

Chapter 1

Key innovation concepts

An innovation system is an open network of organisations that interact with each other and operate within framework conditions that regulate their activities and interactions. It is the implementation of an idea that separates knowledge and invention from innovation. The Department of Industry, Innovation and Science has been collaborating with Australian Bureau of Statistics, the University of Technology Sydney and other institutions to provide new insights on the characteristics and performance of Australia's innovation system.

1.1 Defining innovation

The term **innovation** conjures up different images, associations and meanings, depending on your background or experience.

Business innovation is a new idea or path that is applied practically to create or capture value in a market. Innovation could start with ‘How do I increase my market share?’, ‘How can my business model be more cost effective?’ or ‘How can I reduce my environmental footprint?’ Innovation can be either proactive or reactive.

Innovation is about market experimentation. It involves the acceptance, or at least tolerance, of uncertainty and the risk of failure, on the basis that valuable learning will also come from failure. The collective effect of each individual innovation activity and project is progress itself, the pace of which is determined by how well these innovative activities help find practical solutions to real world problems.

In a market economy like Australia’s, once solutions are discovered or invented they find applications across a range of new or improved goods and services. In economic terms, this application manifests in expanded aggregate production and consumption opportunities.

To systematically compare Australia with other countries, we have adopted an internationally recognised and widely adopted business-level definition of business innovation (Definition 1.1) from the OECD/Eurostat Oslo Manual (Methodology 1.1).

Definition 1.1: Oslo Manual definition of innovation

Innovation is the implementation of a new or significantly improved product (good or service), process, new marketing method or a new organisational method in business practices, workplace organisation or external relations.²

Given this definition, innovation is more than just generating novel ideas or disseminating knowledge. This aspect of innovation, implementation, is crucial, as only those novel ideas that are implemented can lead to economic and social progress. It is implementation that separates knowledge and invention from innovation.¹

Figure 1.1 gives a stylised visual guide to the innovation cycle. Often innovation is described as a process where ideas are translated into a commercial opportunity through investment and market experimentation. Some of the profits are then re-invested into idea generation. These ideas can come from many places, not just from within the business itself. Competitors, customers, suppliers, researchers and others can all trigger innovation.

When measuring innovation activity in the business enterprise sector, the focus is on the proportion of businesses that are innovation-active. Innovation-active businesses are those that undertook any innovative activity (Definition 1.3) during the reference period, including any type of innovation introduced to the market and/or any innovation projects that were either still in development or abandoned.

1.2 Defining the innovation system

Most definitions of innovation systems include three fundamental elements: (1) networks of people and organisations; undertaking (2) innovation-related activities; within (3) an institutional and cultural environment.³ Reflecting this practice, this report adopts the following definition:

