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Bondi Beach Mosaic by Enver Camdal and Helen Bodycomb
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Innovation and Entrepreneurship in Australia

Welcome to the June issue of the *Technology Innovation Management Review*. We welcome your comments on the articles in this issue as well as suggestions for future article topics and issue themes.

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Overview

The *Technology Innovation Management Review* (TIM Review) provides insights about the issues and emerging trends relevant to launching and growing technology businesses. The TIM Review focuses on the theories, strategies, and tools that help small and large technology companies succeed.

Our readers are looking for practical ideas they can apply within their own organizations. The TIM Review brings together diverse viewpoints – from academics, entrepreneurs, companies of all sizes, the public sector, the community sector, and others – to bridge the gap between theory and practice. In particular, we focus on the topics of technology and global entrepreneurship in small and large companies.

We welcome input from readers into upcoming themes. Please visit timreview.ca to suggest themes and nominate authors and guest editors.

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Contribute to the TIM Review in the following ways:

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Please contact the Editor if you have any questions or comments: timreview.ca/contact

About TIM

The TIM Review has international contributors and readers, and it is published in association with the Technology Innovation Management program (TIM; timprogram.ca), an international graduate program at Carleton University in Ottawa, Canada.

Editorial: Innovation and Entrepreneurship in Australia

Chris McPhee, Editor-in-Chief

Welcome to the June 2016 issue of the *Technology Innovation Management Review*. This month's editorial theme is **Innovation and Entrepreneurship in Australia**, and it is my pleasure to introduce our guest editor, **Rowena Barrett**, Head of the School of Management at Queensland University of Technology (QUT; qut.edu.au) in Brisbane, Australia.

The inspiration for this special issue arose during the ISPIM Innovation Summit (summit.ispim.org/brisbane2015/), which was hosted by QUT in Brisbane from December 6–9, 2015 under the overarching theme of "Changing the Innovation Landscape". Fittingly, this international conference of researchers, industrialists, consultants, and public bodies who share an interest in innovation management coincided with the launch of the Australian Government's (2015) National Innovation and Science Agenda on December 7th. The Agenda provides a framework for Australia's new innovation policy, which is accompanied by $1.1 billion AUD investment over four years. In the wake of the collapse of the "mining boom", the National Innovation and Science Agenda is designed to stimulate innovation and entrepreneurship, leading to an "ideas boom" that will (hopefully) lead to new jobs and growth.

The launch of the National Innovation and Science Agenda and strong, interesting presentations showcasing Australia's approach to innovation prompted rich discussions among the conference participants. For this special issue, we invited researchers and practitioners from the ISPIM Innovation Summit in Brisbane who had particular insights about innovation and entrepreneurship in Australia to submit articles based on their presentations and papers and inspired by the feedback and discussions generated during and after the event.

In the first article, Guest Editor **Rowena Barrett**, who also chaired the ISPIM Innovation Summit, introduces the special issue and sets the scene for the contributions from the other authors by reflecting on the concept of innovation in concept and practice, and in light of Australia's new National Innovation and Science Agenda. She explains the rationale for the Agenda and highlights the challenges facing the country as it seeks to re-invent itself through innovation and entrepreneurship.

Next, **Anton Kriz**, **Courtney Molloy**, **Alexandra Kriz**, and **Sabrina Sonntag** from the University of Newcastle and the University of Sydney argue against blanket policies that assume equivalency across Australian regions. Based on fieldwork and ongoing action research from the Australian regions of Hunter and Central Coast (New South Wales) and Northern Tasmania, they identify 11 structural attributes of a regional innovation management (RIM) sandpit framework. The attributes and processes of the RIM Sandpit offer important insights into how policymakers and regional stakeholders, both within and beyond Australia, can enhance innovation in place-based regions and ultimately improve outcomes.

Then, **Troy Haines**, Co-Founder and CEO of theSPACE in Cairns, Australia, shares his experiences developing a startup and innovation ecosystem in a regional setting and extending the model to other regions of Australia. Haines argues that regions face quite different challenges from metropolitan areas and identifies the key ingredients of the champion-based regional model developed at theSPACE, including their physical space, programs, and events. He shares the early results of their efforts, along with lessons learned, before concluding that Australia regions are beginning to understand that building an ecosystem for economic growth is far more than a short-term goal of establishing an incubator or accelerator, but is actually about creating a cultural shift that will offer longer-term benefits.

Luke Hendrickson, **Stan Bucifal**, **Antonio Balaguer**, and **David Hansell** from the Australian Government's Department of Industry, Innovation and Science, and the Australian Bureau of Statistics, draw on five years of data tracking high-growth micro-startups through the Government's Expanded Analytical Business Longitudinal Database. The conclusions fit with international patterns, but they do not fit with innovation stereotypes. Notably, the results show that a very small fraction (about 3%) of micro-startups account for more than three-quarters of job creation by all micro-startups over a five-year period. They discuss the implications of their findings not only for firms but also government policy, emphasizing that high-growth startup activity requires strong strategic management capability.

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Kieran O'Brien from the Australian Innovation Research Centre at the University of Tasmania shifts the perspective to the national level, where he examines "hidden innovation": the value and impact of expenditure on outsourced innovation and activities. O'Brien estimates that hidden innovation in Australia amounted to $3.4–4.0 billion AUD in 2014. He concludes that new, more reliable data sources are necessary for measuring hidden innovation and highlights the need for businesses to monitor the right supplier networks and nurture the capabilities required to source and integrate external expertise, knowledge, technology, and equipment for innovation.

Finally, **Peter Townson**, **Judy Matthews**, and **Cara Wrigley** from the Queensland University of Technology and the University of Technology Sydney demonstrate the potential of design-led innovation in the form of an experienced designer acting as an innovation catalyst to help firms develop customer-inspired innovation. They present findings of an 11-month study in which the researcher/designer was embedded in an Australian manufacturing firm to help it overcome barriers and recognize opportunities within a changing market context.

It was a pleasure to have the opportunity to participate in the ISPIM Innovation Summit in Brisbane, and I hope you will enjoy the timely insights our authors share about innovation and entrepreneurship in Australia in this special issue.

For our future issues, we are accepting general submissions of articles on technology entrepreneurship, innovation management, and other topics relevant to launching and growing technology companies and solving practical problems in emerging domains. Please contact us (timreview.ca/contact) with potential article topics and submissions.

Chris McPhee
Editor-in-Chief

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About the Editor

Chris McPhee is Editor-in-Chief of the *Technology Innovation Management Review*. He holds an MASc degree in Technology Innovation Management from Carleton University in Ottawa, Canada, and BScH and MSc degrees in Biology from Queen's University in Kingston, Canada. Chris has over 15 years of management, design, and content-development experience in Canada and Scotland, primarily in the science, health, and education sectors. As an advisor and editor, he helps entrepreneurs, executives, and researchers develop and express their ideas.

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Innovation Rhetoric and Reality: An Introduction to the TIM Review's Special Issue on Innovation and Entrepreneurship in Australia

Rowena Barrett

> *"Innovation as a term has become meaningless."*
>
> Scott Middleton
> Chief Executive Officer
> Terem Technologies (Australia)

In this introduction to the *Technology Innovation Management Review's* special issue on Innovation and Entrepreneurship in Australia, Guest Editor Rowena Barrett reflects on the perceptions of "innovation", both in terms of its evolving concepts and terminology (the rhetoric) and its frontline application (the reality). Prompted by the recent launch and ongoing implementation of Australia Government's National Innovation and Science Agenda's, this special issue focuses on insights into innovation and entrepreneurship from the Australian context.

Introduction

It is rumoured that the word "innovation" was barred from ministerial lexicons during Tony Abbott's terms as Prime Minister of Australia. Now, with Malcolm Turnbull as Australia's Prime Minister, by way of total contrast, it is difficult to find a ministerial utterance that does not connect innovation with jobs and growth. However, as the 2015 Australian Innovation System report makes clear, innovation is a complex phenomenon (Department of Industry, Innovation and Science, 2015).

Innovation exists along a number of axes ranging from radical (or disruptive) to incremental, first-in-organization to first-in-world, product to process, sector to sector, as well as over the lifecycle, and simply a change in focus over time (i.e., design thinking, open innovation). One danger is that innovation is simply reduced to a notion of change. As writers from Marx and Schumpeter to more recently Stan Metcalfe and academics at the Science Policy Research Unit (SPRU; http://www.sussex.ac.uk/spru/) at the University of Sussex have all pointed out, change is endemic to capitalism. Therefore any discussion of innovation must move beyond the obvious threat of tautology.

What Is Innovation – Other than Simply Change?

Innovation is a poorly defined concept. The meaning of the term varies considerably depending on the context in which it is used, and for what purpose. It is most widely assumed that innovation is about technology and scientific advancements. This view dominates analyses and discussions around policy and regulatory issues, such as intellectual property (IP) protection. This more narrow focus on technological innovation has, unsurprisingly, placed the policy spotlight on the technical skill requirements for innovation, such as skills in STEM (science, technology, engineering, and mathematics). As a result, some governments' policies for promoting growth in STEM skills have called for compulsory science education in schools and at universities, or for students to be introduced to skills such as coding from primary school (Australian Government, 2015; US Government Accountability Office, 2005). These skills are undoubtedly critical to a great deal of new innovation, especially as new technologies disrupt established systems of producing goods and services and challenge traditional business models, but innovation needs to be understood through a lens that is broader than simply technology.

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The most generally accepted definition of innovation comes from the OECD's Oslo Manual (2005):

"The implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relation."

This definition captures innovations that are new or significant to the firm, as well as new to the world. It emphasizes innovation as being broader than simply technical breakthroughs and their application in industry. The definition draws attention to implementation of discoveries and highlights the importance of diffusion of innovation.

The definition includes any activity in an *innovation process* – from the conception of new ideas, inventions, and discoveries; to development and testing; to the production, marketing, and commercialization of those inventions within the ecosystem, not just within particular organizations alone. This also takes us far beyond a simple, technical, and research and development focused view of innovation. These activities in the innovation cycle occur in a dynamic and complex manner, and require the firm to undertake three distinctive sets of activities. Teece (2010) argues these are:

1. *Sensing:* the identification and assessment of new opportunities for growth and profit

2. *Seizing:* the mobilization of resources, skills, and capabilities to realize the opportunity and to capture opportunities for creating value

3. *Transforming:* ongoing efforts to improve and renew the original innovation to sustain the value creating opportunities such innovations present

The Government's *Australia Innovation System Report 2015* (Department of Industry, Innovation and Science, 2015) takes a systems approach to innovation, as the report's title suggests. In it, the argument goes that, without understanding how the components of the national innovation ecosystem interact, it is impossible to identify the causes and implications of innovation. The report defines an innovation system as follows:

"an open network of organisations that interact with each other and operate within framework conditions that regulate their activities and interactions. The three components of the innovation system – networks, innovation activities and framework conditions – collectively function to produce and diffuse innovations that have, in aggregate, economic, social and/or environmental value."

