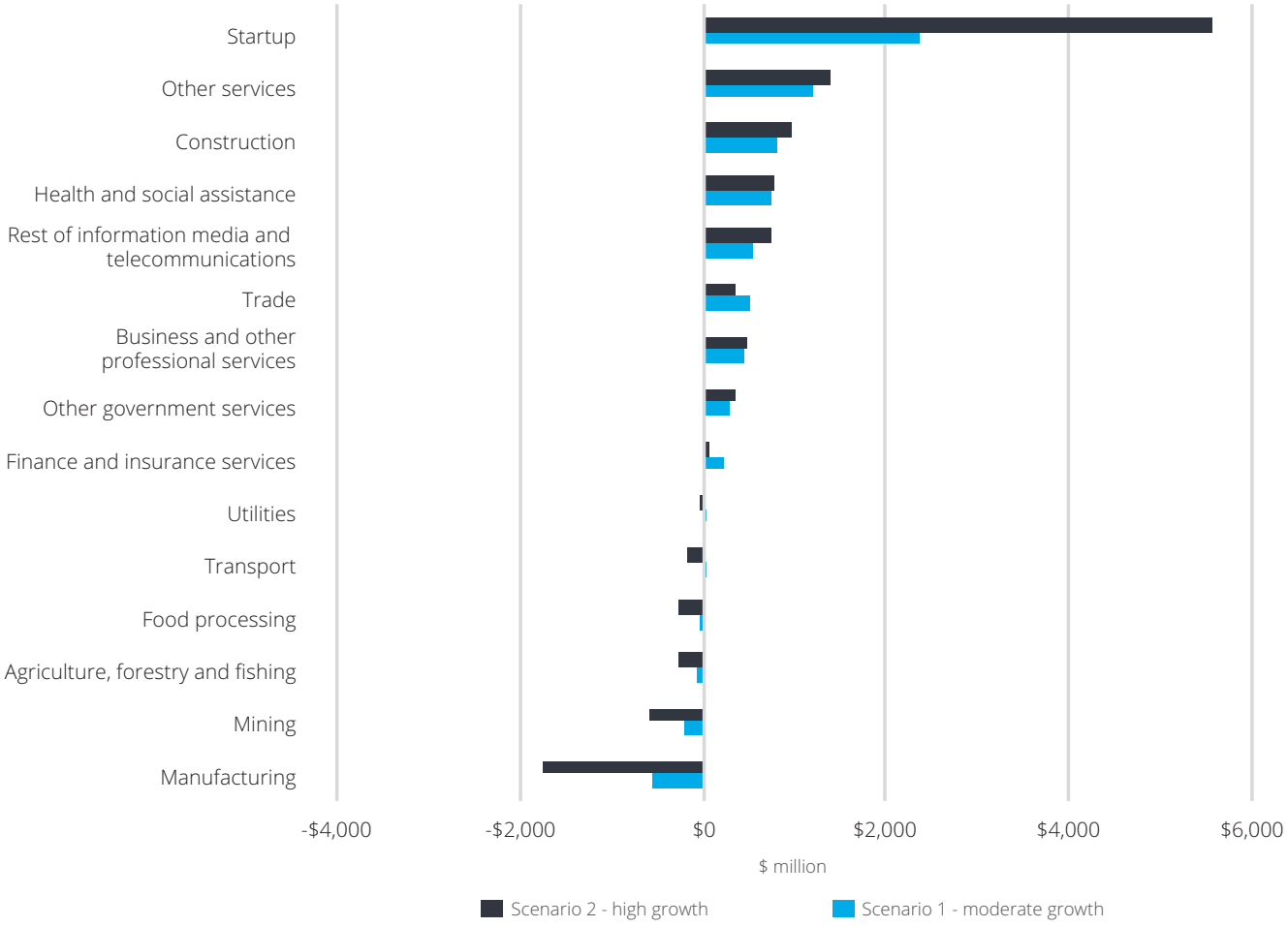
The negative deviation shown for some industries does not necessarily imply that the industry is projected to contract. Rather, it indicates that, relative to the base case, it is simply not growing as fast. While there are decreases in value added across some industries, the additional activity due to **the increase in startups has a positive impact for the Victorian economy.**

The modelling indicates that startups are a large driver of net job creation. This finding is also consistent with the national and international literature, which finds that startups contribute a disproportionate amount to employment.[40,41] Specifically, **the increase in employment relating to the startup industry is modelled to be between 6,200 (Scenario 1) and 15,600 (Scenario 2) in average annual terms over the period 2019-38.**

As was the case with value added, there are similarly some industries that benefit from the expansion of the startup industry (e.g. health), while others (e.g. manufacturing) experience some level of crowding out. Again, these impacts are incremental to the base case and while there are decreases in employment across some industries, aggregate employment in Victoria increases as a whole. The higher average wage (around 0.7% (Scenario 1) to 1.0% (Scenario 2) higher in cumulative terms by 2038) in Victoria also implies a movement to higher value jobs.

In addition to the domestic market, the startup industry sells to international markets including key countries such as the US, UK, NZ, China and India.[42] This is consistent with the objective of lifting the global market reach from early stages of development. The **increased productivity of the startup industry reduces prices and increases the global competitiveness of the industry**. The modelling indicates that this growth has the **potential to lift total exports in Victoria in the order of between $1.6 billion (Scenario 1) and $3.9 billion (Scenario 2) cumulatively by 2038.**

Chart 6.5 Impact on value added by industry in Victoria ($m), cumulative change by 2038, scenarios 1 and 2, incremental to the business as usual scenario



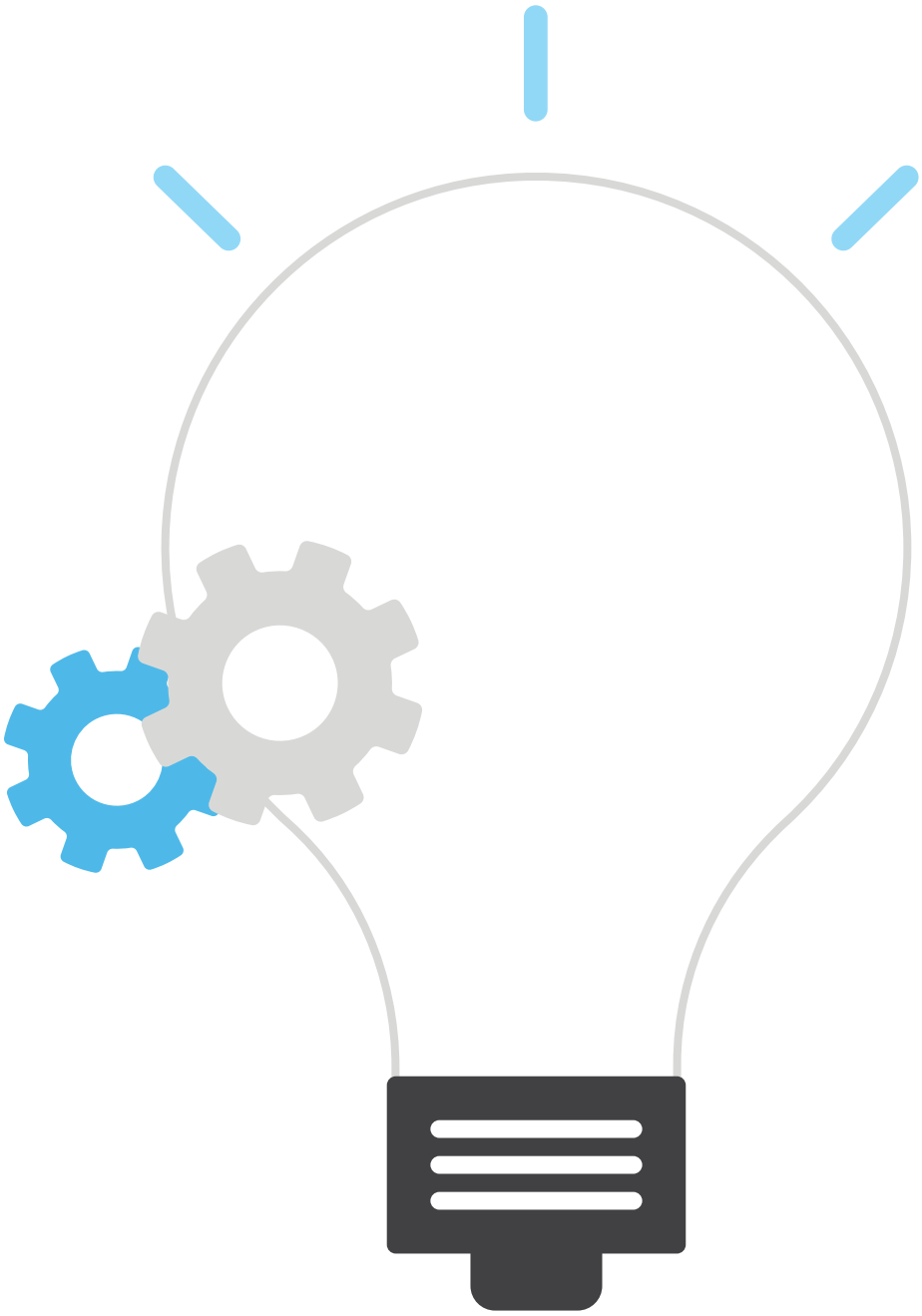

Source: Deloitte Access Economics estimates

As with any analysis, it is important to understand and acknowledge the limitations. These are described below:

- The modelling does not explicitly represent a program evaluation of LaunchVic activities, rather, it estimates the potential economic impacts associated with achieving the startup density targets and scaleup success rates. However, it is noted that LaunchVic will play an important role in supporting this
- Dynamic efficiencies are not captured by this analysis as the CGE model is not set up to take these into account
- The analysis considers the impacts of a change in density and does not explicitly take into the account the quality of startups
- The model does not explicitly consider the age of the firms as each industry is a representative firm, which is a price taker
- The interventions required to achieve higher density and a greater amount of scaleups are not cost free (i.e. there would likely be some costs associated for government).