Definition 1.2: The innovation system

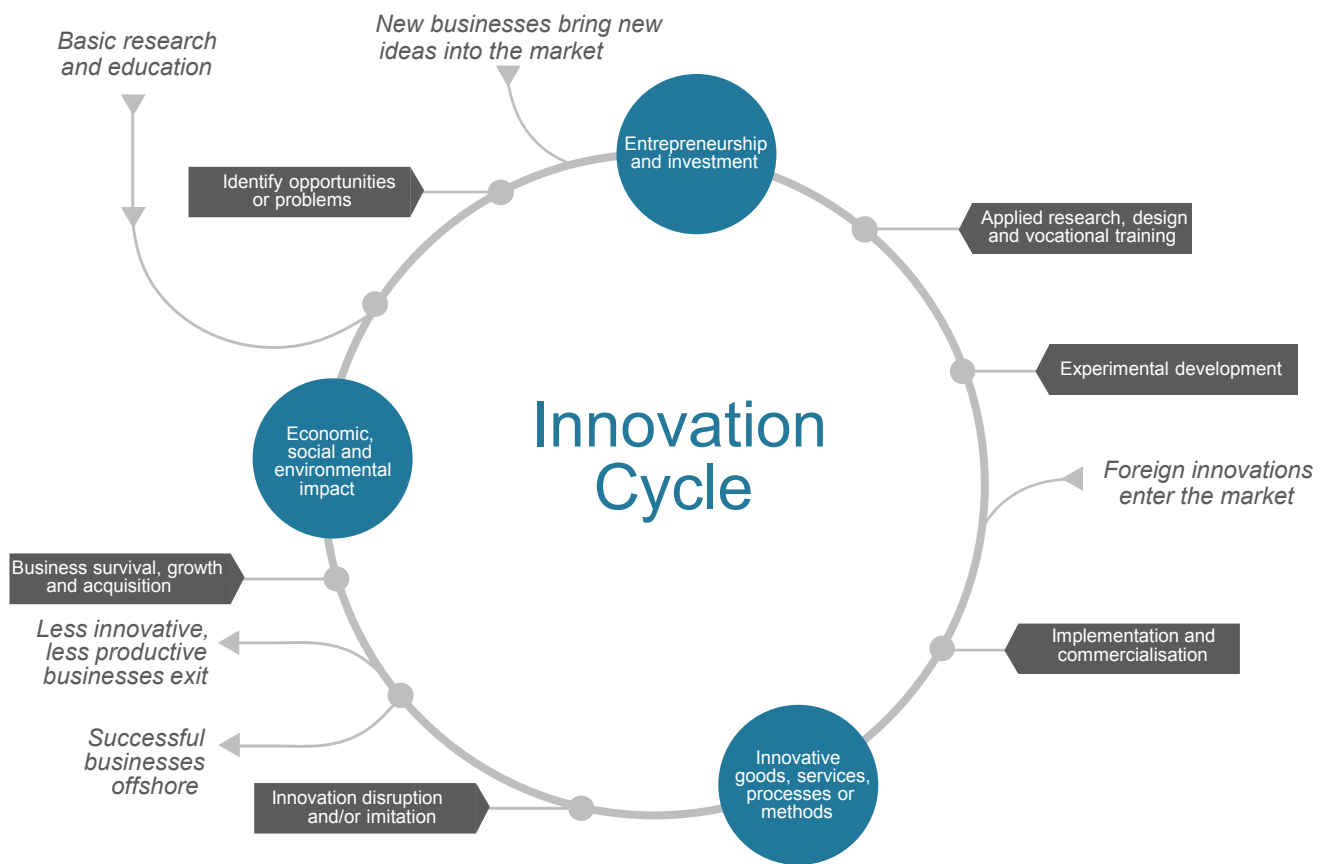
An innovation system is an open network of organisations that interact with each other and operate within framework conditions that regulate their activities and interactions.

These three components of the innovation system — innovation activities, networks and framework conditions — collectively function to produce and diffuse innovations that have, in aggregate, economic, social and/or environmental value.

Innovation activities are the discrete activities that lead to discoveries that have commercial potential, such as R&D, entrepreneurial activity, innovation funding (e.g. venture capital), or the training of scientists and engineers in tertiary education. Because innovation activities are performed across all sectors of the economy (public, private and not-for-profit), the focus on activities emphasises what is done in an innovation system, rather than who does it.

Networks refer to formal or informal linkages between people and organisations in the innovation system, including communities of practice (such as medical professionals and software developers), joint research arrangements, industry-research collaboration and public procurement of private sector research outputs. The strength and quality of these linkages enable coordination of resources and activities between parts of the innovation system.

Figure 1.1: The innovation cycle



Source: Department of Industry, Innovation and Science (2016)

Methodology 1.1: The Oslo Manual

The Oslo Manual is an international source of guidelines for collecting and using data on innovation activities in industry. The first version of the Oslo Manual, issued in 1992, and the surveys undertaken using it, demonstrated the viability of collecting data on innovation.

Successive editions of the manual updated the original framework of concepts, definitions and methodologies to incorporate survey experience and improved understanding of the innovation process, and also to take in a wider range of industries such as services.

The third edition, published in 2005, expanded on the innovation measurement framework in three important ways. First, greater emphasis was given to the role of linkages with other businesses and institutions in the innovation process. Second, it recognised that innovation is important in less R&D-intensive industries, such as services and low-technology manufacturing. Third, the definition of innovation was expanded to include two additional types of innovations — organisational innovation and marketing innovation.