Networks includes geographic clusters, business associations, and supply chains. Framework conditions encompass a range of macro-economic, cultural, educational, and policy settings that nurture innovation. Innovation activities can include training, research and development, venture capital investment, and patenting activity.

As Salter and Alexy (2014) have commented, there is a whole industry of consultants and academics putting new words in front of the word innovation (for an extended discussion see Cunningham et al., 2016). Starting with a distinction between incremental and radical innovation (with the recent addition of the concept of disruption), what we have allied to this is the distinction between first-in-organization compared to first-in-world innovation. The concept widened to include service, technological, and organizational innovation. More recently, the concept of open innovation has gained credence with the allied concepts of customer or user-linked innovation. These latter two are also described as hidden innovation. However, this approach is not the only way in which the concept of innovation has expanded.

The above can be contrasted with the Ten Types of Innovation or "the building blocks of breakthroughs", expounded by Keeley and colleagues (2013). The Ten Types are broken down into three categories:

1. *Configuration:* profit model; network; structure; process

2. *Offering:* product performance; product system

3. *Experience:* service; channel; brand; customer engagement

Sophisticated innovation, it is suggested, uses many types of innovation, customized elegantly and orchestrated with care (Keeley et al., 2015). There are similarities and overlaps with the first list but these are not the only choices available. A Google search under "types of innovation", will yield any number of alternative lists and categorizations.

The problem is that the concept of innovation threatens to become, in Andrew Sayer's (1992) terms, a "chaotic concept". This means the concept, while having great

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political purchase, has little analytical value as it is packed with many differing and sometimes contradictory elements. It lumps together the unrelated and the inessential and divides the indivisible. However, all this notwithstanding, there has never been a more exciting time to launch a national innovation and science agenda.

Australia's National Innovation and Science Agenda

In December 2015, Australia's National Innovation and Science Agenda was launched with the subheading, "Welcome to the ideas boom" (Australian Government, 2015). A sound bite perhaps, but also a signal to Australians that the resources boom might not be so boom-like anymore! The National Innovation and Science Agenda makes clear that innovation and science are seen to be critical for Australia delivering new sources of growth, maintaining high-wage jobs and seizing the next wave of economic prosperity (Australian Government, 2015). Innovation is viewed as being important to every sector of the economy and is about new and existing businesses creating new products, processes, and business models.

Australia's National Innovation and Science Agenda has four key pillars: i) culture and capital; ii) collaboration; iii) talent and skills; and iv) government as an exemplar. To support the agenda, AUD$1.1 billion in funding was allocated to initiatives in these four areas, key aspects of which are outlined below:

1. *Culture and capital:* this pillar builds on the acknowledgement that Australia has a poor record in converting bright ideas into commercial realities – only 9% of Australian small and medium-sized enterprises brought a new idea to market in 2012–13 compared to 19% in the top 5 OECD countries (Australian Government, 2015). Under this pillar, new tax breaks are offered to help overcome what is seen to be a bias against businesses that take risks and innovate. In addition the Commonwealth Scientific and Industrial Research Organisation (CSIRO; csiro.au) and the Biomedical Translation Fund (tinyurl.com/hovnyc7) will co-invest in commercializing promising ideas.

2. *Collaboration:* this pillar is framed around the understanding that Australia's rate of collaboration between industry and academia is reported to be the lowest across OECD nations (PwC, 2015). The aim here is to encourage researchers and businesses to collaborate. The National Innovation and Science Agenda promotes partnership-based research for universities and will target investment to what is seen to be critical research infrastructure.

3. *Talent and skills:* this pillar is almost entirely focused on STEM skills. The first aim of funding initiatives here is to encourage more Australian students to study science, mathematics, and computing in schools. The second aim is to make it easier to attract more entrepreneurial and research talent to come to Australia from overseas.

4. *Government as exemplar:* under this pillar, the aim is to move government from its position of lagging the private sector in innovation. Funding here is all about helping government to be more innovative in how services are delivered as well as making it easier for startups and innovative small businesses to sell technology services to government.

As part of the National Innovation and Science Agenda's promise, the Government claims that it will make innovation central to all policies. To this end, a new body, Innovation and Science Australia (tinyurl.com/z6fgxo4) has been established alongside the Digital Transformation Office (dto.gov.au), a Digital Market Place (tinyurl.com/hxqmlja) and a Business Research and Innovation Initiative (tinyurl.com/j7wd822). The Data61 (www.csiro.au/en/Research/D61) data innovation group has been established to help develop new technology-based industries and transform existing ones.

The National Innovation and Science Agenda approach is based on the assumption that problems in innovation can be laid at the door of an unresponsive and over burdensome government/public sector, lack of support for startups, insufficient focus on STEM education (particularly for women), and a lack of encouragement for collaboration, particularly between industry and universities. However, there are indications that the problems might be somewhat more fundamental.

(Mis)management?

The recently published major study of Australian Leadership at Work (Gahan et al., 2016) suggests there may be more fundamental problems with Australian management. After surveying some 8000 people across 2703 organizations and 2561 workplaces, as well as interviewing people from the top to the bottom of organizations, the conclusion is "Australian leaders, on the whole, have not mastered the fundamentals of management" (Gahan et al., 2016). Gahan and colleagues (2016)

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identify seven significant gaps and weaknesses, which together are a cause for major concern:

1. Many Australian workplaces are underperforming.

2. Many Australian organizations do not get the basics right.

3. Few Australian organisations report high levels of innovation.

4. Many Australian leaders are not well-trained for the job.

5. Too many Australian organizations under-invest in leadership development, especially at the frontline.

6. Leadership in Australian organizations does not reflect wider social diversity.

7. Many senior leaders do not draw on strategic advice in making decisions about the future.

In many ways, these were the same criticisms of Australian management that were outlined in the 1995 Enterprising Nation report (the Karpin Report). Given the 20-year gap between these studies, the lack of progress is worrying.

Focusing specifically on innovation, and again following the findings of the Karpin Report (1995) as well as Green (2009), the Leadership at Work study suggests that lack of leadership for innovation remains a long-standing challenge. In the report, Gahan and colleagues (2016) conclude:

• Australian organizations struggle to turn knowledge and information inputs into innovation outputs.

• Small organizations struggle most with radical innovation. Public sector organizations score considerably higher on radical innovation.

• Short-term performance is more affected by incremental product and service improvements and is less susceptible to radical innovation

• Highly innovative organizations actively sense, internalize, and act upon new knowledge and changes in their operational environment.

• High-performance work practices relate positively to innovation.

• Employee management based on clear goals produces more innovative outcomes.

In a similar vein, the 2016 American Express CFO Future-Proofing Survey (American Express, 2016) suggests that Australian business may not be on the cusp of an ideas boom, with about 70% of Australian mid-sized businesses not significantly investing in innovation. This led the *Australian Financial Review* to speculate as to whether "the Government's ideas boom may be hot air" (Sherbon, 2016) when 40% of Chief Futures Officers said their organization had failed to bring in any new product or service innovation in the previous three years. Half of all CFOs believed their organizations were not evolving fast enough, and that innovation was an ad hoc rather than strategic activity.

Unsurprisingly, when OECD data was drawn upon, the American Express report concluded that Australia has one of the weakest levels of network and collaborative innovation compared with other OECD countries. This finding helps explain why Australia ranks 21st out of 32 countries for innovation in the OECD ranking (American Express, 2016). This position was acknowledged in the Australian Government's own Australian Innovation System Report. In a world economy increasingly dominated by global value chains, the relative isolation of Australian business from these structures (within which innovation and R&D are increasingly concentrated) is a matter of concern. This point was stressed in the Australian Innovation System Report (Department of Industry, Innovation and Science, 2014):

"Businesses that participate in global value chains have been argued to be more innovative, more engaged in research and development (R&D) and skills development, drive the highest productivity premium, and can support high unit labour costs… Participation in global value chains also drives a step change in business culture by challenging participants to upgrade their management, financing and technology, and encourages greater collaboration… Investing in research and innovation will be the key to maintaining a strong position in a global value chain as a price maker."

However, as a number of commentators point out, Australia is relatively under-integrated into the world economy (see Drake-Brockman, 2014). More particularly, in the 2014 Australian Innovation System Report, it is argued that, according to the OECD's global value chain participation index, Australia's overall participation in global value chains is below the OECD median and well behind global value chain hub countries (Department of Industry, Innovation and Science, 2014).

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In reviewing the results of the Global Innovation Index (GII), produced jointly by Cornell University, INSEAD, and the World Intellectual Property Organization, Cunningham and colleagues (2016) argue:

"In 2015, Australia ranked 17 overall out of the 141 countries for which a GII score is available, confirming that Australia has established a comparatively healthy environment for enterprise innovation. However, a further breakdown of this index reveals some important points of weakness. Significantly, Australia shows a notable disparity between innovation inputs (ranked 10th) and innovation outputs (ranked 24th), which include technology and knowledge (ranked 39th) and creative outputs (ranked 7th). This implies a lack of 'innovation efficiency'.

While the input measures are generally adequate, Australia performs significantly below its overall ranking on measures capturing the human capital inputs into innovation systems. On the output side, low scores are particularly prevalent in the areas of knowledge impact and knowledge diffusion. Overall, the GII indicates shortcomings in the capacity of Australian enterprise to generate and, more specifically, to bring innovations to application and diffusion. The low scores in business sophistication—especially in innovation linkages (ranked 38th) and knowledge absorption (ranked 63rd)—indicate that rather than lacking skills in general, Australia lacks capacity in using these skills and other inputs for innovation."

Research for the Australian Government suggest that although Australia has a relatively high (but declining) rate of small business formation, only a very small percentage of startups (3.2%) exhibit serious employment growth and yet this tiny minority accounts for 77% of total post-entry job creation by micro startups (Hendrickson et al., 2015, 2016).

There appears to be some fundamental issues that go wider and deeper than those identified in the National Innovation and Science Agenda. Since it was announced, there has been an Australian budget handed down, but it was not met with universal approval. Professor Roy Green, Dean of the University of Technology Sydney Business School, suggested "we have to look very hard to find the 'ideas boom' in this budget" (Green et al., 2016), arguing that only AUD$1 billion of the AUD$3 billion cut in research and innovation expenditure under the previous Abbott government was being restored. Or, as Professor Marek Kowalkiewicz and colleagues from Queensland University of Technology's PwC Chair of Digital Economy team also noted in their assessment of the 2016 Australian budget, it does not address those who face industry and professional disruption due to automation and the changing nature of work (Green et al., 2016).

John Bessant from Essex University has suggested that the Red Queen in *Alice in Wonderland* is a powerful metaphor for innovation in the modern world (Bessant, 2016). Remember, the Red Queen keeps changing rules, and the game, and this is perfectly normal in Wonderland – and reflects the reality of our own world, it seems. As Bessant argues, "simply recognizing that we need to change what we offer, and how we create and deliver it, isn't going to be enough. We've also got to have the ability to step back and reconfigure our approaches to doing so as the game shifts and the rules change beneath our feet" (Bessant, 2016).