# Appendix A

## Economics of innovation, startups and ecosystems



## A.1. Definition of actors in the startup ecosystem

The key actors that make up a startup ecosystem are described in more detail below. These descriptions are generally consistent within literature, with high-level descriptions detailed in Appendix B.

Table A.1: Key actors within a startup ecosystem

| Actor | Role in ecosystem |
|---|---|
| **Startup** | Business with high impact potential that uses innovation and/or addresses scalable markets. These firms are in the early stages of formation, developing an idea into a functioning business that meets market needs and is able to grow. |
| **Scale ups** | An enterprise with average annual growth in employees or turnover greater than 20 per cent per annum over a three-year period, and with more than 10 employees at the beginning of the period. |
| **Incubators/ Accelerators** | Provide a physical space for innovators to collaborate and share ideas while benefiting from shared technology infrastructure and equipment. They also often provide innovators with access to a network of business and technical advisors / mentors capable of providing guidance and assistance. |
| **Corporations** | The private sector plays an important role in successful innovation ecosystems. Business-led initiatives, such as research and development partnerships, knowledge-sharing platforms, technology and skills transfer and infrastructure investment have the potential to catalyse, develop and scale innovation, while also providing fertile ground for future innovation to emerge. |
| **Research Institutions** | Research Institutions are crucial for innovation due to their role in knowledge creation and diffusion and are a primary tool for governments seeking to spur research and innovation in their economies. |
| **Investors** | Within the startup ecosystem, there are investors that provide different types of capital, which all play a significant role in an ecosystem's expansion:[xviii]<br><br>Pre-seed capital is the preliminary round of funding, which usually comes from founders themselves, friends and family, and accelerator programs. Seed capital supports preliminary activities including product research and development (R&D) and business plan development.<br><br>Seed capital follows pre-seed capital and is typically provided by Angel Investors – typically High Net Worth (HNW) individuals and sophisticated investors who invest directly in startups in exchange for equity or convertible debt. Angel Investors also form Angel Networks that approach the market, evaluate and at times invest as a single unit. Angel Investing is a specialized skill, and Angel Investors often invest in industries of which they hold a significant expertise and as such provide valuable access to networks, advice and mentorship to founders in addition to capital. Angel funding has been shown to have a significant positive impact on startup success by increasing the probability of:<br>• Successful exits by +9-11%;<br>• Employment growth by +16-20% on average; and<br>• Follow on funding (Series A) by 70%.<br><br>Venture Capital (VC) is provided to startups exhibiting high growth potential in exchange for an equity stake. VC funds typically invest in startups through multiple funding rounds, starting with Series A, however in some cases may provide seed funding. VC funds pool capital from a variety of sources including family offices, HNW individuals and superfunds (including self-managed superfunds). A typical VC fund will have a lifespan of about 10 years, in which the majority of the capital will be allocated in the first 5-6 years with the later years focused on follow on funding and exits.<br><br>Private equity (PE) is provided by PE firms, which money committed by pension funds, other institutional investors and high net worth individuals. In contrast to VCs, PE typically having a lower risk profile and a preference of investing to secure a majority stake in mature businesses. VCs tend to invest minority stakes in high risk growth companies. The average PE deal size is $150 million compared to a median early stage VC size of $3.03 million. |
| **Government** | Governments play many critical roles within the ecosystem, such as an innovator, as well as an innovation enabler though creating a supportive policy and regulatory environment in which startups are encouraged and able to thrive through a variety of tax or partnership incentives that enable the growth of scientific research, angel, venture capital and private equity communities. |

Source: Startup Genome (2019); LaunchVic (2019); IDIA (2019)

xviii. IDIA (n.d). Typical Actors in an Innovation Ecosystem.

## A.2. Economics of innovation

Economic growth is not something that just simply occurs; growth in an economy is the result of a multitude of factors (and actors), with increasing productivity being one of the most critical.

Fundamentally, there are two ways of increasing the output and growth of the economy:

1. **More production** – by increasing the number of inputs that go into the productive process, or
2. **Getting productive** – by coming up with new ways to get more output from the same number of inputs.

But what is productivity?

The conceptual model of production can be presented as the simple relationship known as the Cobb-Douglas production function. This function demonstrates that output depends on the amounts of inputs employed (capital and labour), the efficiency with which they are used and total factor productivity (effects of factors other than labour and capital on total output).

Broadly, the factors that cause productivity to change can be classified as either improvements *embodied* in the capital and labour inputs in production, or *disembodied* changes that boost productivity in more general ways.

Embodied productivity improvements increase the *quality* of labour and capital. For labour, this includes areas of focus for policy makers such as education, training and health, which mean that the quality of a one hour unit of labour today is higher than it was 50 years ago. Similarly, technological advancements such as the all-pervasive rise in computers have substantially improved the efficiency of the production process.

Disembodied productivity improvements typify the idea of "working smarter, not harder". These productivity improvements include better production processes, substitution of cheaper materials and faster rates of commercialisation. Typically, this also includes publicly funded capital such as infrastructure which are not included in private production functions.

A stylised depiction of the relationship between productivity and living standards is provided in Figure A.1. Economics tells us that continual improvements in productivity drives economic growth, which in turn supports increasing living standards.[xix] Importantly, what this figure also shows is the role of innovation in kick-starting this process – indeed, growth in living standards is a dividend of innovation.

In reality of course, the links between investments in innovation and economic outcomes are complex.

An important consideration in thinking about the role of innovation in improving living standards – and what the simplified diagram does not show – is that in most cases it takes many years for innovation to translate into changes in living standards. Most major innovations start in a very basic condition and go through years of technical improvements and cost reductions before becoming universal products and services.

Take the computer, as an example. The first digital computer was in operation at the University of Pennsylvania in 1945 and was soon after manufactured by a number of firms. Yet, in a congressional committee testimony in 1956, Howard Aitken – one of the pioneers of computers – considered computers to be nothing more than a highly specialised scientific instrument.[43] Today, computers are ever-present in society, culture and the economy.[xx]

A cursory study of the history of technological change highlights the complexity of the process of innovation – with the concurrent emphasis on experimentation and serendipity on the one hand, with systemic investment in R&D on the other; the diffusion of innovation in the short run spurring the process of disruption in the longer run; the cost of imitation in the short run being as significant as the investment of knowledge in the process of innovation in the longer run.

Moreover, the understanding of this process of innovation in an economy has developed alongside the understanding of economic models.

Figure A.1 The stylised link between innovation and living standards


xix The relationship between economic growth and standards of living is not discussed further. This chapter takes as a given that when output grows faster than the population, the standard of living rises. The inclusiveness of this growth and subsequent rise in the standard of living is not discussed here, but is an important consideration for policy makers.

xx The story of the iPhone provides a counter-balance to the time frames of the computer – building on the technology of personal computers, the iPhone (and subsequent smart phones) revolutionised the impact of technology in a matter of years.

With the evolution of economic models, there has been an increasing emphasis on the role of technological progress – or innovation driven productivity – and an understanding of the dynamics and complexity of innovation as it proceeds in not some simple linear and incremental manner, but is characterised by periods of discontinuities and periods of incremental innovation.

Consequently, the realisation of the economic (or social, or environmental) value of an innovation is uncertain and can only be fully assessed some time after its implementation. Furthermore, this value evolves over time as the benefits are realised in other industries and other locations, and the benefits compound with the introduction of new innovations.[xxi] As such, directly measuring the benefits of an innovation is not straightforward.

## A.3. Do startups influence economic growth?

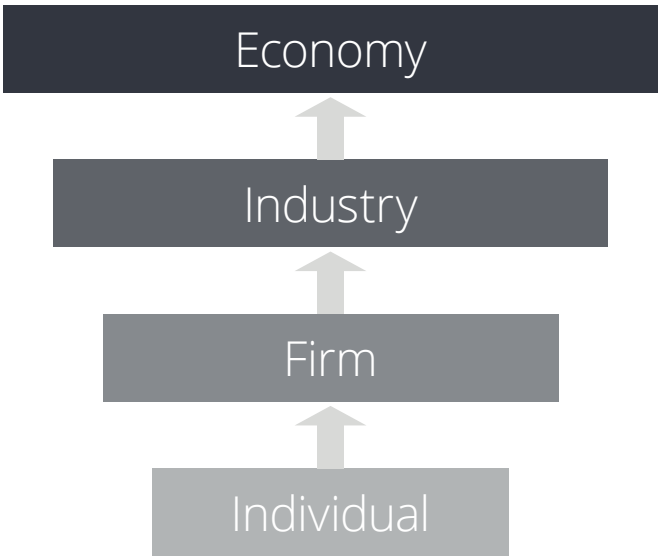
**Yes, they do**

As shown above, innovation spurs improvements in productivity which, in turn, supports economic growth. But, how does this relationship work and what is a role of startups?