The Oslo Manual is currently being updated and revised by the OECD. The Department of Industry, Innovation and Science and the Australian Bureau of Statistics (ABS) have been advocating for the OECD to improve international comparability, include new forms of business model innovation, improve the measurement of environmental and social innovation, and develop new methods for harmonising measures of management capability.

The third edition of the Oslo Manual can be found [here](#).⁴

Framework conditions refer to the institutional environment and general conditions for innovation activities, networks and collaboration. These conditions comprise the practices, rules and conventions that collectively regulate the behaviour of actors in the system and encourage or discourage innovation activity. Examples of framework conditions include the tax treatment of research and development (R&D), trade tariffs and industry technology standards, entrepreneurship culture, and attitudes towards risk.

Framework conditions reflect the history of an innovation system in action, and their state at a particular point in time can either impede the momentum of the innovation cycle or accelerate it.

The literature emphasises that innovation systems are a product of history, and are embedded in a particular industrial structure and institutional environment. Since each sectoral, regional or national innovation system evolves independently with its own set of rules, practices and cultures, no two systems are identical, and therefore there is no optimal or ideal system to be compared to. Each innovation system is like an experiment. The only way of knowing if Australia is performing well or not is to compare Australia's performance with other countries on each indicator (Methodology 1.2).

1.3 The evolution of innovation indicators

Historically, there have been two main sources of innovation indicators: the OECD's Frascati and Oslo Manuals. The Frascati Manual⁵ provides guidelines for collecting and interpreting R&D data, and the Oslo Manual does the same for innovation data.

The OECD has been the leading organisation promoting development of the innovation indicators. Through its key publications and research projects, the OECD has made international comparisons of hundreds of indicators publicly available and helped member countries build the necessary data infrastructure.

One important example of this is the development of the Business Longitudinal Analytical Data Environment (BLADE; section 2.6). The development of the BLADE by the ABS and the Department of Industry, Innovation and Science was necessary for Australia to participate in the OECD's project, Dynamics of Employment and Micro Drivers of Productivity.

Methodology 1.2: A systems approach to innovation indicators

Defining, measuring and comparing innovation systems present conceptual challenges, as there is no ideal or optimal innovation system model.

We use a mix of quantitative (indicator based) and qualitative (case study based) methods to present a picture of the system and its impact. Each concept (for example, collaboration) will have a range of indicators that show Australia's relative strengths and weaknesses. We focus on the most robust, trusted data (usually from the ABS or OECD) for policy purposes. We also use complementary indicators that either reinforce or challenge our more robust datasets.

International comparisons for each indicator are presented as part of a systems approach to measuring innovation. There are some challenges with making these comparisons. Unlike Australia, many other OECD countries' national survey instruments for measuring business innovation are not mandatory, leading to variable coverage and low response rates.⁶ This may have the effect of skewing other country data towards the most innovative businesses that are motivated to report their innovative activities.

Most Australian innovation data is compiled according to fiscal years, while OECD data is compiled according to calendar years. In this report, the performance of the Australian innovation system in a fiscal or calendar year is compared with the previous corresponding period unless stated otherwise.

It is also not possible to adjust for industrial structure for every indicator and every sector (Methodology 3.1). Further analysis is required to consider how differences in innovation between Australia and other OECD countries might be explained by differences in industrial structure.



New innovation data

To continue meaningful and timely analyses of the Australian innovation system, the Office of the Chief Economist (OCE) at the Department of Industry, Innovation and Science collaborated with the ABS and the Australian Innovation Research Centre at the University of Tasmania to develop a suite of new innovation questions (Methodology 1.3 and feature article, 'Innovating the innovation indicators'). Three of these questions were taken up by the ABS in the Business Characteristics Survey (BCS; see Methodology 1.3 and 1.4). Throughout the report we present results from this 'new generation' of innovation indicators.

We have also created and published an Innovation Insights Database, which collects input, output and outcome indicators of Australia's innovation system using a wide range of publicly available sources.

We are able to combine existing data to create new insights or new indicators (Methodology 1.4). The BLADE provides the data environment that enables new indicators that integrate innovation characteristics and administrative data on business performance. A number of these new indicators are cited throughout the report.