Thankfully, the contributors to this special issue help provide a pathway through this chaos, which reflects both the rhetoric and reality of innovation. Through sharing insights gleaned from the Australian context, we hope the articles in this issue will benefit all players and supporters of the innovation game, with its ever-changing rules, wherever in the world it is being played.

About the Author

Rowena Barrett is Head of the School of Management at Queensland University of Technology (QUT) in Brisbane, Australia. She has played leading roles in organizing, managing, and administering research in universities in Australia and the United Kingdom. Rowena holds a PhD from the University of Melbourne, Australia, on industrial relations in smaller firms, and she has spent many years investigating the ways people in smaller firms are managed and how those firms are organized. She has a sizeable portfolio of research publications including books, book chapters, journal articles, as well practitioner papers and reports. Her research has been funded by university, industry, and government sources in Australia and the United Kingdom. She has extensive experience in teaching in the areas of management, human resource management, and industrial relations, while she has supervised over 10 PhDs to successful completion. She has also held numerous board and council member positions, both within and beyond academia. In 2015, Rowena chaired the ISPIM Innovation Summit "Changing the Innovation Landscape", which took place at QUT in Brisbane, Australia, from 6–9 December.

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Keywords: innovation, entrepreneurship, Australia, National Innovation and Science Agenda

All Australian Regions Are Not Born Equal: Understanding the Regional Innovation Management Sandpit

Anton Kriz, Courtney Molloy, Alexandra Kriz, and Sabrina Sonntag

> *"They were like kids in a sand[pit]. It was a great feeling watching their creativity spread to everyone."*
>
> Brittany Murphy (1977–2009)
> Actress, singer, and voice artist

In this article, we highlight and challenge an overly simplistic assessment of regions and regional innovation systems in Australia. Treating each region and place as equal and prescribing blanket policy is anathema to the reality. Having argued that places are not equivalent, we then move on to highlight that commonalities at a deeper institutional level are possible. We draw on fieldwork and ongoing action research from the Australian regions of Hunter and Central Coast (New South Wales) and Northern Tasmania. Results of the theory and case work have been instrumental in the development of 11 structural attributes of a regional innovation management (RIM) sandpit framework. The framework provides attributes but also important process insights related to regional programs, enterprise development, and project innovations. Although developing from the Australian context, we expect that the RIM Sandpit and its place-based insights can be generalized to other regions around the world.

Introduction

Regional innovation is an essential avenue for countries to improve growth, employment, and economic outcomes (Asheim et al., 2011b). However, few really understand the complexity and dynamics of people and communities interacting with a place-based environment to bring a region to life. In this article, we offer a framework for improving regional place-based strategy, innovation policy interventions, and community outcomes. In developing this approach, we recognize that the significant variations across regions also extend equally to unique business and enterprise systems within. Essentially, regions are far from "even playing fields". Rather, each respectively comprises a complex, place-based natural and built environment offering a kaleidoscope of different infrastructure and industry dynamics with distinct people and talent variations. Hence, regional innovation can be described as a complex adaptive system with dynamic and emergent systems adapting and co-evolving to a changing place-based set of endowments (Sotarauta & Srinivas, 2006).

In the late 1950s, there was a television series in Australia called *The Magic Boomerang*. The main character, Tom Thumbleton (played by David Morgan), threw his boomerang (with its magical powers) and everything within range, including people, suddenly came to a complete standstill. Young Tom would then intervene and rearrange the events for what he considered a more positive outcome. Tom would throw the boomerang again and re-activate the people and setting. Unfortunately, there is no chance of such a magical solution to regions. These systems are moving targets, continually on the go, and the outcomes are definitely not so easily reversible. If one could start from scratch, as has occurred with cities in China and the United Arab Emirates, things may be different. But regions, as our article title suggests, are not born equal with different natural endowments. The article is informed by ongoing action research that allows for direct experience and learning from the field as it unfolds (Stringer, 2013). Researcher participation is fundamental to such an approach. So, there are elements of Tom in this place-based regional game, with the researchers able to also witness a series

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of events. Equally, like Tom, some change is possible through the action research process but not courtesy of a magic boomerang or to the extent of reversing events.

Three Australian regions – Hunter and Central Coast of New South Wales and the Northern Tasmania region – are the focus of this study. Immersion in these systems and learnings from literature has led to us to describe 11 structural attributes of a regional innovation management (RIM) sandpit framework. The framework is offered as an appropriate regional platform for policy intervention and encouraging regional and enterprise growth. We believe the RIM Sandpit framework offers an overarching recipe for regional innovation that allows for political dynamics, power relationships, and a better interpretation of the vast array of activities and intervening agents. The aim of this recipe, unlike other tools in regional innovation systems, is to shift from functional descriptions to identifying a process for administering change. This is important at a program and operational level. Similar to Audretsch (2015), the article suggests that strategic management is useful for understanding dynamics of regions. However, we go a step further than Audretsch in developing our place-based recipe. Like Kanter (2003), we also acknowledge regions can be more deliberate in organizing their outcomes. Predicated in such dynamics is an appropriate mechanism for regional leadership. The sandpit (or sandbox) metaphor describes the activities, actors, processes, and strategies played out within a particular environment, making up what we describe as the "regional rules of the game". The sandpit however includes researchers and key regional stakeholders getting in and actually getting dirty (playing in the sand).

The role of policymakers in complex regional environments is critical and has been discussed consequently in other domains (Magro & Wilson, 2013; Sotarauta, 2009). Our aim is to shed light for policymakers and industry on the deeper, more systemic structural influences of place. The purpose is to simplify the reality of place without eroding the unique complexity within. The RIM Sandpit framework and its attributes and processes offer important insight into how policymakers and regional stakeholders can enhance innovation in place-based regions and ultimately improve outcomes.

The article commences with a review of key literature related to regions and their management. Leadership is a fundamental element to place-based success and this is discussed. What is also important is to be proactive but also realize that each business and set of enterprises within are also unique. An action research approach is used and outlined before the three main Australian cases are introduced. The next two sections discuss the RIM Sandpit attributes and the subsequent framework. The conclusion reinforces the importance of appropriate governance mechanisms and people dynamics as well as challenges if one relies solely on theory without entering the sandpit and interpreting the actual place-based situation and context.

A Strategic and Regional Innovation Management Perspective

The research and innovation strategies for smart specialization (RIS3) concept, which is increasingly advocated as a potential regional panacea by the European Commission, nominates regional advancement through an entrepreneurial discovery process (Foray et al., 2012). The issues around such discussions are now linked closely to the triple helix and quadruple helix that brings industry, government, university, and community relationships to the fore (Leydesdorff & Fritsch, 2006). But the essential question is, why are you intervening in a system and for what purpose? Flyvbjerg, Landman, and Schram (2012) tackled this challenge through situated knowledge development in the traditions of *phronesis,* that is, practical wisdom and prudence, where learning is informed by doing and insightful interpretation. Experience and understanding of context is critical in such approaches. Hence, we suggest later that *playing* in the regional sandpit goes beyond observation and simply understanding the *rules* to developing real expertise. Asheim, Boschma, and Cooke (2011a), Todtling and Trippl (2005), and others such as Porter (2000) have provided important insights into place-based innovation systems but largely from a "helicopter" regional view. What is lacking is a more critical analysis of the challenges and nuances on a localized level.

Flyvbjerg (2006) noted that idealized rational models do not reveal what is really happening. On occasions, investigations do go deeper (Leydesdorff & Fritsch, 2006), but still most researchers have only "scratched" the sandpit surface. Few understand what it is like to be in the actual sandpit. As Flyberg suggests, it is easy to be a novice or even competent as opposed to developing real expertise. Attention here is on regional understanding at a meso-level (Dopfer et al., 2004) with the aim of providing a window to better understand the micro-level. Audretsch (2015) identifies a broad schema for strategic management of place, which include factors

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of production, the spatial and organizational dimension, the human dimension, along with economic performance and policy as ways of enhancing our understanding. From his empirical observation, he suggests it is difficult to make our prescriptions more specific and detailed. Regions are complex systems and have a unique mix of institutions, culture, and variations of human capital.

Yet, there are examples of delving more deeply with better analysis and interpretation. These insights are paradoxically at a macro-level largely built around "national rules of the game". Elinor Ostrom for example delved into community, conditions, rules, and respective actors and actions (Drew & Kriz, 2012). Ostrom was one researcher who did immerse herself more deliberately in the field. Acemoglu and Robinson (2012) have brought important insights on national rules of the game by comparing "extractive" institutions built around economic rent and power versus "inclusive" institutions where societal benefits are central. Aspects such as power and underlying political structures have become central in a number of other discussions as well (Glaeser et al., 2004). Like Audretsch, we believe place-based domains are ripe for such investigations. Flyvbjerg's (2001) qualitative in-depth study of Aalborg is a rarity in this domain. Like Flyvbjerg, we suggest objective-based reality will not do the trick and unlike Ausdretsch, we believe that, although the regions are different, there will be ways to interpret institutional elements with more precision.

We believe comparisons with corporations can support an understanding of regional innovation. Like corporations, a place is gifted with human and natural resources. Corresponding to corporate organizations, capabilities can be built and regions structured and led. Corporations do have clearer boundaries and their objective is more targeted: to turn a profit. Who is actually leading the region (Sotarauta, 2005) and how policies are shaped (Collinge & Gibney, 2010) is also not straightforward. Nevertheless, it is foolish to simply dismiss parallels between organizing regions and firms. Mintzberg and Waters (1985), in tackling the firm as an organization, identified realized strategy as a combination of emergent patterns and more deliberate activities. This lexicon of emergent patterns with purposive support has entered the regional domain (Collinge & Gibney, 2010). Such regional innovation systems, like an organizing firm, will also arguably rely on innovation processes working both bottom-up and top-down (Kriz et al., 2013). One advantage for regions over firms is that they generally take longer to fail. There is competitiveness in regions but not yet to the extent of creative destruction in enterprise. A downturn in the forestry industry in Tasmania and reduction in coal exports in areas such as the Hunter highlight that change – whether through policy intervention or declining markets – can still come quickly to regions as well.

Teece (2009) acknowledges that "Economic growth theory has underplayed the importance of the management enterprise in economic growth and development." The management and development of regions we believe is equally poorly acknowledged. Audretsch (2015) highlights that the Germans are advanced in such notions with their concept of location- or place-based strategic management: *standortpolitik*. Logically, regional innovation systems cannot function effectively without strategic intervention. The focus in regions is now shifting to constructed advantage where more purposeful interventions are applied (Asheim et al., 2011a). If regions, like corporations, want to leave their destiny to chance they can, but increasingly we are learning that better firms seem to more consistently get "luckier" (Collins & Hansen, 2011; Tellis, 2012).