To explain the dynamics of this relationship, we split the total economy into its building blocks – the individual (i.e. the entrepreneur), the firm (here, we focus on new businesses and startups), the wider industry in which the firm operates and then the broader economy. This allows us to trace the effects of the original innovation through the economy, demonstrating that at the individual firm level (and startup level), actions can, and do, have implications for the wider (aggregate) economy.

Decisions about innovation are primarily made at the individual and firm level, from idea generation, to testing, to implementation. When such innovation decisions are combined across industries and markets, this translates into economy-wide innovation, knowledge spillovers and dividends from it. This section steps through each of these building blocks in turn.

Figure A.2 How the impact of innovation flows through the economy




**At the individual level**

Economist Joseph Schumpeter considered innovations as essential to explaining economic growth, and the "entrepreneur" as the central innovator. Schumpeter visualised the entrepreneur as the key figure in economic growth because of his role in introducing innovations stating that "the pure new idea is not adequate by itself to lead to implementation … it must be taken up by a strong character (entrepreneur) and implemented through his influence".[44]

Entrepreneurs look for opportunities, and identify, commercialise and scale their innovation, often for economic gains.[45] They have a pivotal role in the innovation process, giving spark to economic activities through their decision-making – exploiting innovative opportunities and acting as a catalyst for economic growth.

Indeed, without the individual (think Bill Gates, Steve Jobs, Mark Zuckerberg, Pierre Omidyar and Arianna Huffington), we wouldn't have the technologies and digital platforms such as Microsoft, Apple, Facebook, ebay or Huffington Post, which permeate our everyday lives.

xxi. This is a central premise of the OECD's Oslo Manual.

### At the firm level

New businesses, or startups, represent an entry of new capacities into markets, and become an essential element within market processes and competitiveness forces.[46]

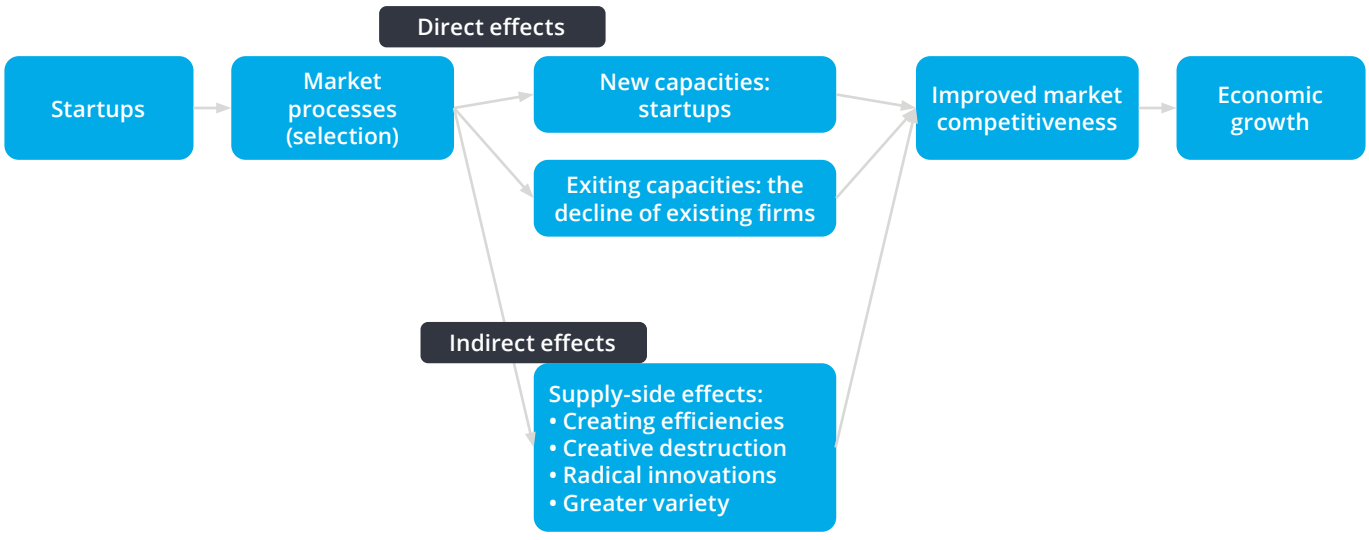
The direct effects of startups are two-fold: 1) they bring *new* capacities to the markets, and 2) the entrance of startups into markets results in the *exits* of capacities from markets. There are two types of exits which can result from the entry of startups. Firstly, there are startups that fail to be sufficiently competitive and therefore will exit the market after a period. Secondly, there is a crowding out effect of existing firms by their new competitors, leading to declining market shares or market exits.

The indirect effects of startups entering markets result from intensified competition and pertain to the supply-side of the market. There are four main types of these indirect effects:[47]

- **Securing efficiency:** by contesting established market positions. Efficiency effects can relate to both within the startup, and also competitive forces inducing existing firms to behave more efficiently.
- **Acceleration of structural change:** structural change occurs with a turnover of economic players i.e. by the entry of new startups inducing exits of older firms. Joseph Schumpeter called this concept *creative destruction*, which is explained in detail in the box below.
- **Amplified innovation:** particularly in the creation of new, dynamic markets. Startups tend to bring about more radical innovations, as opposed to incremental innovations by existing firms.
- **Innovative entry:** may lead to a greater variety of products and problem solutions.

These supply-side effects of startups augment the aggregate stock of knowledge in the economy and can lead to significant improvements in the competitiveness of an economy, industry or region. In this *indirect* way, startups stimulate economic growth.

Figure A.3 Startups and the market process




Adapted from: Fritsch, M.; 7 Mueller, P (2004), Effects of New Business Formation on Regional Development over Time

**Economic rents and creative destruction**

A firm's profits are equal to the revenue it gets from selling outputs, minus its costs. It is assumed that in a competitive market, all firms sell their output (good or service) at the same, market clearing price, and is required to pay the same price for labour and capital inputs.

A firm, or startup, creates or is an early adopter of new technologies, organisational forms, and other efficiency-enhancing opportunities. New technology or innovative business processes reduces the relative price of inputs.

Firms therefore benefit from lower costs associated with their introduction or adoption of the new technology within an industry, which then translates to higher profits, compared to firms who do not adopt. The difference in profit is referred to as an **economic rent**.

Innovation rents will not last forever. Other firms, noticing that entrepreneurs are making positive economic rents, will eventually adopt the new technology. They will also reduce their costs and their profits will increase.

This process will continue until everyone is using the new technology, at which stage prices will have declined to the point where no one is earning innovation rents. The firms that fail to adopt the new technology will be unable to cover their costs at the new lower price and exit the market.

Economist Joseph Schumpeter called this concept **creative destruction**. Schumpeter describes the entrepreneur (and entrepreneurial firm) as the economic agent who changes the economic system from within; traditionally referred to as endogenous change.

Adapted from: Bowles, S; Carlin, W & Algan, Y (2018), The Economy: Economics for a Changing World[48]

### Disruptive technology and creative destruction

Disruptive technologies embody Schumpeter's concept of creative destruction.[49] Disruptive technologies *disrupt* the current capabilities within markets.[50]

Innovations that are *radically different*, are resisted by the existing market structures and create entirely new market structures. The role of entrepreneurial firms more broadly (both existing firms and startups) in this process is to overcome user resistance and create new markets. They must demonstrate that the technologies embodied in a new product provide significant cost reductions and/or performance improvements to overcome resistance.[51]

Startups play a vital role in creating *new economic opportunities* that can be exploited by themselves or by others. As startups, in their infancy, are independent of markets and existing firms, and do not have an existing customer base. They are therefore not trapped within an existing striation of evolutionary technology and are free to innovate and commercialise for a whole new market and set of customers.[52]

### At an industry level

Industries are the aggregation of firms (including startups) that produce similar goods and/or services. It stands to reason, then, that as an innovation in one firm is adopted by firms of a similar nature, the benefits begin to accumulate at the industry-wide level.

At the industry level, productivity growth is the result of different combinations of:[xxii]

1. Productivity gains within existing firms (as a result of firm level investments in innovation);
2. Increases in the market-share of high-productivity firms (when those firms that innovated capture more and more of the total market); and
3. The entry of new firms that displace less productive ones ("*creative destruction*").

As such, the dynamic benefits from innovation are realised at the industry level through these changes in market shares and the reallocation of resources from declining firms to growing firms. Firms within the *same industry* differ in their productivity and the reallocation dynamics reflect moving resource away from the less productive to more productive businesses. *Startups* play a critical role in these dynamics, placing competitive pressure on existing firms – critical for innovations.

xxii. In reality, the interactions between these three factors can be just as important as any one factor; for example, the entry of a new highly productive firm can incentivise incumbents to invest in, or adopt, innovative practices to maintain market share. However, for the purposes of illustration, the simple taxonomy provides a useful framework for understanding the mechanisms for translating firm-level productivity into industry-wide productivity.

In reality, investment in, and adoption of new innovations across an industry are far from uniform and it is impossible to make general conclusions about industry-wide growth from the analysis of a handful of firms. Some firms make great gains from taking leading investments in innovation, while others do not. This first group is often referred to as 'frontier' firms, reflecting their position on the so-called innovation frontier, while the latter group is referred to as 'laggard' firms.

Research by the OECD and the Bank of England show that this non-uniformity has implications for the 'average' level of productivity of an industry, or even a region.[xxiii] In an industry with more frontier firms than laggards, the average productivity of the industry will be relatively high, for example, whereas an industry where the development/adoption of new innovations is slow for many firms, average productivity will be low.