Methodology 1.3: Three new or significantly improved questions in the Business Characteristics Survey

1. Innovation frequency
 - The number of new or significantly improved goods or services introduced
 - The number of new or significantly improved operational processes introduced
 - The number of new or significantly improved organisational/managerial processes introduced
 - The number of new or significantly improved marketing methods introduced
2. Innovation investment
 - Greater innovation expenditure ranges and a new percentage allocation against different types of expenditure.
 - Additional innovation expenditure options:
 - Re-organisation of existing business models, work practices and decision-making processes
 - Other labour costs related to the development or introduction of new goods, services, processes or methods
3. Innovation impact
 - The percentage of income that resulted from new or significantly improved goods or services introduced

Definition 1.3: Types of innovation

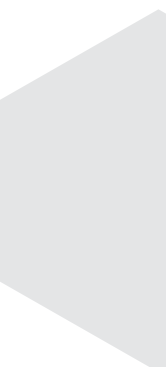
Product innovation is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness, or other functional characteristics.

Process innovation is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.

Marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion, or pricing.

Organisational innovation is the implementation of a new organisational method in the business' business practices, workplace organisation, or external relations.

Source: OECD (2005) Glossary of statistical terms





Methodology 1.4: Creating novel innovation indicators using the Business Characteristics Survey

The AIS Reports rely on the Business Characteristics Survey (BCS), an annual survey administered by the ABS. The BCS is financially supported each year by the Department of Industry, Innovation and Science. The OCE collaborates with the ABS on the ongoing improvement of the BCS. Several new approaches and indicators discussed in this year's report flow from this collaboration.

The BCS is the vehicle for the ABS' Integrated Business Characteristics Strategy, which integrates the collection and quality assurance of data required for input into the ABS' Business Longitudinal Database. The BCS also produces point-in-time estimates for the use of information technology, innovation, and a broad range of other non-financial characteristics.

Approximately 7,000 businesses are randomly sampled using an online questionnaire, which is stratified by industry and employment. The sampling methodologies for the BCS are standard statistical practice and in line with other economic surveys in Australia and the OECD. All businesses on the Australian Business Register identified as having 300 or more employees are included in the sample. The ABS then uses the sample to estimate the activity of the entire employing business population.

A key part of the BCS is a detailed set of questions on business innovation, which are asked every

second year. This is why some business innovation data presented in this report is only available every second year. The detailed survey includes questions on drivers, sources of ideas, and collaboration for innovation.

These detailed questions on innovation, and the broader BCS questions on markets and business performance, have allowed the department to undertake detailed analysis of the impact and nature of innovation in Australia, as well as constructing novel, customised innovation indicators. For example, by cross-tabulating business financial indicators with innovation questions, we get Figure 2.8. Any chart in this report that cites 'ABS customised data' is an example of this.

The BCS is a relatively small sample of businesses in Australia. It is not a census. This means that when we try to evaluate the performance of small sectors of the economy, the quality of the insights can be poor because of sampling errors or unavailable data due to confidentiality restrictions. This has historically limited our ability to accurately measure the contribution of innovation to economic or productivity growth — a perennial question for policy makers. To develop robust economic policies, at some point Australia needs to measure innovation across all economically active businesses. We suggest that this be done through business income tax collection once every five to ten years.



Feature article: Innovating the innovation indicators

Kieran O'Brien and Anthony Arundel

In 2015, the Australian Innovation Research Centre (AIRC) at the University of Tasmania undertook a pilot survey of Australian businesses to gather new data on the frequency, cost and impacts of different types of business innovation activity in Australia. The project was a collaboration between the AIRC; the Department of Industry, Innovation and Science; and the Australian Bureau of Statistics. The objectives of the study were to:

- determine if useful, high-quality data could be collected from Australian businesses on the frequency, costs and impacts of their innovative activities.
- determine if new survey questions on these topics could provide useful data for businesses, governments and researchers.

In the pilot survey, mailed and online questionnaires were sent to a random sample of 1,600 Australian businesses in all industries except for Public administration and safety, Education and training, and Financial asset investing and superannuation. Survey questions covered business innovation activities in the 2014 calendar year (ended 31 December 2014). Of the 1,600 businesses in the study sample, 359 completed the questionnaire, giving a response rate of 22.4 per cent. The distribution of businesses by industry is very similar for both the 359 participating businesses and the full sample of 1,600 businesses. Consequently, the industries in scope are well represented in the results.