Regions we suggest are the same. Kriz (2015) refers to planned and constructed interventions that guide and steer policy as regional innovation management (RIM). This is an important extension on the concept of regional innovation system. RIM is defined as a purposeful approach to systematically analyzing, developing, organizing and implementing processes and practices to improve regional outcomes. RIM incorporates smart specialization entrepreneurial processes but also extends the analysis of place to include a more *holistic* and *systemic* approach to regional development. Successful regions go well beyond entrepreneurial discovery to encompassing all aspects of growth and development. Talent and knowledge development now goes from cradle to grave.

Need for Strategic Leadership of Regions

Strategic leadership literature stemming from corporations has benefits for regions as well. This is not a new concept, with several authors supporting this premise (Beer & Clower, 2014; Collinge & Gibney, 2010; Sotarauta, 2005). Finding *who* is leading and accountable in Australian regions is quite difficult. Governments at local (council), state, and federal levels have become adept at shifting responsibility and governance arrangements and these vary state-by-state and council-by-council.

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Many regional areas in Australia are suffering high levels of unemployment and underemployment, leading to ancillary social problems around health, drugs and alcohol; youth unemployment is extremely high; and gross regional product (GRP) of these regions is not keeping pace with capital cities. Establishing the mission of a region is therefore a priority but if there is no definitive leadership, articulating and delivering on objectives is problematic.

Figure 1 suggests three possible trajectories for Australian regions. Do nothing and the trajectory of the lowest line (C) is likely. Regions, like firms, can get lucky with a resources boom; a prime example of which is the Hunter region. Equally, they can get unlucky with the rapid decline of such booms. Accelerated technological change, robotics, and computerization are increasing the challenge for regions globally. As in the United States, productivity increases are occurring but notably now without wages and employment growth. Expectations are that GRP will need to be raised even higher to sustain regional employment numbers. If a region wants to shift the trajectory into positive realms – the upper line (A) in Figure 1 – then business and regional systems will need to be even more proactive. Like the Red Queen and Alice in *Through the Looking-Glass* (Carroll, 1871), it appears regions are going to have to run twice as fast in the future to raise employment levels adequately.

Lerner (2009), in *Boulevard of Broken Dreams,* rightfully acknowledged that governments are notoriously poor at developing such systems. Offering large incentives for regions to embark on such strategies is the basis of smart specialization. Yet this is increasingly counter to the way Australian policy is operating. Minimal government financial support is available in the Australian context, which means harnessing extant resources and capabilities has never been more important (Kriz, 2015).

As Machiavelli and later Lewin identified (Burnes, 2004), forces against change can prohibit most initiatives. We believe understanding where such push-back is likely to come from is critical in regions. Finding coalitions, sponsors, promoters, and innovation champions for supporting change is equally advantageous (Bankins et al., 2016). Brokers have been discussed in regions but there is more to such change. At a regional level, positive change takes some doing. Some regions with strong strategies and collective leadership are offering important examples in the Australian domain.

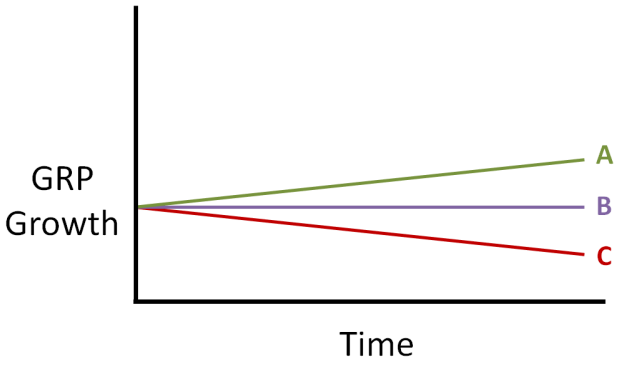

Figure 1. Three possible gross regional product (GRP) trajectories over time

The Geelong region with its G21 Regional Alliance (www.g21.com.au) of five municipalities working toward a common objective is an example. The area has been hit by industry closures, but through harnessing the power of its constituent stakeholders, the region has been forthright in accessing government assistance and generating new enterprise. The Sunshine Coast Economic Futures Board (tinyurl.com/h3vz78v) is setting a similar agenda. Generally, Australian regions are lacking a detailed understanding of their innovation ecosystem and the networks and business systems underpinning their macro-meso-micro development.

In Australia, the approach to regions and their underlying business systems has generally been one-size-fits-all. Redding and Witt (2007) drilled down considerably to understand the nuances around business systems. Recently, a heavy emphasis on the business system has been placed on generating startups in Australia. Shane (2009) warned global and United Kingdom policymakers against putting too much emphasis on such startups. Gazelle-style high-growth approaches have become popular with researchers (Acs & Mueller, 2008) and gazelle enterprises are now advocated by some Australian states and nationally. However, recent research suggests steady-growth firms (Kunkle, 2013), similar to the German Mittelstand approach, may be even better. These "stickier", family-based regionally supported and financed operators, with their longer-term horizons (Audretsch, 2015), have commonalities with some family businesses operating in Australian regional areas. Companies such as the Elphingstone Group (elph.com.au) in Tasmania, Varley Group (varleygroup.com) in the Hunter region, and Borg Manufacturing (borgs.com.au) on the Central Coast are good examples. Analyzing the business system and dynamics in more

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detail is beyond the scope of this article. But, like regions, we *should not* be treating such systems as identical.

In summary, what is important is to utilize burgeoning research globally and take lessons in the field to go beyond a macro-level surface view of regions. Constructing and guiding regions and place-based systems rather than forcing them to change is about understanding bottom-up *and* top-down innovation interventions and molding both a deliberate *and* emergent strategy. This means guiding and also "steering" the direction with support of the community. The aim of this article is to offer insights from an action research agenda that, like Flyvbjerg, takes the researchers from simply observers to participants in the process. Watching from the "ground" (contextual view) rather than just the "air" (helicopter view) gives what we believe is a new perspective to regional realities. Importantly, this situational understanding will ensure the *why* of the place-based region is equally top-of-mind.

Action Research and the Respective Cases

This research combines qualitative in-depth cases, empirical evidence, and reflection under an overarching action research base to gather deeper structural regional insights. Action research where immersion and shared understanding is possible adopts, as Gummesson (2001) suggests, "curiosity, courage, reflection and dialogue". Like case studies, it is an underutilized methodology that has many critics. We agree that detachment and more objective designs have their advantages from a bias perspective but they also have weaknesses with increased potential for misunderstanding (Kriz et al., 2014). Action research is reserved for situations when researchers assume the role of change agents. Learnings can definitely happen both ways in such participant approaches with the researcher also gaining significantly. Literature and secondary data do add significantly in action research and case study approaches. For example, insights from leadership studies such as the competing values framework (Lavine, 2014) and from innovation champions literature (Howell et al., 2005) have proved critical when doing the fieldwork related to this study.

The three action research cases reported here relate to the Hunter region in New South Wales, the Central Coast region of New South Wales, and Northern Tasmania region:

1. The Hunter region is classified as old industrial under the Todtling and Trippl (2005) regional innovation system framework but appears to be transitioning toward metropolitan as the region broadens. The Hunter region is located 120 km north of Sydney with its major city being Newcastle. It has approximately 620,000 inhabitants and the world's largest coal port. The region is well known for its wines but is also strong in manufacturing, mining services, defence, horse breeding, and education (particularly the University of Newcastle: newcastle.edu.au).

2. The Central Coast is based around two cities, Gosford and Wyong, with a population over 330,000. The region is located 70 km North of Sydney and is classified as peripheral under the Todtling and Trippl schema. This region has over 30,000 daily commuters and has a low level of research support and activity. Tertiary education is offered through a campus of the University of Newcastle. Industry is built around logistics and food processing with services around construction, retail, and health services.

3. Northern Tasmania's largest city is Launceston with the total area having a population around 132,000. Key features of the region are the Tamar Valley, which boasts wineries, boutique arts and crafts, and the Australian Maritime College (amc.edu.au). Northern Tasmania has similarities to the Hunter region, with an old industrial base in this case built around a convict heritage, early trade, and agriculture. The area is complex, with eight local government areas and strengths beyond agribusiness that include tourism and manufacturing, with aspects such as mountain biking and outdoor recreation as highlights. Bell Bay Aluminum (bellbayaluminium.com.au) is a key industry player in the region.

The Central Coast was pivotal in initial learnings that led to the RIM Sandpit framework outlined in this study. The first named author was asked by the Federal Government to assist in developing an innovation strategy for the Central Coast as part of an Innovative Regions Centre national agenda. To add sustainability to the initiative (including developing, monitoring, and evaluating the overarching program and projects), a strategic body called Innov8Central (innov8central.com.au) was established. Projects included the development of Central Coast Manufacturing Connect (ccmconnect.com.au) to stimulate industry collaboration. The success of the Central Coast initiative and Innov8Central led to

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an invitation to the first named author to undertake workshops in Tasmania. This has led to various initiatives and what has emerged as an action research agenda in Northern Tasmania. The balance has been more emergent than deliberate but key stakeholders have now bought-in. The activities in the Hunter region developed independently. The first named author had provided strategic and innovation management advice to a number of the region's key stakeholders, including the HunterNet cooperative (hunternet.com.au). Known nationally as a highly successful cluster in mining services and manufacturing, this cooperative and its 200 members is a central agency for enterprise activity in the Hunter region.

Three of the authors of this paper are now directly involved in workshops and other ongoing activities related to the cases. Seeing regional strategies first hand as they unfold has offered rare insights. Developing trust and support takes time and continually being invited back suggests the stakeholders are seeing positive outcomes. Over 150 interviews have been conducted in the studies, along with formal workshops such as innovation champions programs for businesses on the Central Coast and various community events. Six annual Innovation Summits on the Central Coast (approximately 175–200 people per event) are an example of some of the additional regional innovation activities underway. HunterNet has an annual formal planning day for the board with a follow-up day for its members. The first named author has been responsible for facilitating such days. Tasmania runs an annual Breath of Fresh Air Film Festival (BoFA; bofa.com.au) with workshops and planning for regional innovation activities incorporated in recent years around the RIM paradigm.

The RIM Sandpit framework has developed from a range of these initiatives and field-based learnings. This work has included over 600 surveys for a regional innovation readiness evaluation in Tasmania built around the lessons from the earlier Central Coast experience. The first named author has also been pivotal in this readiness assessment, which has now also included the development of a new Northern Tasmanian Futures Strategy under Northern Tasmania Development (NTD; northerntasmania.org.au). Two of the research team are now involved in skills training programs aimed at economic development officers and key stakeholders in Northern Tasmania. The aim is to build human capital resources that extend the capabilities of the region. Although the original Federal Government IRC program on the Central Coast was quite focused, many of the other elements have resulted from positive feedback and bottom-up informal support. A journey was kick-started and the destination is still unknown. Irrespective, the regions have benefitted. Sizeable research and development investments and outcomes on the Central Coast linked to Innov8Central are an indication of extant success.