**At an economy wide level**

By definition, productivity improvements at the firm and industry level have implications for aggregate economic growth, as the macroeconomy is merely the combination of all firms/industries. However, this level has a particular importance as it is at this level that policy makers typically look for the impacts of innovation in headline macroeconomic statistics, such as Gross Domestic Product, and discuss the societal benefits of innovation.

Much like the industry level, the impact of innovation on the macroeconomy is dynamic. Depending on the diffusion of innovations through the economy, the outcomes of disruptive technologies and the impact of broader patterns of creative destruction, innovation can have a minor impact right the way through to a transformative impact on the macroeconomy.

**The importance of place: agglomeration**

The value of human capital has increased over time, and knowledge sharing between firms and between workers is driving innovation, leading to economic growth. Location is increasingly becoming a crucial component within this relationship.

Location is particularly important as firms are seen to benefit from locating within dense employment centres due to a range of benefits, including:

- Economies of scale and scope: with a larger customer base firms are able to develop efficiencies through operating at a larger scale. This also enables firms to focus the scope of their expertise in a particular field, gaining improved efficiencies through specialisation.
- Deep and diverse pool of clients/employers/employees: A competitive marketplace presents people and firms with a multitude of potential options. This frees them from reliance on a single (or limited) client or employer base, allowing firms to better align their specific skills, again improving productivity.
- Technological spillovers: With multiple firms located together there will be a higher level of technological and knowledge spillovers and transfers, which will help bolster innovation. This transfer occurs both directly, through stronger supply chain linkages and connections between local firms, and indirectly, when skilled labour moves between firms and transfers knowledge, as well as through incidental exchanges.

Density and diversity are the hallmarks of success for urban economies and industries based on knowledge.

*Agglomeration economies* describes the benefits that flow to firms from locating in areas that have a high density of economic activity.

Agglomeration and the resulting *close proximity of a number of different industries* increases the interactions *between industries*, generating highly competitive environments, resulting in a diverse range of better, smarter and cost-efficient products and services.

Agglomeration and the resulting *close proximity of a firms within the same industry* supports the creation of a 'critical mass' to allow for specialisation and to deliver shared infrastructure cost-effectively. Critical mass is necessary to begin to attract and retain people, stimulate a range of activities and increase financing.

Adapted from: SGS Economics and Planning (2018), Analysing Melbourne's Enterprise Precincts

xxiii.

**But how does innovation diffuse across industries, leading to growth in the aggregate economy?**

Our understanding of innovation, the role of startups, their innovative activity and productivity in an economy has developed alongside the evolution in economic thinking about how economies grow. Economics is not a fixed science; rather ideas and models about how the economy works, which have changed over time. This is important when considering the economics of innovation as it is in the most recent iterations of economic growth models that innovation has gained prominence, reflecting and reinforcing the increased distinction given to innovation in economic policy. Where technological progress (or innovation) was once an afterthought in trying to understand growth and economic progress, it is now the central driver.

*Neoclassical growth models*

The earliest theories of economic growth assumed that diminishing marginal returns to at least one input to the production process could not be overcome by technological progress. However, the neoclassical model pioneered by Swan and Solow took the view that economic growth is determined explicitly by stocks of capital and labour, and technical change entered the production function exogenously as a shifting factor, critical to long run growth. Indeed, in these models the long run growth rate of an economy is equal to exogenous technological progress, although the models don't explain how the technological progress comes about.[53] The neoclassical growth model implies that productivity is not the product of explicit economic activity.

Enhancements were made to neoclassical growth models to account for the important role of human capital and knowledge, as opposed to raw labour and physical capital, in economic growth.

*Endogenous growth models*

New (endogenous) growth theories attempt to address some of the shortcomings of the neoclassical growth model; in particular, the endogenous growth models focus on the determinants of technological progress rather than leaving technological progress as an unexplained residual. Specifically, these models try to explain economic growth *and* technological progress and therefore imply that long run economic growth can be influenced through productivity improvements.

The most important development to the endogenous growth model was by Paul Romer in 1986. He showed that the returns to capital can be split into private returns and social returns. Lucas (1998) extended the analysis to show that the public good and non-rivalrous characteristic of knowledge, accessible to be used by an entire economy, causes spillovers to human capital economy-wide.

### The spillover effect

The production of knowledge can lead to *spillovers* of knowledge when individuals or firms other than the creators of the knowledge benefit from the knowledge that the creator has produced. This is known as a knowledge externality. The social returns to innovation exceed private returns to innovation if the knowledge produced in an innovation process is not fully appropriable by the innovating firm.

Knowledge spillovers across firms within an economy largely occurs as a result of a firm's own investment in R&D. Firms are not able to effectively appropriate all knowledge generated as the result of their innovation efforts. Explicit knowledge, the type of knowledge that is easy to articulate, write down and share – such as the information within textbooks, contracts or operational manuals – is the knowledge more easily appropriable. However, tacit knowledge, the embedded knowledge in an individual accumulated from personal experiences, is more difficult to communicate, visualise and transfer. Firms would like to prevent knowledge loss, but tacit knowledge follows wherever the employee may go.

Knowledge spillovers arise due to failures in the protection mechanisms to appropriate all knowledge (both tacit and explicit), examples being patents, copyright, trademarks and trade secrets.

By a firm investing in knowledge, not only are they increasing their own level of knowledge but are contributing to the **aggregate stock of knowledge** within the economy. As an example, when securing a patent, a firm produces new knowledge, and the information within the patent is made available to the general public and therefore, to competitors. This information can be used by competitors to extend their own R&D and investments in related knowledge, and this related knowledge can lead to new patents or innovative products.

**At the firm level**, knowledge can be exchanged between companies. This can occur between companies located within a close proximity, or can happen as a result of these companies doing business together.

**Intra-industry** knowledge spillovers happen as a result of industry specialisation, where knowledge accumulated by one firm tends to help the development of technologically close firms. Industries that are geographically concentrated benefit most from exchange of knowledge within the industry and should, therefore, grow at a more rapid pace.

**Inter-industry** knowledge spillovers happen as a result of the diversity and variety of knowledge between complementary industries or customers and suppliers that service each other. The diversity of industries in an area may lead one sector to adopt a technological solution that has worked for another.

Adapted from Block, J.; Thurik, R.; & Zhou, H. (2012), What turns knowledge into innovative products? The role of entrepreneurship and knowledge spillovers & Fallah, H & Ibrahim, S (2004), Knowledge Spillover and Innovation in Technological Clusters[54]

The developments to endogenous growth models showed that the creation of new knowledge by one firm has a positive spillover effect on the production possibilities of other firms. Further, while tangible capital such as land and machinery are scarce, ideas and knowledge are abundant, can build on each other and can be replicated cheaply or at zero cost – that is, knowledge is not subject to diminishing returns.

These models show that knowledge creation and technological opportunities are crucial to economic growth, but they do not contribute to our understanding of the mechanisms of the transformation of knowledge into economic growth.

Investment in new knowledge is only one necessary condition for economic growth; new knowledge must be exploited, leading to innovation embedded in products to be put to commercial use, so that it can translate into stronger competitiveness and subsequent economic growth.

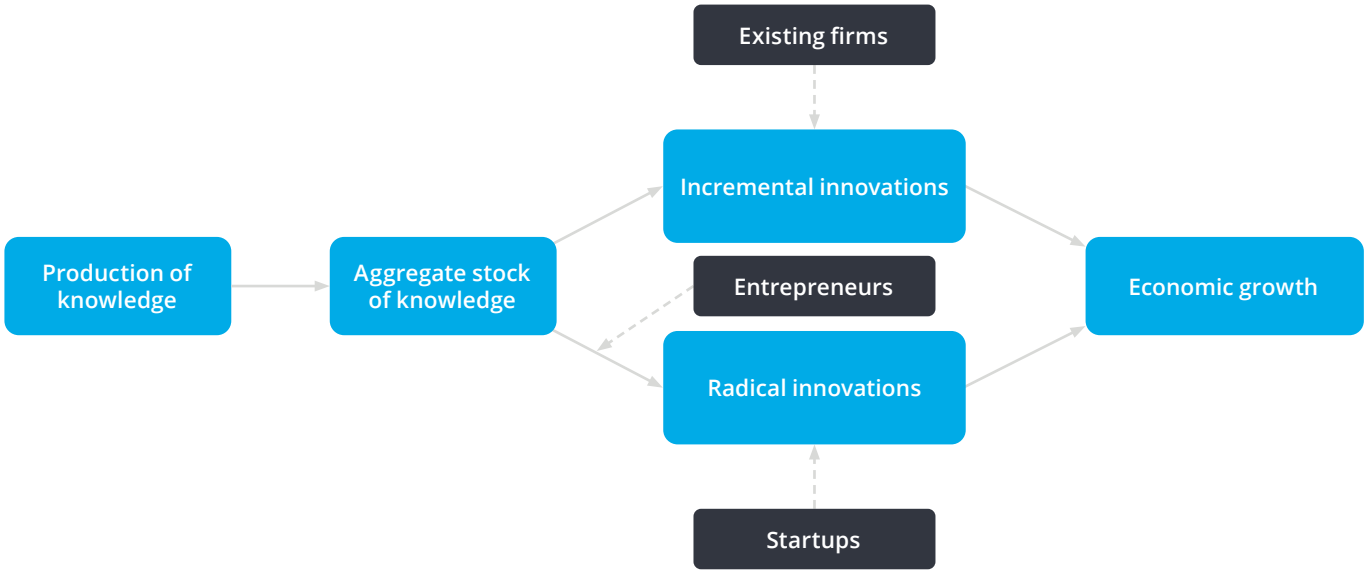
The contribution of Arcs et al. extends the microeconomic foundations of endogenous growth models through the **knowledge spillover theory of entrepreneurship**. Their work showed that entrepreneurs act a *missing link* between knowledge creation and economic growth. Entrepreneurs exploit innovative opportunities, resulting in the commercialisation and diffusion of innovative outputs through the economy, leading to economic growth and development.[55] The transformation of knowledge into economic growth depends on how knowledge diffuses through entrepreneurial activity, existing firms and startups.