Our report assesses 20 new indicators and analyses the results of a pilot survey using these questions. The full report can be found [here](#).⁷

Results from these questions offer improved understanding of the frequency, costs and impacts of innovation in Australian businesses.

Innovation investments

Investment in innovation can be measured by the expenditures that businesses make to develop and implement any innovations. Innovation investment can include external expenditures on 'tangible' items such as new equipment, machinery or technology; or purchases of 'intangible' items such as research, consulting or design services, technology licences or patents.

Alternatively, internal innovation investments include expenses on development activities within the business, such as for staff training or in-house software development.

For the majority of businesses (52 per cent), their expenditures on external activities for innovation were greater than their internal expenditures. In the survey, total reported expenditure on all external activities for innovation was approximately \$1.8 billion in 2014. The vast majority of total external expenditure (88 per cent) was for purchasing new machinery, equipment or technology for innovation (Figure 1.2). This was followed by purchases of design, marketing or training services from other organisations (10 per cent of total external investment). Purchases of licenses and external research services accounted for only 2 per cent of the total.

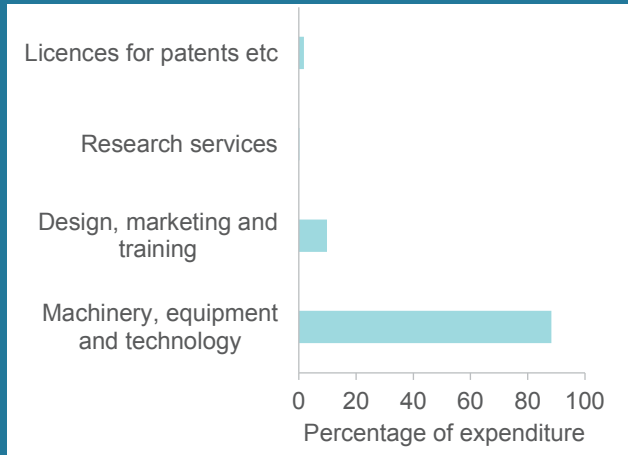
Innovation management planning

The survey asked businesses whether they had an innovation management plan or policy in 2014, and what the contents of that plan covered. Of all responding businesses (including innovators and non-innovators), 33 per cent reported having an innovation management plan/policy in 2014. However, only 10 per cent reported that their plan was documented in a written format. Relatively few business innovation plans (36 per cent) included a method for rewarding individuals or teams involved in successful innovations.

Though not shown here, more detailed analysis of these results showed that businesses with a written innovation management plan were more likely than those without a plan to have higher reported innovation sales.

An active innovation management plan is one way to help shape the direction and success of different innovation activities and strategies, and the results suggest potential for further formal innovation management in Australian businesses.

Figure 1.2: Total expenditures on external activities for innovation, 2014



Source: O'Brien K, Arundel A and Butchart DB (2015) *New evidence on the frequency, impacts and costs of activities to develop innovations in Australian businesses: Results from a 2015 pilot survey*, Hobart, University of Tasmania and Australian Innovation Research Centre

Most important innovations for Australian businesses

Innovative businesses were asked to identify the single innovation introduced in 2014 that was most important for the financial position of the business. This question provides a new measure of the impact of different types of innovation on business performance.

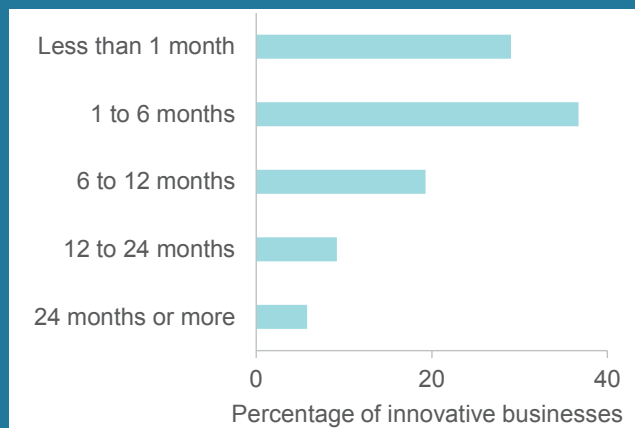
For 47 per cent of respondents, the most important innovation in 2014 was an operational process innovation, while 31 per cent cited an organisational or managerial process innovation as most important. Innovative goods were the least common, cited by only 14 per cent of respondents. Of note, innovative services were cited more than twice as often (28 per cent) as innovative goods. This is because considerably more respondent businesses are in services than in manufacturing, which reflects the structure of the Australian economy.