RIM Sandpit Analysis and Findings Leading to 11 Attributes or Positions

Reviewing regions at this deeper action-research level has provided two-way benefit. It has allowed the research team and particularly the first named author unprecedented access. Common themes have evolved through the process. The notion of a region as an enterprise (albeit not perfect technically) helps crystallize a regional purpose and simplifies the complexity of a region. The Federal Government through the IRC, and more recently the Entrepreneurs' Programme (tinyurl.com/z5akss6), provided seed funding for the Central Coast initiative; continued momentum in all three regions has been managed through strong stakeholder support but it has been limited by lean budgets as well as minimal stakeholder funds (Kriz, 2015). This level of support varies from the significant resources for smart specialization in Europe. Key elements that seem constant from both smart specialization and RIM is that innovation management operates most effectively from bottom-up before top-down and a systems perspective is a critical lens for a place-based view.

The knowledge gathered from literature investigations and three cases has highlighted 11 key elements common to all regions. Fundamental to a systems perspective is that innovation at an organizational level has two key drivers: one pitched specifically at developing the core capacity and processes and the other focused on driving new growth opportunities and external advantage. Anthony, Duncan, and Siren (2014) suggest that these "two buckets" are fundamental to organizing successful short-term innovation outcomes. The case learnings suggest this applies equally to regions. The first bucket is about positioning a region on a key strength and setting up a platform around regional leadership. Smart specialization and RIM rely on a central process that acts as a thrust for regional outcomes. The regional development platform method from Finnish academics helped inform the research around such central programs (Pekkarinen & Harmaakorpi, 2006). The external projects (or second bucket) that emanate are products of this central hub and need scoping

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and vetting before being actioned. Seeing innovation as a sequence of *projects* is recognized in the contemporary strategy and innovation management literature.

Klerkx and Aarts (2013) discuss different forms of innovation network orchestration related to constructing broader regional initiatives and innovation champion activity. The Australian experience identifies that a network catalyst in the form of an independent network administrative organization (Klerkx & Aarts, 2013) has benefits. This is why Innov8Central and other vehicles like Northern Tasmania Development and HunterNet are so important. Innov8Central provides more independence than a university or government body. Essentially, such bodies sit in the space shared by the three circles (the shaded mandala) of the triple helix (quadruple helix). Their role is to support the regional innovation overarching program and to operate a project pipeline for sustainable growth and competitiveness. What has been learned in the Australian experience is that these entities require proper resourcing and support. However, lean budgets are possible because regions have a lot of goodwill. If you can harness the forces as in the three case studies, there is significant volunteerism at hand to make things happen. Ultimately, we are likening the network administrative organization to a "SWAT team" for assisting the leadership and human capital in such change. The action research is identifying that such entities need to be built into the deeper regional institutions and structures (Frost & Egri, 1991) to protect them from short-term politics and power plays.

A synopsis of the empirical elements, distilled through the literature and action research, are discussed below; a more detailed analysis is beyond this article's scope. Autio's (1998) original regional system of innovation followed by Todtling and Trippl's (2005) regional innovation system identifies numerous actors and the knowledge processes involved. This is akin to identifying functional elements of an organization. These models also provide a broad idea about the importance of knowledge exchange between actors. What is unique about RIM Sandpit is the schema developed focuses more on purposefully constructing and managing innovative change in such a system. The concept of regional innovation management, with its notion of a sandpit, has additional meaning (Kriz, 2015). Already, the role of researcher and others entering the sandpit has been discussed. *Immersion* in the pit (or box) is essential for building real knowledge and expertise. But the importance of politics and power are also known intuitively by stakeholders. Likening this to the softer games of children "tossing" sand around in the sandpit always brings a wry smile to those involved in workshops and seminars. The quotation at the outset of the article appears apt. Interestingly, creativity flourishes when cooperation and conflict are present.

The 11 attributes, or *positions,* in the RIM Sandpit that we have developed from relevant theory and strategic practice and insights in the field are:

1. *Place:* The location of a region plays a critical role as the natural and physical environment and endowments influence significantly how the region and businesses within operate. The Central Coast and Hunter regions may be within 70 km of each other but the former is largely built on commuters and micro and small business dynamics whereas the latter is founded on a port, minerals, and old school ties. Natural and physical resources as well as regional culture and institutions need to be considered. The regional development platform method originally focused on the Lahti region in Finland as an example.

2. *Planning:* A thorough understanding of the region and its internal and external environment is required before working on a strategy. The planning process includes identifying key attributes such as the region's core competence, capabilities, and resources. This was the first step in the Central Coast development and has proven critical. It has enabled a focus and is constantly under renewal. The Futures Strategy in Tasmania is an advancement that aligns well with processes behind smart specialization.

3. *Positioning:* Similar to enterprises, regions need to identify their vision, values, and mission (VVM). Some major companies are now referring to mission as *purpose,* which would suit a regional approach and importance of community. Defining statements for VVM will help both enterprises and regions understand their positioning. Values also help with the *why*. The Central Coast and the Hunter regions are undergoing significant council upheaval. which makes positioning difficult. A level of readiness is required but we are finding a vision really focuses the troops. The Regional Futures Strategy of Northern Tasmania Development is using positioning to drive change. New Zealand, the Sunshine Coast, Queensland, and Geelong in Victoria have been useful in informing the researchers in this area.

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4. *Program(s):* Programs are a way to actively pursue long-term growth in a region and to improve skill-sets. Program choices have significant influence on growth outcomes. Finding the unique value proposition is not unlike the focus behind smart specialization or the platform derived in the regional development platform method. For regional development, it is important to understand how knowledge, infrastructure, government, economy, community, and culture link together to gain constructed advantage. The Central Coast region is developing food and health initiatives; the Hunter region is looking at engineering capabilities and solutions; Northern Tasmania is focusing efforts around food, tourism, and advanced manufacturing.

5. *People:* Human capital is significant for a region as people acting individually and in groups enable regional development through providing knowledge, skills, and capacity. Talent in the tradition of Richard Florida is now used to illustrate such capabilities (Audretsch, 2015). All three areas of the Central Coast, Hunter, and Northern Tasmania regions have underemployment issues with the Central Coast and Northern Tasmania lagging on tertiary education indicators.

6. *Power:* Experience in the field and the literature highlight regional power plays and their importance. It is not clearly defined *who* is in power. For a region, it is important to identify where power resides and to distribute responsibilities accordingly. What the leadership theory describes as toxic leadership is also important in regions. We now look at place attachment as an important indicator. Power in the Hunter region is scattered among key stakeholders. Drawing on lessons from Pittsburgh in the United States, the Hunter region is finding collective leadership a challenge.

7. *Politics:* Regions need to consider different levels of government, multiple higher education institutions, community groups, and both for-profit and not-for-profit organizations. NORTH Link (melbournesnorth.com.au) in Northern Melbourne has informed the research here – multiple universities, multiple stakeholders, and multiple councils buying into a directed platform helps offset conflict around egos and power. Eight local government areas make the politics of regions complex in Northern Tasmania. Northern Tasmania Development is the vehicle to bring this together, but it has had its challenges as it is purely council funded. The Central Coast had two local government areas but the politics, power plays, and lack of a regional approach has seen a merger implemented by the state government.

8. *Process:* Process looks at the key capabilities in a region including human capital, stakeholder dimensions, and political issues; it is used to identify capacity for change. Process is fundamental in the regional development platform method, and lessons from the three regions identify that process is likely to help drive growth. Innov8Central on the Central Coast has continually revised its development, and Northern Tasmania is putting together a project platform to support such processes. Monitoring "the two buckets" is critical here.

9. *Pivot:* Places and regions need to constantly rethink and reformulate, just like organizations. Rarely do things flow as easily as the literature explains. It is a constant process of learning by doing. Ries (2011) highlighted a need for lean startups to pivot. Regional change is similar. Each place is unique and every step and project is new. Anthony, Duncan, and Siren (2014) draw on lean startups and a "minimum viable innovation system" as a way of building an innovation engine. The Central Coast is a good example of pivot with Innov8Central moving from the university to the New South Wales Business Chamber. Moving to a stronger industry base was always the plan. Procrastination is an innovation "killer". Tasmania has suffered from many such false starts.

10. *Perfect:* Evidence-based decision making and calculated risk taking are ways to build strong place-based outcomes. A key step in the process is to perfect ongoing strategies and programs to develop and maintain growth. Perfection is never reached and reflecting on outcomes is a significant element. The Northern Tasmania region has set important goals through its Futures Strategy. The Central Coast is about to embark on a similar goal. HunterNet (operating for 24 years) is closer in its lifecycle to realizing such goals. But this too is a constantly altering journey. The capability literature discusses sensing, seizing, and transforming (Teece, 2009), and this view sums up the place-based project journey.

11. *Project:* After identifying and developing strategic plans for the region and improving and perfecting the system (including leadership, human capital, politics, and programs), different place-based pro-

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jects need execution. Project management skills are therefore also significant. Northern Tasmania has used a project portfolio as a way of cementing and measuring success. One of its key projects in 2016 is the training of council economic development staff and key industry stakeholders. The aim is to broaden the regional innovation expertise. This was one of the earliest project platforms for the Central Coast and its Innovation Champions Program (tinyurl.com/j3d7o4d).

The 11 attributes can also be likened to 11 positions in a football (soccer) team. The 11 positions are not only attributes but set the framework. Like football, in this game, the eleventh "P" (Project(s) or striker(s)) sometimes kick-off the game. This view sees the regional rules of the game starting more from bottom-up rather top-down. A strategically top-down regionally directed approach would alternatively be built around the first "P": Place. Ideally, Place would be the starting point under most regional rules of the game. Systems perspectives are rarely straightforward. Sometime "kicking off" projects and activities in the field of play from the bottom-up actually engenders more in-kind goodwill and support. This is very much the way the Northern Tasmania experience has developed. This is a potential issue with smart specialization, with top-down funds a great way to generate activity, but are communities ready? No doubt potential regional beneficiaries will not resist the funds (Kriz, 2015).

Adding a RIM Sandpit framework

Figure 2 offers a schematic illustration and representation of what a region confronts in constructing advantage, as indicated by fieldwork and research. The 11 elements outlined above appear to be critical in understanding and building capacity and resilience in regions and offer important strategic insights for policymakers, regional stakeholders, and planners. Guiding a complex adaptive system within regionally specific rules of the game is an incredible challenge. Flyvbjerg (2001) noted it takes courage for academics to get so involved. Observing an irrational waste of public money in Aalborg, Denmark, was not his idea of "good science" or "good practice" (Flyvbjerg, 2006). The Futures Strategy in Northern Tasmania and Innov8Central's platform is largely built around what we have termed a RIM Sandpit framework. Figure 2 adds critical innovation process implications to the aforementioned attributes. Place provides a boundary to all. Planning and positioning are central and provide an overarching schema for leaders and communities. If the region is treated like a complex organization, then positioning around vision, values, and mission (the VVM circle holding up the see-saw, or teeter-totter) is critical.