So what role do startups play in all of this? Both existing firms and startups can exploit spillovers, drawing from the aggregate stock of knowledge to develop innovations. Startups, however, tend to exploit knowledge spillovers to produce radical innovations. In contrast, existing firms mainly produce incremental innovations from knowledge spillovers, exploiting profit possibilities of their existing products instead of searching for new opportunities.[56]

Startups and their radical innovations commercialised in markets lead to a greater variety of products, and problem solutions available.[57] The increased variety means that there is a higher probability of finding a supply which better matches customers preferences, than the supply available before. Increased variety, due to these new supplies, may stimulate an intensified division of labour, as well as follow-up innovations. Together, this can generate economic growth.[58]

From a policy perspective, promoting the production of new knowledge (e.g. R&D subsidies or university education) is not sufficient if the goal is economic growth. There needs to be both a strong presence of entrepreneurs to exploit innovative opportunities and of startups to create markets and commercialise the innovation embedded in new products and processes them. If left unexploited, or under-exploited, profits and economic rents will not flow back into the economy and economic growth will not reach its full potential.

Figure A.4 The relationship between knowledge, innovation and economic growth




Adapted from Block, J.; Thurik, R.; & Zhou, H. (2012), What turns knowledge into innovative products? The role of entrepreneurship and knowledge spillovers. J Evol Econ, 23:693-718

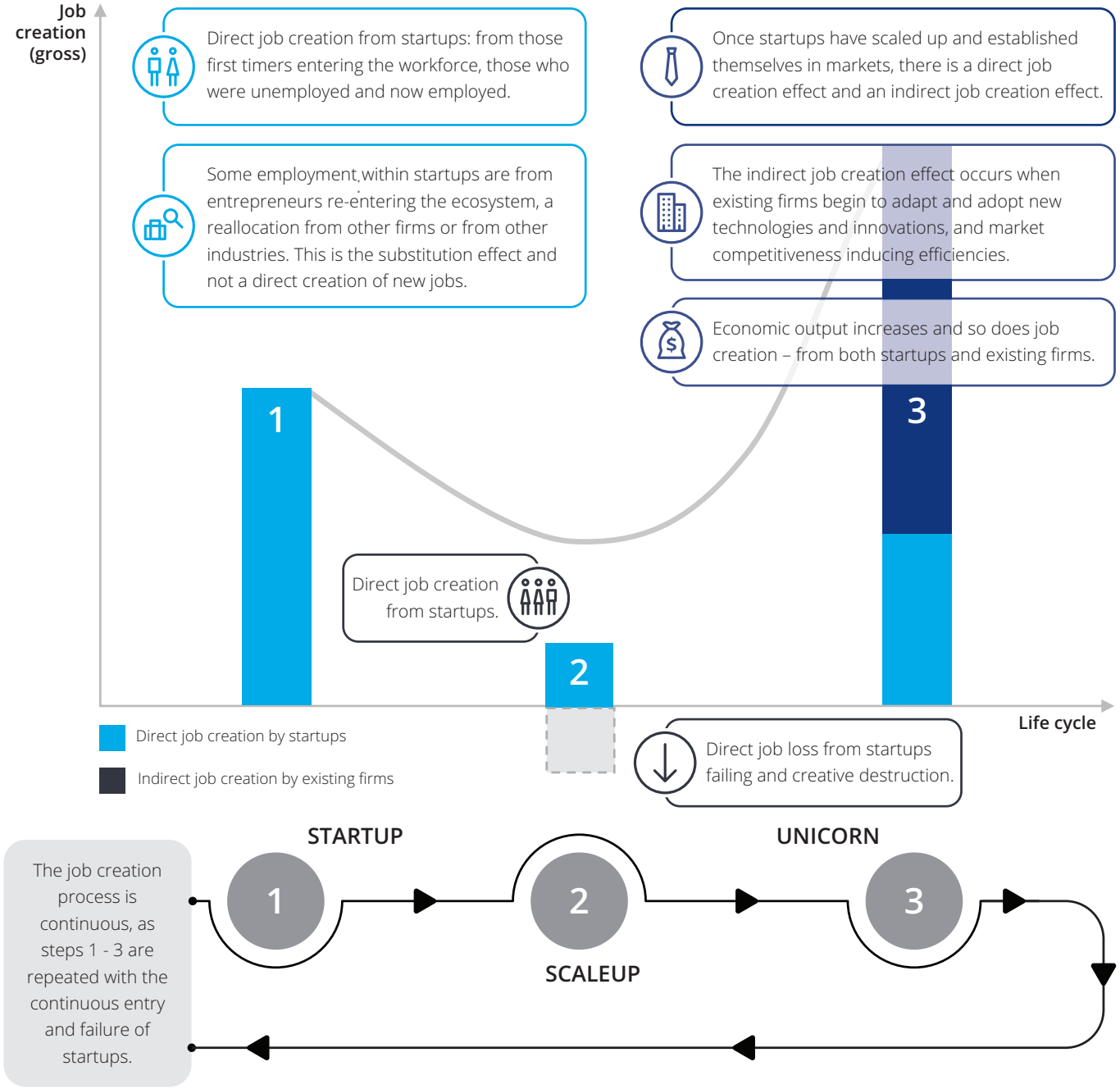
## A.4. Do startups create employment?

**Yes, they do**

Startups create employment, however, the relationship between startups and increasing overall employment in an economy is more complex than just: more businesses, more jobs. The literature to date acknowledges the important role of startups and their contribution to job creation, however the underlying economic mechanisms for why this is so are not as well understood.[59] The relationship between job creation and the life cycle of a startup reflects a u-shape (Figure A.5).

Overall, the impact of startups on job creation is a net increase, with contributions coming directly from startups throughout their lifecycle, and indirectly from existing firms and induced market competitiveness and efficiencies. We can break this down into the life cycle of startups to look at the direct and indirect effects.

Figure A.5 A conceptual model of startup job creation




Source: Deloitte Access Economics

### Startups

There is what we might call *modest* direct job creation from startups in their infancy.[60] Startups can be created by a range of people: 1) those who are entering the workforce for the first time (i.e. school leavers or university graduates), 2) those who have lost jobs and been unemployed and are re-entering the workforce, or 3) those who are relocating from other employment (within the same industry or from another) or from a failed startup.[61] The latter is called a *substitution effect* within the workforce and does not actually create employment in the economy.

Startups increase employment growth within a sector, largely from a reallocation of employment from other sectors. This is called a displacement effect. A positive displacement effect sees individuals crowd into a relevant sector, outweighed by a negative *displacement effect* of the reallocation of these individuals from other sectors.[62]

### Scaleup

After startups have established themselves within markets, the indirect supply-side effects (refer to Figure A.3) result in increased market competitiveness and the crowding out of existing firms.[xxiv] Indirect supply-side effects occur when startups enter markets with disruptive technologies and radical innovations; there is a crowding out effect of existing firms by their new competitors, leading to declining market shares or market exits. These indirect effects, or alternatively, the failure of startups themselves, cause a contraction in employment growth across industries, and the economy.

This declining employment growth in the medium term can be expected if market mechanisms results in a 'survival of the fittest' scenario, and the produced output remains constant in the market. In this case surviving firms (both existing and startups) will produce a given amount of output more efficiently than before and as labour productivity rises, this implies less employment – the *labour-saving* effect.

### Unicorn

Over time, surviving existing firms begin to fully adapt to changes within markets, and adopt innovations commercialised by startups. Labour productivity increases induce further efficiencies, resulting in improved competitiveness in markets, more startups entering and higher economic output and growth. Economic output increases and so does job creation – from both startups and existing firms.