The high frequency of process innovations (operational or organisational) indicates that many Australian businesses obtain greater financial benefits from efficiency and quality improvements than from product (goods and services) innovations.

The survey also asked innovative businesses to estimate the number of person-months required to develop and implement their single most important innovation in 2014.^(a) The results provide an indication of the scale of innovation projects, the speed of implementation, and the costs associated with those innovations that had the most impact in Australian businesses.

Figure 1.3 shows that 66 per cent of innovative businesses report a development time of less than 6 person-months. Furthermore, 29 per cent of businesses report a development time of less than 1 person-month. These results partly reflect the small number of employees in many respondent businesses, but also demonstrate that small, incremental innovations have important outcomes for many businesses in Australia.

Figure 1.3: Person-months required to develop most important innovation in 2014



Source: O'Brien K, Arundel A and Butchart DB (2015) *New evidence on the frequency, impacts and costs of activities to develop innovations in Australian businesses: Results from a 2015 pilot survey*, Hobart, University of Tasmania and Australian Innovation Research Centre

^(a) A person-month is the share of a full-time employee's time spent on development or introduction activities. For example, two employees working half-time for one month would equal one person-month.

Methodology 1.5: The Management Capability Survey

The role of management and leadership in driving innovation, investment, performance, collaboration and the building of business capability is increasingly recognised. Recent empirical work on US businesses suggests that one quarter of cross-country and within-country total factor productivity gaps can be attributed to management practices.⁸

The Management Capability Survey (MCS) is an ambitious project that aims to expand understanding of Australia's business management performance. The MCS is a collaboration between the OCE, the ABS, the University of Technology Sydney (UTS) and Stanford University (USA).

The MCS will sample over 15,000 businesses from all sectors of the economy and all classes of business size. The MCS will develop a comprehensive management dataset, covering all sectors of the Australian economy. The survey will include questions on performance monitoring, target setting, incentives/people management and strategic planning and management. The survey is targeted at CEOs and business owners rather than a range of managers within a business.

The project aims to:

- provide improved capability and understanding of organisational and strategic management capability in businesses across the Australian economy.
- deliver rigorous analysis of management capability and its importance to productivity and economic growth.
- provide data that allows for rigorous evaluation of industry programmes that focus on management capability, such as the Industry Growth Centres and the Entrepreneurs Programme.
- benchmark Australia's business management capability against other countries.

Results from the MCS will be released by the ABS in mid-2017. The OCE will be linking the management capability results to the BLADE to determine the impact of management capability on business financial performance and broader economic and productivity growth. Results are expected in mid-2017, and will be published on the ABS and OCE websites (www.industry.gov.au/innovationreport).



Feature article: theSPACE

Author Troy Haines
CEO, theSPACE, Australasia



In regions such as Cairns, Queensland, we experience similar challenges to other regional areas in Australia. The challenges of high unemployment, fading traditional industries, a lack of economic diversity, and a ‘brain drain’ of talent to urban centres all highlight the need for novel economic development strategies. Innovation and entrepreneurship are highlighted as potential solutions, but both require knowledge and support to be successful.