The inverted triangle reinforces that success is built from the bottom-up. But success ultimately requires top-down support. Northern Tasmania is building a platform as is Innov8Central for balancing such agendas. Regions, like organizations, find change difficult; selecting the "right" programs and buckets to pursue for the core and for growth is fundamental and a key element in regional innovation management. Balancing countervailing forces with needs of enterprise (E), government (G), university (U), and other stakeholders is difficult. This is highlighted with the see-saw figuratively centred between Lewin's forces of change. We now get participants in regions to analyze these forces in some detail. Note that RIM Sandpit uses enterprise more generically than industry in its triple helix (i.e., enterprise incorporating entities, clusters, networks, sectors, and industry). Community interests are represented by the people in the centre circle, which captures the quadruple helix. People and power and politics combine to create constant to and fro action around programs. In essence, the three shared circles in the middle, or triple helix, is better described as two enablers of (G) and (U) supporting enterprise (E). The ultimate goal is to grow the enterprise circle and improve GRP as depicted.

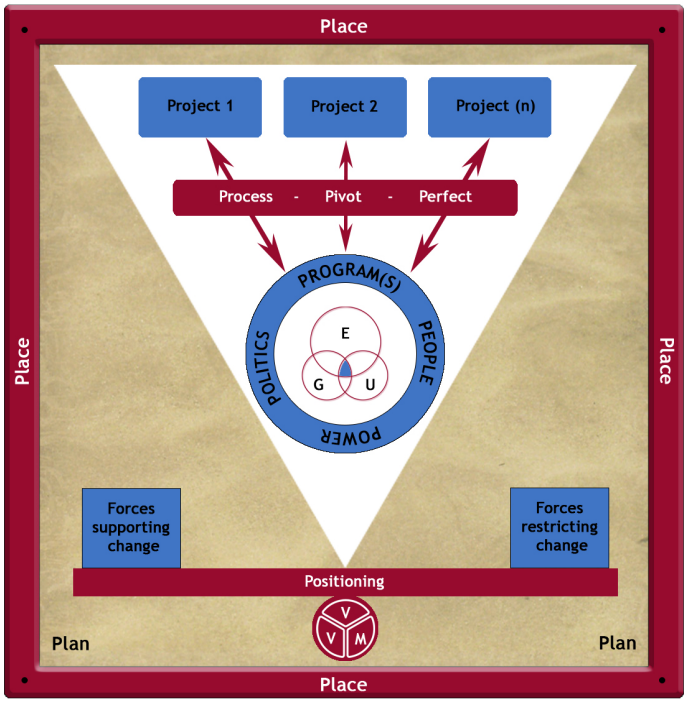

Figure 2. The RIM Sandpit framework

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This program is like a nation's "sovereign" domain. Each region and their requisite community need to determine their own *why*. Regions, programs, and projects need adjusting, and this reinforces why methodologies such as action research are appropriate. Process refers to driving regional projects. The two-way arrows between process, pivot, and perfect linked also to working on the overarching program(s) and the place-based core has key importance (two important buckets of innovative activity). This process of activity can include internal and external innovative projects. As in lean and the startup literature, pivoting and constantly changing and reflecting is critical. Trying to perfect outcomes in a region means adequate implementation and execution. Innovation in regions is becoming project driven, as highlighted. This framework adds insights and advantages to policymakers and regional stakeholders. Using this model, plus additional business systems insights, a company and new venture has key information around locational dynamics. Frost and Egri (1991) are clear about seeing the "surface" but note the importance of interpreting these "deeper" intuitional elements.

Conclusion

In regions, it is not simply a case of "innovate or die". Pittsburgh in the United States is a good example of what can happen to cities when key industries (such as steel) implode. Enterprise lifecycles are getting shorter (Ormerod, 2007) and this will impact on regions; however, most regions still die more slowly. Fortunately, through strong leadership Pittsburgh has turned its fortunes around and innovation has advanced in a range of new sectors. Once leadership is identified, equally each region and place needs a carefully crafted and constructed strategy. This article has discussed regions from a smart specialization and now a RIM Sandpit perspective. The business dynamics that sit within enterprise dynamics are also key and they differ for each place. The next step for the Central Coast, Hunter, and Northern Tasmania regions is to work on unique business characteristics and to drive enterprise growth from the central program and triple helix perspective. One size does not fit all for regions, and treating the business landscape as equivalent is poor policy. Simply advocating startups as a panacea is not sufficient. Regions are complex ecosystems. What this article outlines is a recipe that incorporates a process for programs and projects that potentially perfects innovation for place.

The idea of leadership is implicit in the model once the region establishes its *why*. The mandala is a key component and hence the shading in the center of the RIM Sandpit. Setting up a governance structure is not easy. Setting goals around GRP, we have found, is also important. It builds purpose, responsibility, and accountability. That is when the first bucket around programs kicks in. Fundamental to growth are the enterprises. Regions in Australia should start looking further afield to German Mittelstand and what is known as "hidden champions" for enhancing their place outcomes. These steady growth companies are regionally "sticky" and are likely to remain in the region as it grows. This is the current priority of the Central Coast and Hunter regions through state government and federal government support. Superior leadership is required at a regional level to understand context and paradox and to integrate trade-offs between competing values (Cameron et al., 2014). The cases and practice highlight that regional leadership in Australia is currently variable in such capacity. Once the "why" and leadership are identified, then a region needs to ask "what" and "how". The RIM Sandpit in essence helps identify the *what* and the *how* but relies on place stakeholders for deciding *why* and ultimately *who*. Then, as the RIM Sandpit highlights, it becomes a case of constructing and then "steering" the program and projects around an established vision and platform.

Regional innovation management ultimately is built around community; this means placing people and their needs as central (quadruple helix). The RIM Sandpit identifies that people also bring in power and politics and ultimately it is the region's responsibility to work with its leaders to address the fine balancing of forces going forward. Innovation champions literature and practice is proving fruitful for the cases. As suggested, there is a lot of goodwill currently not being tapped. This article fills an important gap for those wanting to make interventions stick. It offers insights into a meso-level and this can be drilled down further to a micro-level. This approach is helping considerably at the policy and regional governance level for all three cases but there is a long way to go. This is not a short-term game. The RIM Sandpit framework is not dissimilar to how modern business contemplates the *two buckets* associated with innovation. Finding unique value and growing the business (regional) model is fundamental to both. It is a case of sensing, seizing, and ultimately transforming capabilities and regions. Undervalued are the field officers in Australian regions

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from state and federal departments. A number have become invaluable sources and experts in their understanding of the local terrain. They are ideal agents for assisting with change.

The Australian experience has shown that it is critical to have some form of apolitical network administrative organization. The expanding enterprise circle should always be central with universities and government as enablers. This approach needs support and acceptance within the governance structure. In cultures where top-down strategy is more accepted, a different leadership structure is probably warranted. Regional innovation management's applicability beyond the Australian regional context is yet to be explored but the *recipe* itself appears generalizable. Place is the important outer element of the RIM Sandpit framework that makes regions and places different but, like their corporation counterparts, regional leaders need to develop, refine, and sometimes reconfigure their strategy. We have found pivoting and adjusting a critical component. The RIM Sandpit enables those entrusted with regional advancement to make such adjustments. However some words of caution: just learning the rules without context, experience, and judgement does not make you an expert (Flyvbjerg, 2001). Also remember that many of the "children" in this sandpit have big egos and do play for higher stakes. But these challenges are outweighed by the goodwill normally apparent in such systems.

About the Authors

Anton Kriz is Senior Lecturer at the University of Newcastle, Australia, where he is a specialist in innovation management and strategy. He has an extensive background in business, industry, government, and academia. He has been a CEO, a management consultant, and while working in Government, has secured international joint ventures as well as conducted major research and development projects in Australia and overseas. Anton has had over 20 years research experience in Asia working with key markets such as Japan, Malaysia, Singapore, South Korea, Hong Kong, Taiwan, and Korea. Because of his understanding of doing business in China, Anton has also worked on projects such as Tourism Australia's 2020 China Strategy. He is known for his ability to boundary span between government, university, and industry. Anton's other expertise is in enterprise-specific innovation management in areas such as mining services, manufacturing, agribusiness, and sport.

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Alexandra Kriz completed a Bachelor of Economics (Honours) at the University of Sydney, Australia, where she also recently completed her PhD in the early growth of firms related to innovation in spin-outs. She has been a visiting researcher at the Turku School of Economics (University of Turku, Finland) and the Adam Smith Business School (University of Glasgow, Scotland). Alexandra's Honours thesis explored ambidexterity and the ability to undertake both radical and incremental innovation.

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Developing a Startup and Innovation Ecosystem in Regional Australia

Troy Haines

> *"If a man does not keep pace with his companions, perhaps it is because he hears a different drummer. Let him step to the music which he hears, however measured or far away."*
>
> Henry David Thoreau (1817–1862)
> Author, poet, and philosopher

Technology is enabling change at an ever increasing pace, not only in urban contexts, but also in regional centres, where the Internet in particular is enabling entrepreneurs to compete in the global marketplace despite the size and remoteness of their home cities or towns. In regional Australia, the challenges of high unemployment, fading traditional industries, a lack of economic diversity, and a "brain drain" of talent to urban centres 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. In this article, the author shares lessons learned as an entrepreneur and through the ongoing development of a self-sustaining startup and innovation ecosystem in the remote region of Cairns, Australia. The model described in this article is now being applied to other regions in Australia, where trained champions are driving the development of startup and innovation ecosystems adapted to regional needs.

Introduction

The Cairns region of Australia (Box 1) faces challenges that are similar to other regional areas in Australia and around the world: declines in traditional industries, a boom-and-bust economic cycle, and a scarcity of "good jobs". With young talent facing a choice between moving to the big cities or staying behind but remaining unemployed, it is no wonder that an air of pessimism can set in. And yet, regional communities are the heart of Australian culture, are often areas of outstanding natural beauty, and can host rich and vibrant communities of individuals that care about each other and their region, and wish to see it flourish. If a region is fortunate enough to have a strong tourism industry, money may flow into the region (at least when the economy is going well); but there still remains a substantial economic development challenge to stimulate sustainable development and long-term prosperity.

In my own experience as an entrepreneur and an "ideas person", I dreamed of creating a company that could change the world, but from my remote location I struggled to figure out how it might be done, even despite recent advances in technology and Internet accessibility. Five years ago, I was working on what I thought was going to be "the next big thing" in the personal development industry: iAMconnected (iamconnected.com) – a goal-setting and accountability application that connects people to mentors and coaches. But, after investing $40,000 of personal savings into the project and having created what I thought was an amazing web application, the platform struggled to gain traction. It was fast becoming apparent that, despite having previously built and sold a successful online travel business, I had no real idea how to build a high-growth venture. As I desperately kept adding features, changing layouts, and changing directions, not much else changed except for my bank balance.