### A snowball effect

Placing this all together, *over the lifecycle of startups*, job creation is largely driven by increased economic growth induced by improved efficiencies, caused by competitive pressures of startups – *the indirect effect*.[63]

The employment created directly by startups is from those which survive a long enough period (in excess of four years, empirically) – *the direct effect.*

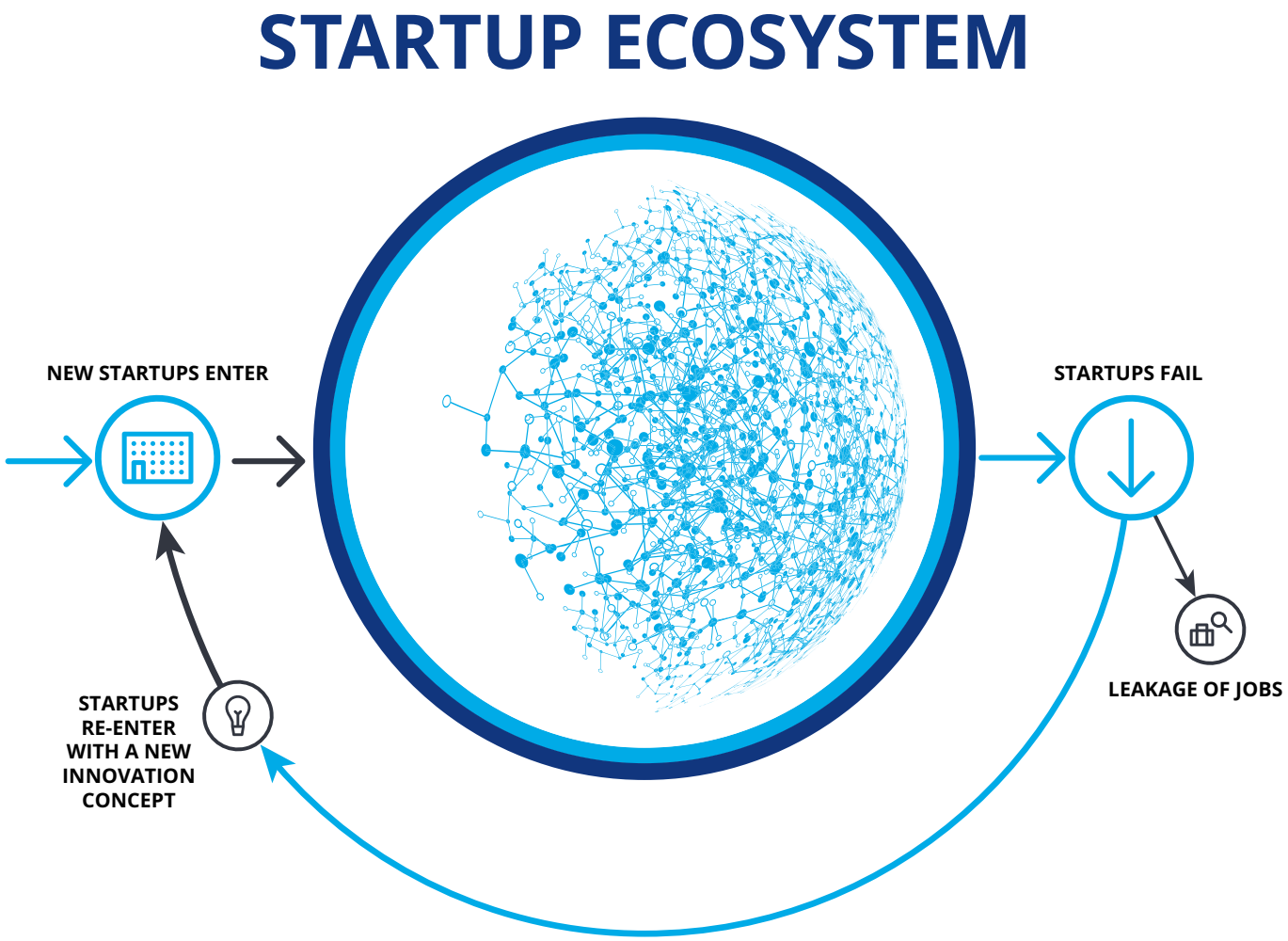
xxiv. These indirect supply-side effects could include: securing efficiency (improved efficiency within markets leads to higher output per worker), acceleration of structural change (Schumpeter's creative destruction), amplified innovation (creation of new markets), and innovative entry (increased variety of products and solutions to problems). See section 2.2 and Figure 2.3 for more detail.

This process of job creation over the lifecycle of the startup – from startup to unicorn phase – is continually repeated as new startups enter the ecosystem, and as existing startups fail (resulting in some leakage of jobs from the ecosystem but also the recycling of jobs back into the ecosystem). Throughout this process, (a net increase of) jobs are continually added to the economy – *like a snowball effect.*

Research conducted by Enrico Moretti, Professor of Economics at the University of California, Berkeley, found that where **startups are clustered**, a snowball effect generates an attractive pull, making that region more attractive for further knowledge-intensive companies and workers.[64]

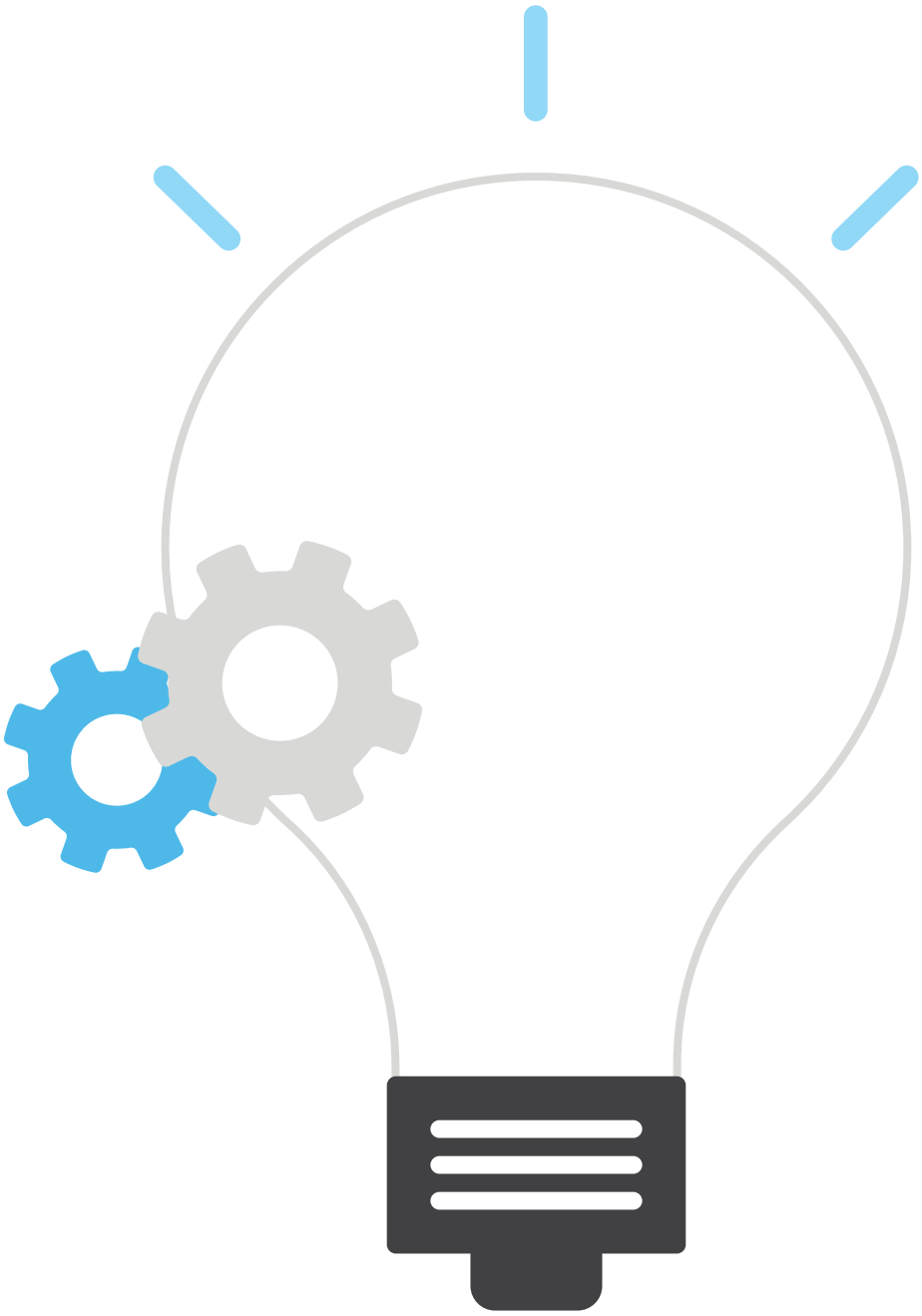
The magnitude of job creation growth, however, should depend on **quality** of startups and market processes, and not the **quantity** of startups. Quality refers to their competitiveness, and therefore the challenge they bring to existing firms in markets. For startups to create jobs, they should be started by the right people, with access to the essential resources to ensure the success of the startup, and the flow-on of market processes and efficiencies.[65]

Figure A.6 The cycle of startup entries and exits to the startup ecosystem




Source: Deloitte Access Economics

# Appendix B
## Economic modelling methodology



This Appendix provides details on the methodology and assumptions underpinning the economic modelling. Specifically, this covers:

- The process for carving out the startup industry and the mapping of LaunchVic sectors to the Australia and New Zealand Standard Industry Classification (ANZSIC) 2006 industries
- The technical specification of Deloitte Access Economics' Computable General Equilibrium Model (DAE-RGEM).

**Carving out the startup industry and ANZSIC mapping**

Deloitte Access Economics used LaunchVic's database to estimate the size of the Victorian startup industry in 2019. This database was first constructed by Dandolopartners in 2017 through their independent survey, which reached 1,137 Victorian startups. This database was subsequently updated by Dandolopartners in 2018, resulting in 2,770 startups. In 2019, Deloitte Access Economics, in collaboration with LaunchVic, adopted a modified process to update the database, which builds on previous work, while refining the classification of startups/scaleups, and employment and revenue attributable to the Victorian startup ecosystem.