TheSPACE is Far North Queensland’s innovation and start-up hub. By studying models developed abroad, such as in Boulder and Silicon Valley, and through our own experiences and assessments of regional entrepreneurs, we identified the following key ingredients of a start-up and innovation ecosystem:

1. **Culture:** It is essential to develop an entrepreneurial culture among all stakeholders within a region.⁹ Small businesses differ from start-ups and stakeholders need to understand the ‘scalability’ and ‘innovation’ required for a start-up to deliver the growth required for economic development.
2. **Champion(s):** An ecosystem needs a champion or a team of champions to provide a driving force, and to keep stakeholders focused and moving forward on an ongoing basis. Ideally, champions benefit from the ecosystem as entrepreneurs, but also develop it for the benefit of the broader community.
3. **Stakeholder engagement:** In a regional context, the saying ‘it takes a village to raise a start-up’ is particularly relevant. Key stakeholders in a region include local, state, and federal governments;

service providers (e.g. accountants, lawyers and consultants); educational and research institutions; mentors; investors; media; and, most importantly, entrepreneurs.

4. **Process:** To build capacity in a region, there must be a clear process (or runway) that will lead entrepreneurs from idea to commercialisation to exit, and provide the necessary support services along the way.¹⁰
5. **Physical space and events:** Entrepreneurs benefit from the availability of co-working spaces, which become a means of sharing information and knowledge, building a community, and fostering the necessary culture.

Some recommendations for others wishing to build a sustainable regional start-up and innovation ecosystem are:

1. **Recognise that building an ecosystem takes more than just funding an accelerator or incubator:** Ecosystem building requires a cultural shift where failure is celebrated, tall poppies are encouraged, and global entrepreneurship becomes common. An ecosystem requires bringing together diverse components — especially people — and developing a process to turn ideas into reality. The goal is to bring long-term capability and sustainability to the region from which companies will emerge, not just in the short term, but long into the future.
2. **Take a lean approach to space:** A physical space provides a place to run events and programmes, gives entrepreneurs a place to work, and helps provide a focus to the ecosystem. We have found that, in the early stages of building an ecosystem, growing the community and soft infrastructure (i.e. the ecosystem and culture) is far more important than a physical space. We encourage a lean mentality to growing the co-working space in step with the needs of the growing community.
3. **Reflect the region:** It is important for the ecosystem to reflect and embrace the uniqueness of its own region.
4. **View technology as only part of the solution:** A start-up and innovation ecosystem is not just about developers ‘building apps’. For example, in our experience some of the most innovative people in the regions are tradespeople. The opportunity is to bring technology to what regions already do well, and educate our entrepreneurs on an effective commercialisation process.



5. Reduce volunteer burnout: Having a trained start-up and innovation coach helps to overcome volunteer burnout, builds capacity in the region, and provides sustainable revenue.
6. Focus on sustainability: Initial funding from high net worth individuals or government agencies to start an ecosystem certainly can be helpful, but building a sustainable business model (which is not solely reliant on funding) is critical. Our model has allowed us to grow to five staff over the past four years.
7. Entrepreneurs are at the heart of any ecosystem: In an ecosystem, stakeholders may make or take particular roles that might do more harm than good, even when their intentions are good. For example, we've learned that it's not the governments' or the investors' role to lead the ecosystem. These stakeholders play key roles in ecosystem development, but entrepreneurs need to be the ones to drive the development of the ecosystem, as it creates a culture of entrepreneurship.
8. Build from the grassroots up: Having a trained start-up and innovation coach provides high levels of support for early-stage entrepreneurs who require significant amounts of time for development and nurturing. This approach fosters a grassroots approach to ideation in the communities, and helps build the ecosystem organically.

Although it is still early days, we are seeing positive activity in other regions and finding champions inspired to do the work in building the ecosystems. Our regions are beginning to understand that building ecosystems for economic growth is far more than a short-term goal of establishing an incubator or accelerator. Building an ecosystem is about creating a cultural shift that will allow a community to be strategically agile long into the future. It requires working with students in schools and universities and teaching them the fundamentals of entrepreneurship, particularly how to turn an idea into a scalable business.

The future of a region's economic development will depend on a widespread culture shift to entrepreneurship that is educated around risk, and views strategic failure as a learning opportunity. To remain relevant in the modern global economy, it is critical that regions in Australia (and around the world) embrace building ecosystems and adopt processes that help entrepreneurs turn good ideas into high-growth, scalable businesses. That is the path we're taking in Cairns, and in supporting other regions throughout Australia we hope our model and experiences will encourage many other regions to do the same.

For more information visit the [SPACE website](#).¹¹