I started looking around my region for help from other entrepreneurs, mentors, key service providers, and investors. But there was no obvious network to tap into, no path to follow, and no regional infrastructure to help build the high-growth, high-scalability startups that promised to be the engines of economic growth. Looking abroad, I could see that places such as Silicon Valley had all the things I needed, but I was not in a position

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Box 1. An overview of Australia's Cairns region (Cairns Regional Council, 2016)

The Cairns region of Australia is located on the east coast of Far North Queensland, approximately 1,700 km from Brisbane, which is the nearest urban centre with a population greater than 200,000. Formed in 1876 as a transport and support hub for the local mining and agriculture industries, tourism now plays a major role in the Cairns economy, attracting over 2 million visitors per year. The region is part of the Wet Tropics Rainforest and is commonly known as the "Gateway to the Great Barrier Reef".

Key statistics:

- Land area: 1689 km2
- Population: 160,000
- Annual population growth in past decade: 2.3%
- Gross Regional Product (GRP): $7.83 billion AUD
- Key industries: tourism, agriculture, healthcare, and retail
- Employment growth in past five years: education and training; public administration and safety; healthcare and social assistance (Economy ID, 2015)
- Employment declines in past five years: accommodation and food services; construction; professional, scientific, and technical services (non-computer); retail (Economy ID, 2015)
- Youth unemployment: 22.1% compared to Queensland average of 14.1% (Queensland Government, 2015)
- Top markets being addressed by startups: professional services; agriculture; education and training; tourism; information media (Queensland Government, 2016)

to relocate. I have family in Cairns and I was committed to the region. So, as a frustrated entrepreneur experiencing the problem first-hand, I sensed that there was an opportunity to build the support structure we needed to assist us and others in the region.

This article shares the lessons learned from the first four years of attempting to develop the Far North Queensland startup and innovation ecosystem, at the heart of which lies theSPACE Cairns (thespacecairns.com), a self-funded, regional startup and innovation hub. In conjunction with stakeholders from across the region, we have developed a model that is showing early signs of success and has been sufficiently encouraging to be ready to roll out to other regional areas across Australia.

Here, I will first describe the gap we needed to fill: what key ingredients were missing from the region that would enable the creation of supporting infrastructure and the required culture of entrepreneurship. Then, I will outline the model we have developed to create a startup and innovation ecosystem in Cairns, but which also serves as a general model to roll out to other regional areas. Finally, I will share specific lessons we have learned. We hope that our experiences will prove valuable to others who are taking a regional approach to stimulating innovation and fostering entrepreneurship.

Key Ingredients

By studying models developed abroad, such as in Silicon Valley, and through our own experiences and assessments of what regional entrepreneurs need to be successful, we identified the following key ingredients of a startup and innovation ecosystem, which were largely missing, underdeveloped, or disconnected in the Cairns region:

1. *Culture:* It is essential to develop an entrepreneurial culture within a region, not only among the entrepreneurs themselves but among all stakeholders (Mason & Brown, 2014; World Economic Forum, 2013). The irony of the regional mindset is that, despite its familiarity with "small businesses", it struggles to understand how a "startup" is something altogether different. For many stakeholders, there is a learning curve in understanding the "scalability" and "innovation" required for a startup to deliver the kind of growth required to fulfill the promise entrepreneurship holds for economic development. Today's regional startups represent a completely new way of doing business, and despite their regional location,

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they often aim to operate on a global scale from the very beginning. The entrepreneurial culture must reflect this paradigm shift.

2. *Champion(s):* An ecosystem needs a champion or a team of champions to provide a driving force. A champion is a catalyst that accelerates interest and activity, which is particularly important in the very beginning or when entering a new growth phase. But champions also play important roles in keeping stakeholders focused and moving forward on an ongoing basis. Beyond passion, a champion must inherently understand the necessity for an ecosystem. Ideally, they seek to benefit from the ecosystem as entrepreneurs but also wish to see it developed for the benefit of the broader community. As emphasized by Stam (2015), entrepreneurs with a long-term commitment to a regional ecosystem can play a leadership role because they "are often best positioned to recognize the opportunities and restrictions of the ecosystem, and to deal with them, together with the "feeders" (such as professional service providers and the financial infrastructure)." Here, we see champions as both "leaders" and "feeders" who drive the ecosystem and work with other leading entrepreneurs, key stakeholders, and service providers to ensure its health and sustainability.

3. *Network:* Working in isolation, an entrepreneur is doomed to fail. A strong and diverse network of other entrepreneurs, mentors, service providers, investors, etc. helps entrepreneurs share ideas, access resources, receive encouragement and advice, overcome barriers, and learn about new opportunities (Isabelle, 2013; Stam, 2015). Although every individual has their own set of relationships, an ecosystem can help formalize, expand, and activate an entrepreneur's network, and act as a support system of mentors, peers, service providers, etc. (Mason & Brown, 2014; World Economic Forum, 2013).

4. *Stakeholder engagement:* In a regional context, the saying "it takes a village to raise a startup" is particularly relevant. The ecosystem must ensure ongoing engagement among key stakeholders, meaning those "who have a self-interest in the development of entrepreneurs and the economic development outcomes that result" (Markley et al., 2015). 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.

5. *Process:* To build capacity in a region, there must be a clear process, or runway, that will lead entrepreneurs from idea to commercialization to exit and provide the necessary support services along the way (Markley et al., 2015). Champions can play a pivotal role in leading entrepreneurs through this process. However, *all* stakeholders should contribute to process development and execution, and every aspect of the ecosystem should be designed to support and further develop the process.

6. *Physical space and events:* Entrepreneurs need a place to work and benefit from the availability of co-working space. Having a suitable place to run events and programs also helps to promote engagement among "highly visible and authentic participants" (Stam, 2016) and to stimulate an environment of strategic risk taking and entrepreneurship. Thus, the physical space becomes a means of sharing information and knowledge, building a community, and fostering the necessary culture.

Our Model

Over the past four years, our company – theSPACE Cairns – has operated as a private equity company, with a mandate of “for profit, for purpose”. In the absence of significant funding or a not-for-profit status, our model has required that we “practice what we preach” and generate results (revenue) by delivering real value. This approach has created grass roots growth, which we believe will be sustainable long term. As a result of our efforts to build our own businesses following this model, theSPACE Cairns is now one of several companies owned by our parent company, theSPACE Australasia (Box 2).

In most instances, the startups that we support pay fees for services such as coaching, programs, events, and our membership program. However, when we find something that aligns with our vision and values, then we may become partners in the companies. There is no fixed structure for equity exchange; we negotiate this with individual founders based on their requirements.

theSPACE Cairns team has grown to five members who work with key strategic partners to build a startup and innovation ecosystem in Far North Queensland. The model is designed to fit the needs of our own region, but is also being developed as a replicable and sustainable model that can be "exported" and applied to other regional areas in Australia and beyond. Although no

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Box 2. Examples of companies owned by the parent company, theSPACE Australasia

- *theSPACE Cairns* (thespacecairns.com): drives the startup and innovation ecosystem in the Cairns region, including delivering program and events and providing physical space for entrepreneurs
- *Emerging Entrepreneurs* (emergingentrepreneurs.com.au): a school-based entrepreneurship online learning platform with associated teacher accreditation. It allows teachers to effectively teach students startup skills, collaboration, proactiveness, and responsiveness. Effectively, the platform shows students how to create a job as opposed to look for one.
- *Innovation Ecosystems* (innovationecosystems.com.au): the organization we use to spread the work we are sharing as part of this article beyond the Cairns region.
- *IoT Australasia* (iotaustralasia.io): the latest of our companies works with regions and industry to assist them in the establishment of Smart City design.

"one size fits all" approach is possible (or desirable, given the different opportunities possible in each unique region), we have identified fundamental concepts that apply to most regions and can be customized as needed.

Our model recognizes that building a startup and innovation ecosystem in a regional area is fundamentally different than in a large city. The lack of population density if a regional setting means that large investments in hard infrastructure (i.e., hubs, co-working spaces) are often a waste of resources, at least until the ecosystem develops to a critical mass. Time and resources are much better spent educating the community around the startup methodology and how to apply technology to existing industries, with a view to finding high-growth, scalable startup opportunities.

The foundation of our approach is based on coaching and consulting through champions who also drive the ecosystem and the engagement of key stakeholders (Figure 1). This approach developed organically through our efforts in Cairns, where we fulfilled the roles of champions and coaches through our efforts to create our regional startup and innovation ecosystem. Now, we are applying this approach to train local "startup and innovation coaches" to catalyze and drive the development of new ecosystems in other regions of Australia. In a regional setting, this approach has several advantages:

1. It requires little startup capital because it is focused on "soft infrastructure", meaning developing connections throughout the ecosystem and building a culture of entrepreneurship.

2. Champions create an income from the development of the ecosystem, so the approach is self-sustaining. However, the coaching and consulting income should be considered a medium-term supplement that allows them to work on their own high-growth, scalable ideas in the meantime. Ideally, champions are replaced over time as their own startups eventually flourish.

3. The ecosystem is driven by members of the local community.

4. Regions can customize the approach to develop their own brand.

5. Champions are trained in the fundamental principles of entrepreneurship, such as agile planning, establishing core assumptions, building minimum viable products, validating assumptions, and repeating this learning process.

6. When a person's core business comes from within the ecosystem, they are sufficiently motivated to develop that ecosystem. This involves building relationships with key stakeholders, running programs, and offering events.

7. The champion organizes and runs programs and events, and offers consultations and coaching programs. Thus, the approach builds capacity in the region as more and more people develop effective entrepreneurial skills. Mentors still play a substantial and essential role, but the champion teaches a specialized process to guide entrepreneurs through the commercialization runway.

In empowering regions through a champion model, we focus on people who understand the uniqueness of a region and work with them to accentuate opportunities relating to what their region already does well. For example, in the broader community, there is a stigma that startups are all about creating "Uber-type apps" and that related communities are only for "technical geeks". The reality is that the very remoteness of the communities tends to foster an innovative spirit and create diverse opportunities for startups.

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Figure 1. Priority interactions with key stakeholders as startups move through the "runway" to commercialization

Our physical space

We offer physical co-working space to the ecosystem, with desks available on a casual, permanent, or semi-permanent basis. In addition to being a convenient and affordable place for entrepreneurs to work, it brings them together to share ideas and facilitate collaboration. As the ecosystem has developed, we have moved to larger facilities to better suit our growing needs for desk space, meeting rooms, private rooms, leisure rooms, kitchen facilities, and communal areas in which to hold events (Figures 2 and 3).