A cohort of large startup/scaleups (>100 employees) were analysed, and those startups/scaleups which were not attributed to an industry were categorised for the purpose of the ANZSIC code mapping. The employment and revenue data for this cohort was also tested with CrunchBase and Owler sources and subsequently tested with LaunchVic if there was a significant variation between the database and the external sources.

Where appropriate, changes were made to the database. Specifically, the identified large startup/scaleups (>100 employees) which either: had been acquired; were founded earlier than 1995; or were removed from the database for the purposes of this report.

A similar process was undertaken for startups/scaleups that had large revenue, although the majority of this cohort was within those that had over 100 employees.

Due to data limitations, Deloitte Access Economics apportioned the economic activity (revenue and employment) of Victorian startups/scaleups using the following assumptions:

1. For startups, all economic activity recorded in the database was deemed attributable to Victoria

   This assumption was adopted under the belief that once a startup establishes themselves in Victoria, the economic activity generated from this startup is attributable to the Victorian economy. Therefore, it is assumed that only when a startup begins to scale up and expand its operation to new regions, that a portion of its economic activity is attributable to regions outside of Victoria.

   Assumption 1 is expected to reflect the activity of the vast majority of startups, however, it is acknowledged that this assumption may attribute a small proportion of economic activity that occurred in other regions to Victoria. This portion of activity is not expected to be significant and the conservative approach adopted in Assumption 2, is expected to offset this small impact.

2. For scaleups, economic activity was apportioned using the Victorian industries (mapped to ANZSIC codes) share of the national industry in value added terms

   In the absence of having access to data from each scaleup which states the proportion of their economic activity that occurs in Victoria, alternative measures were adopted. For the purpose of this study, Deloitte Access Economics has applied the portion that each Victorian industry contributes to the national industry in value added terms to scaleups that operate within each of these industries.

   After data cleaning and the adoption of the above assumptions, the resulting database is expected to be a conservative reflection of the direct economic activity induced by the Victorian startup ecosystem.

   The database now details close to 1,670 startups[xxv] across Victoria was provided by LaunchVic, which was used to inform the size of the startup industry. This database categorised the startups into 16 different sectors and included revenue and employment estimates.

As revenue and employment data was not available for the entire list of startups, this was extrapolated based on average revenue and employment figures for each sector (see Table B.1):

- The average revenue across all sectors was $3.6 million based on data from 575 businesses (representing approximately 35% of the total cohort). The average revenue by sector was then used to extrapolate the revenue for the businesses where data was not available. An adjustment was then made to reflect that an estimated 21.5% of the businesses do not earn revenue (Dandolopartners, 2018). Based on these calculations, the revenue of the Victorian startup industry is estimated to be in the order of $4.6 billion in 2019.
- The average employment across all sectors was 14 employees based on data from 1,368 businesses (representing over 80% of the total cohort). As the employment data represented roughly 80% of the cohort, it was assumed that the remaining businesses employed only one person. Following this approach, it is estimated that the startup industry in Victoria employs around 18,900 jobs in 2019.

xxv. It is worth noting that the number of startups in Victoria, which was previously estimated at 2,770, was revised down by LaunchVic since the Victorian Startup Ecosystem Mapping Report (Dandolopartners, 2018).

Table B.1 Average revenue and employment per startup by LaunchVic sector

| LaunchVic sector | Average revenue ($m) | Average employment |
|---|---|---|
| Agriculture | 1.8 | 8 |
| Commerce Shopping | 4.7 | 13 |
| Defence | - | - |
| Education | 2.9 | 15 |
| Energy | 3.1 | 15 |
| Enterprise | 4.4 | 20 |
| Financial Services | 4.9 | 20 |
| Hardware Manufacturing | - | - |
| Health | 3.6 | 11 |
| IT Digital Technologies | 2.8 | 11 |
| Media Creative Industries | 3.0 | 10 |
| Property Construction | 3.3 | 11 |
| Space Technologies | - | - |
| Sport Recreation | 1.6 | 16 |
| Transportation Logistics | 1.6 | 8 |
| Travel Tourism | 6.6 | 16 |
| **Total** | **3.6** | **14** |

Source: LaunchVic, 2019
Note: average revenue and employment for defence, hardware manufacturing and space technologies are not presented due to insufficient sample sizes. The total average revenue and employment includes those that startups that were not categorised under a sector.

For the purposes of identifying the startup industry in the model, it was necessary to map the LaunchVic sectors (described in Chapter 4.1) to ANZSIC 2006 industries at the 1 Digit level (see Table B.2). This exercise was undertaken at the sector level, where the most appropriate ANZSIC industry representing the sector was selected.

It should be noted that while in some cases the LaunchVic startup sectors includes activity from a number of ANZSIC industries, the approach simplifies this to select the primary industry, or the industry that is considered to be the most representative. As a result, this may result in some under or overrepresentation of certain industries. However, it is noted that the results of the mapping appear to be reasonable based on a priori expectations considering the composition of industries (see Chart 4.1 and Chart 4.2 in Chapter 4.2).

Table B.2 LaunchVic to ANZSIC mapping

| LaunchVic sector | ANZSIC 2006 |
|---|---|
| Agriculture | Agriculture, Forestry and Fishing |
| Commerce Shopping | Retail Trade |
| Defence | Public Administration and Safety |
| Education | Education and Training |
| Energy | Electricity, Gas, Water and Waste Services |
| Enterprise | Professional, Scientific and Technical Services |
| Financial Services | Financial and Insurance Services |
| Hardware Manufacturing | Manufacturing |
| Health | Health Care and Social Assistance |
| IT Digital Technologies | Information Media and Telecommunications |
| Media Creative Industries | Information Media and Telecommunications |
| Property Construction | Construction |
| Space Technologies | Manufacturing |
| Sport Recreation | Arts and Recreation Services |
| Transportation Logistics | Transport, Postal and Warehousing |
| Travel Tourism | Arts and Recreation Services |

Source: Deloitte Access Economics

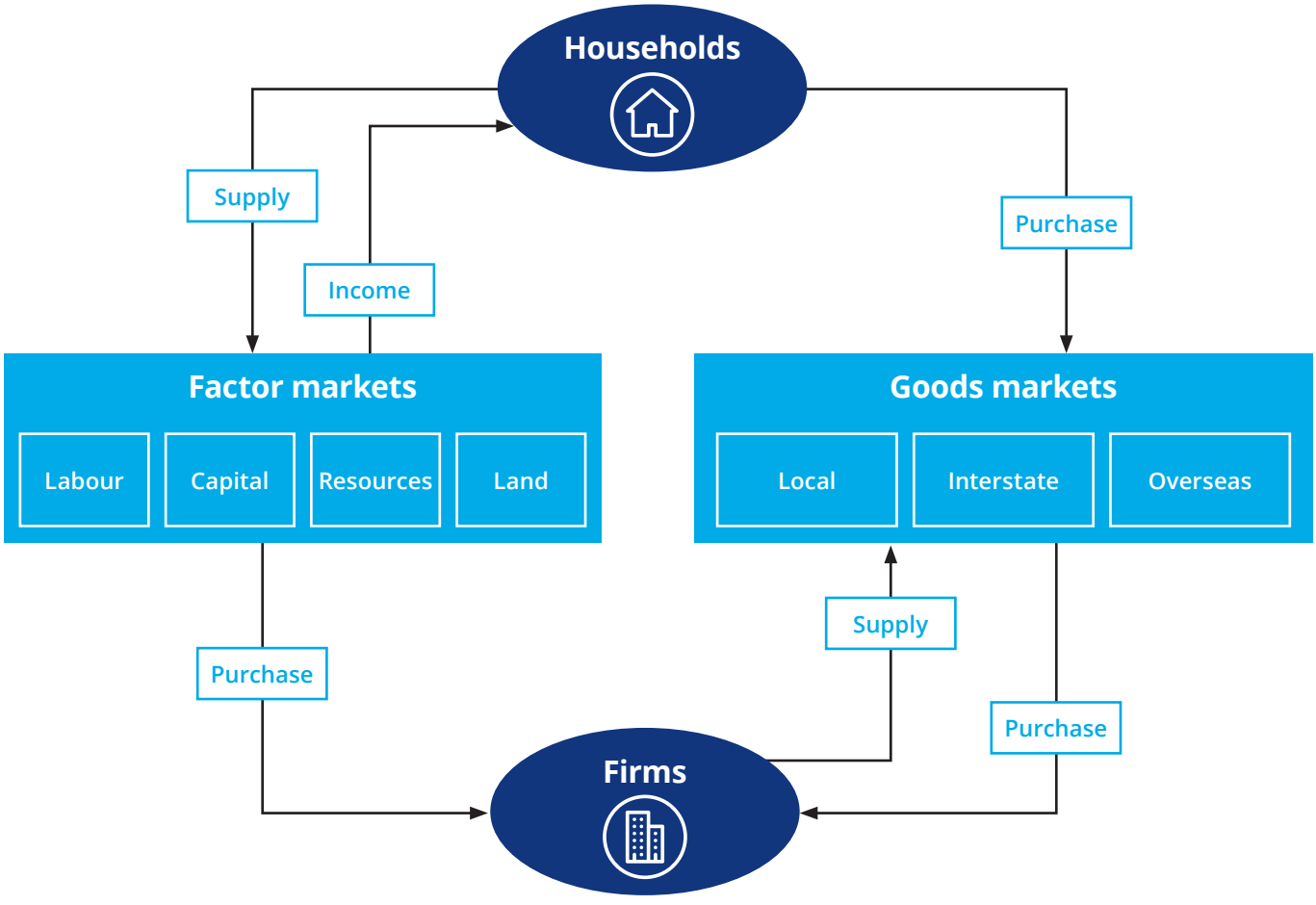
### CGE modelling methodology

Computable general equilibrium (CGE) modelling is a framework that is well suited to modelling the impact of large projects or policies on the economy. In this framework, it is possible to account for resourcing constraints and opportunity costs, and to model changes in prices and the behaviour of economic agents in response to changes in the economy.

This project has used the Deloitte Access Economics regional general equilibrium model (DAE-RGEM). This is a model of the Australian and world economy, and represents the interaction of households and firms with factor markets and goods markets over time. DAE-RGEM represents all economic activity in the economy, including production, consumption, employment, taxation and trade.

The circular flow of income and spending that occurs in DAE-RGEM is captured in a stylised form in Figure B.1. To meet demand for products, firms purchase inputs from other producers and hire factors of production (labour and capital). Producers pay wages and rent (factor income) which accrue to households. Households spend their income on goods and services, pay taxes and put some away for savings.

Figure B.1 Stylised diagram of DAE-RGEM




Source: Deloitte Access Economics

For this project, the CGE model has been customised to represent the Victorian state economy and capture the startup industry, along with relevant upstream and downstream industries. To identify these in the model, the ANZSIC industries are mapped to Global Trade Analysis Project (GTAP) industries. The full list of modelled industries includes:

- Agriculture, forestry and fishing
- Mining
- Food processing
- Other manufacturing
- Trade (including wholesale and retail)
- Transport
- Utilities (including electricity, gas, water and waste services)
- Construction
- Startups
- Information media and telecommunications
- Finance and insurance services
- Business and other professional services (including professional, scientific and technical services)
- Health and social assistance
- Other government services (including public administration and defence)
- Other services (including recreation and other services).

As the startup sector includes activity across a range of industries, when identifying this in the model, the startup related activity was partitioned out from the industries above (where relevant). For example, the startup industry above includes the economic activity associated with startups in the information media and telecommunications industry, while the remaining activity in the information media and telecommunication industry relates to the non-startup related activity. A similar approach was taken for other industries to specify the startup industry in the model.

**Theory of DAE-RGEM**

The Deloitte Access Economics regional general equilibrium model (DAE-RGEM) is a large scale, dynamic, multi-region, multi-commodity computable general equilibrium model of the world economy with bottom up modelling of Australian regions. The model allows policy analysis in a single, robust, integrated economic framework. This model projects changes in macroeconomic aggregates such as GDP, employment, export volumes, investment and private consumption. At the sectoral level, detailed results such as output, exports, imports and employment are also produced.

The model is based upon a set of key underlying relationships between the various components of the model, each of which represent a different group of agents in the economy. These relationships are solved simultaneously, and so there is no logical start or end point for describing how the model actually works. However, they can be viewed as a system of interconnected markets with appropriate specifications of demand, supply and the market clearing conditions that determine the equilibrium prices and quantity produced, consumed and traded.

DAE-RGEM is based on a substantial body of accepted microeconomic theory. Key assumptions underpinning the model are:

- The model contains a 'regional consumer' that receives all income from factor payments (labour, capital, land and natural resources), taxes and net foreign income from borrowing (lending).
- Income is allocated across household consumption, government consumption and savings so as to maximise a Cobb-Douglas (C-D) utility function.
- Household consumption for composite goods is determined by minimising expenditure via a CDE (Constant Differences of Elasticities) expenditure function. For most regions, households can source consumption goods only from domestic and imported sources. In the Australian regions, households can also source goods from interstate. In all cases, the choice of commodities by source is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption for composite goods, and goods from different sources (domestic, imported and interstate), is determined by maximising utility via a C-D utility function.
- All savings generated in each region are used to purchase bonds whose price movements reflect movements in the price of creating capital.
- Producers supply goods by combining aggregate intermediate inputs and primary factors in fixed proportions (the Leontief assumption). Composite intermediate inputs are also combined in fixed proportions, whereas individual primary factors are combined using a CES production function.
- Producers are cost minimisers, and in doing so, choose between domestic, imported and interstate intermediate inputs via a CRESH production function.
- The supply of labour is positively influenced by movements in the real wage rate governed by an elasticity of supply.
- Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. A global investor ranks countries as investment destinations based on two factors: global investment and rates of return in a given region compared with global rates of return. Once the aggregate investment has been determined for Australia, aggregate investment in each Australian sub-region is determined by an Australian investor based on: Australian investment and rates of return in a given sub-region compared with the national rate of return.

- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.
- Prices are determined via market-clearing conditions that require sectoral output (supply) to equal the amount sold (demand) to final users (households and government), intermediate users (firms and investors), foreigners (international exports), and other Australian regions (interstate exports).
- For internationally-traded goods (imports and exports), the Armington assumption is applied whereby the same goods produced in different countries are treated as imperfect substitutes. But, in relative terms, imported goods from different regions are treated as closer substitutes than domestically-produced goods and imported composites. Goods traded interstate within the Australian regions are assumed to be closer substitutes again.
- The model accounts for greenhouse gas emissions from fossil fuel combustion. Taxes can be applied to emissions, which are converted to good-specific sales taxes that impact on demand. Emission quotas can be set by region and these can be traded, at a value equal to the carbon tax avoided, where a region's emissions fall below or exceed their quota.

What follows is a description of each component of the model and key linkages between components.

**Households**

Each region in the model has a so-called representative household that receives and spends all income. The representative household allocates income across three different expenditure areas: private household consumption; government consumption; and savings.

The representative household interacts with producers in two ways. First, in allocating expenditure across household and government consumption, this sustains demand for production. Second, the representative household owns and receives all income from factor payments (labour, capital, land and natural resources) as well as net taxes. Factors of production are used by producers as inputs into production along with intermediate inputs. The level of production, as well as supply of factors, determines the amount of income generated in each region.

The representative household's relationship with investors is through the supply of investable funds – savings. The relationship between the representative household and the international sector is twofold. First, importers compete with domestic producers in consumption markets. Second, other regions in the model can lend (borrow) money from each other.

- The representative household allocates income across three different expenditure areas – private household consumption; government consumption; and savings – to maximise a Cobb-Douglas utility function.
- Private household consumption on composite goods is determined by minimising a CDE (Constant Differences of Elasticities) expenditure function. Private household consumption on composite goods from different sources is determined is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption on composite goods, and composite goods from different sources, is determined by maximising a Cobb-Douglas utility function.
- All savings generated in each region is used to purchase bonds whose price movements reflect movements in the price of generating capital.

### Producers

Apart from selling goods and services to households and government, producers sell products to each other (intermediate usage) and to investors. Intermediate usage is where one producer supplies inputs to another's production. For example, coal producers supply inputs to the electricity sector.

Capital is an input into production. Investors react to the conditions facing producers in a region to determine the amount of investment. Generally, increases in production are accompanied by increased investment. In addition, the production of machinery, construction of buildings and the like that forms the basis of a region's capital stock, is undertaken by producers. In other words, investment demand adds to household and government expenditure from the representative household to determine the demand for goods and services in a region.

Producers interact with international markets in two main ways. First, they compete with producers in overseas regions for export markets, as well as in their own region. Second, they use inputs from overseas in their production.

- Sectoral output equals the amount demanded by consumers (households and government) and intermediate users (firms and investors) as well as exports.
- Intermediate inputs are assumed to be combined in fixed proportions at the composite level.
- To minimise costs, producers substitute between domestic and imported intermediate inputs is governed by the Armington assumption as well as between primary factors of production (through a CES aggregator). Substitution between skilled and unskilled labour is also allowed (again via a CES function).
- The supply of labour is positively influenced by movements in the wage rate governed by an elasticity of supply is (assumed to be 0.2). This implies that changes influencing the demand for labour, positively or negatively, will impact both the level of employment and the wage rate. This is a typical labour market specification for a dynamic model such as DAE-RGEM. There are other labour market 'settings' that can be used. First, the labour market could take on long-run characteristics with aggregate employment being fixed and any changes to labour demand changes being absorbed through movements in the wage rate. Second, the labour market could take on short-run characteristics with fixed wages and flexible employment levels.

### Investors

Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. The global investor ranks countries as investment destination based on two factors: current economic growth and rates of return in a given region compared with global rates of return.

- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.

### International

Each of the components outlined above operate, simultaneously, in each region of the model. That is, for any simulation the model forecasts changes to trade and investment flows within, and between, regions subject to optimising behaviour by producers, consumers and investors. Of course, this implies some global conditions that must be met, such as global exports and global imports, are the same and that global debt repayment equals global debt receipts each year.

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# Contact us

**Dr Pradeep Philip**
Partner,
Head of Deloitte Access Economics
**(07) 3308 7224**
**pphilip@deloitte.com.au**

**Daniel Terrill**
Partner,
Deloitte Access Economics

**Claire Atkinson**
Associate Director,
Deloitte Access Economics
**(07) 3308 1249**
**catkinson@deloitte.com.au**

**Emily Hayward**
Senior Economist,
Deloitte Access Economics

**Nathan Brierley**
Senior Economist,
Deloitte Access Economics

**Mairead Davis**
Economist,
Deloitte Access Economics

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Deloitte.

Deloitte Access Economics
ACN: 149 633 116
Level 23, Riverside Centre
123 Eagle St
Brisbane QLD 4000

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