Our programs and events

Programs and events foster a culture of innovation and help build the foundation of the supporting ecosystem. In Cairns, we offer:

- a ten-week, school-based "Emerging Entrepreneurs" program that teaches high school students about entrepreneurship and links them into the broader ecosystem. We are now rolling out a digital version with supportive teacher accreditation that is presently in numerous schools throughout Queensland

Figure 2. Co-working and event space at theSPACE Cairns

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Figure 3. Stakeholders coming together for a pitch event at theSPACE Cairns

- an eight-week "Startup Basecamp" pre-accelerator program that helps budding entrepreneurs validate their ideas
- programs to link startups to small and medium-sized enterprises (SMEs)
- programs to help SMEs, corporations and government agencies to develop their own cultures of innovation and intrapreneurship
- an investment fund (under development) to seed early-stage ideas with the view of then attracting follow-on funding into our region
- a membership program to build the network and engage the community in innovative thinking
- mentoring events that allow entrepreneurs to meet one-on-one with successful startup founders who have exited, founders of growth-stage startups, angel investors, venture capitalists, senior management of technology companies, etc.
- other one-off events and hosting of community activities, such as Startup Weekend Cairns

Early Results

Four years into the journey, the model that we have developed and applied in Cairns is now being deployed in regions throughout Australia. Measuring progress at this early stage is difficult, but there are a few early signs of success:

- As of June 2016, 592 people, including 137 paid annual members, have attended events or made enquiries through theSPACE.
- theSPACE now has 6 major corporate sponsors and receives support from both local and state governments.
- Up and coming startups that have grown with the support of theSPACE include: Inspection Apps (inspectionapps.com) digital checklists, the Natural Evolution (naturalevolutionfoods.com.au) farm and natural food products, the Catch'n'Release (catchnrelease.com.au) anchor retrieval system, and the Emerging Entrepreneurs (emergingentrepreneurs.com.au) school-based entrepreneurship education program.
- A recently completed study conducted by the Queensland Government, which mapped startup ecosystems

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throughout Queensland, showed that Cairns has the highest density of startups per capita of any region in Queensland (Queensland Government, 2016). Cairns has one startup for every 5,300 people compared with, for example, South East Queensland, which has one startup for every 12,700 people. However, the study also highlighted that the money raised by these startups in Cairns remains relatively low.

- In 2014, my fellow theSPACE Co-Founder, Damian Zammit, and I were named Innovation Champions by the Minister of Innovation and the Premier of Queensland. We were further inducted into the Queensland Government Innovation Wall of Fame for the work we have done thus far in building the North Queensland startup and innovation ecosystem.

- Through its coaching program, theSPACE helped an established aluminum fabrication company survive the collapse of the Cairns construction industry in the wake of the global financial crisis. Norweld's (norweld.com.au) directors were encouraged to closely examine their business to identify what it did particularly well, what it could uniquely offer, and how they could scale and grow it beyond the Cairns region. By refocusing the business on fabricating premium, heavy-duty aluminum trays and canopies for utility vehicles, or "utes", the company was able to reinvent itself. Defying the trend of a shrinking manufacturing sector, in the last 2 years Norweld has gone from 18 to 35 staff and has taken over a large manufacturing plant. Today, Norweld ships its products throughout Australia and is pursuing international sales.

- In 2015, theSPACE won a national challenge through Sustainable Economic Growth for Regional Australia (SEGRA; segra.com.au), and we are now working with them to support regions throughout Australia to develop their own startup and innovation ecosystems, as described in the next section.

- In 2016, Australian Prime Minister Malcolm Turnbull visited theSPACE (Figure 4) to see first-hand the innovations created by our regional entrepreneurs and to announce $10 million in funding for an Innovation Centre to be built at James Cook University in Cairns, which theSPACE will collaborate with as a commercialization partner (Groom, 2016). This federal government funding is in addition to $10 million in funding from the state government and a further $30 million from private investors, resulting in a total investment of $50 million for the Cairns Innovation Centre. A video of the Prime Minister's visit to theSPACE and his funding announcement, which provides context for the investment in alignment with the National Innovation and Science Agenda (Australian Government, 2015), is available here: youtu.be/nqOWBlVpUcs

Figure 4. Australian Prime Minister Malcolm Turnbull meets members of theSPACE Cairns team

Next Steps: Applying the Model to Other Regions

Moving forward, with the support of SEGRA, we are beginning to evaluate the status of other regions with the aim of applying the model we have started in Cairns to the development of startup and innovation ecosystems across regional Australia. This work is being supported by Charles Sturt University (csu.edu.au) as an academic research partner to: i) review current literature on regional startup/innovation ecosystems, ii) research different models that are currently being utilized in regions, and iii) compare the findings to the results generated by the champion model in Cairns.

Early-stage discussions have taken place with 13 regions, which have highlighted challenges such as funding the initial training and overcoming general parochialism of regions, which we are presently working to overcome. Also, we recently started working with a pilot region – the Atherton Tablelands, a rural area 80km from Cairns – to assist them in the development of their own startup and innovation ecosystem. An early snapshot of this pilot region has revealed the following:

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1. The region has a few passionate drivers for the ecosystem, but no real champions.

2. Key stakeholders can be identified, but very few have been effectively engaged.

3. The region lacks a physical space to serve as the hub for an ecosystem.

4. A limited number of events have been held, including eight small events relating to innovation and entrepreneurship in addition to one startup weekend.

Accordingly, our work in this pilot region is focused on:

1. Appointing a Champion Team of nine people who are currently being mentored by theSPACE.

2. Supporting the region as national host for the international Future Agro Innovation Challenge (futureagrochallenge.com). Agriculture is a primary industry in the Atherton Tablelands region, and is therefore an area of focus for the ecosystem.

3. Building the ecosystem while also building the region's own consultancies and startups.

4. Hosting twice-monthly startup and innovation events run by the region's champions.

Lessons Learned

Although our model is now well developed and tested locally and is being deployed in other regions, our early ecosystem-building efforts involved a lot of trial and error, through which we learned many lessons. Some key lessons in the form of recommendations for others wishing to build a regional startup and innovation ecosystem are outlined below:

1. *Recognize that building an ecosystem takes more than just funding an accelerator or incubator:* Ecosystem building 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 programs and gives entrepreneurs a place to work, and it helps provide a focus to the ecosystem. However, many ecosystems put too much effort (and expense) into providing a polished physical space right from the beginning. We have found that, in the early stages of building an ecosystem, growing the community and soft infrastructure (i.e., the ecosystem and culture) are far more important. We encourage a lean mentality to growing the co-working space in step with the needs of the growing community.

3. *Reflect the region:* Although the approach can generally be applied to any region and it encourages entrepreneurs to start global businesses, 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 startup 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 trades people. The opportunity is to bring technology to what regions already do well and educate our entrepreneurs on an effective commercialization process.

5. *Remunerate ecosystem builders:* We observed that ecosystems that rely solely on volunteers put tremendous strain on these people and inevitably, despite their best efforts, they burn out and move on. Having a trained startup and innovation coach helps to overcome volunteer burnout.

6. *Focus on sustainability:* Initial funding from high net worth individuals or government agencies to start an ecosystem certainly can be helpful, but the benefits will soon dry up if the underlying business model is not sustainable or if the initial investment only provides hard infrastructure. Building a community is far more important.

7. *Pay attention to roles:* In an ecosystem, stakeholders may make or take particular roles that might do more harm than good, even when their intentions were good. This risk highlights the need to build and maintain relationships with key stakeholders, encourage connections, and help individuals or organizations find or create beneficial roles.

8. *Build from the grassroots up:* Having a trained startup and innovation coach provides early-stage support for entrepreneurs that are often too early stage for most mentors to spend significant amounts of time nurturing. This approach fosters a grassroots approach to ideation in the communities and helps build the ecosystem organically.

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Conclusion

Although it is still early days, we are seeing positive activity in regions and 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 champion's role is to engage with stakeholders and founders to shift their attention globally and give them the knowledge and support they need to turn their dreams into reality.

A region's economic development depends on a widespread culture of entrepreneurship that is not risk averse and views strategic failure as a learning opportunity. To remain relevant in the modern global economy, regions in Australia (and around the world) must build the ecosystems and apply the processes that help entrepreneurs turn good ideas into high-growth, scalable businesses. That is the path we have started taking in Cairns, and we hope our model and experiences will encourage other regions to do the same.

About the Author

Troy Haines is Co-Founder and CEO of theSPACE Australasia in Cairns, Australia. He is also a Startup and Innovation Coach who has worked with hundreds of entrepreneurs across Australia to help them commercialize their ideas. Amongst many awards, he was named Innovation Champion in 2014 by the Minister of Innovation and Premier of Queensland. He was also inducted into the Queensland Government Innovation Wall of Fame for his work in building the North Queensland startup and innovation ecosystem. Troy and the team at theSPACE have developed startup and innovation programs, which they deliver across a wide audience, from high school students and SMEs to government (and everyone in between). He holds a Bachelor's degree in Business (Marketing) from Australia's Charles Sturt University and is currently working towards a Master's degree in Applied Innovation and Entrepreneurship from the University of Adelaide.

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Employment Dynamics of Australian Entrepreneurship: A Management Perspective

Luke Hendrickson, Stan Bucifal, Antonio Balaguer, and David Hansell

> *"Entrepreneurs – the most successful, though not the only, practitioners of innovation – rarely stop to examine how they do it. Most of them simply get on with the job of creating value by exploiting some form of change – be it in technology, materials, prices, taxation, demographics, or even geopolitics."*
>
> Nicholas Valéry
> In "Industry Gets Religion"
> *The Economist*
> February 18, 1999

This article attempts to draw together the literature on high-growth firms and management capability using Australian Government data from the Expanded Analytical Business Longitudinal Database. We tracked cohorts of new micro-sized firms (startups) over five years from birth. Compared with startups that had a low employment growth trajectory, medium- and high-growth micro-startups exhibited higher financial performance, higher innovation activity, and a greater propensity to seek external (debt or equity) finance. From a management perspective, medium- and high-growth startups were also significantly more likely to monitor and assess their performance across a wider range of performance indicators. High-growth micro-startups exhibited significantly higher operational process and organizational/managerial innovation, a higher likelihood of foreign ownership, and a greater demand for equity finance than medium-growth micro-startups. This data is consistent with other evidence that suggests that sustained high growth comes from superior strategic management and may suggest an ongoing role for government policy in building firm management capability in order to foster employment growth.

Introduction

Creative destruction is a restructuring concept within an economy where it is argued that new, more innovative, and more productive firms replace less innovative, less productive ones (Schumpeter, 1942). The efficient reallocation of resources between these growing and shrinking firms is critical to aggregate employment and productivity growth. Empirical research has accelerated over the last few decades and appears to be validating the creative-destruction concept, at least from the employment-growth perspective. High-growth firms generate most of the jobs in an economy and tend to be younger than their non-high-growth counterparts (Moreno & Coad, 2015). Large, persistent productivity differences between firms within industries is observed in all countries examined and productivity, driven in the long term by innovation, has repeatedly been shown to affect firm survival and growth (Mohnen & Hall, 2013; Syverson, 2011). Considerable international evidence suggests that entry, exit, expansion, and contraction of firms are closely related to measures of innovation, productivity, and profitability (Bartelsman & Doms, 2000; Foster et al., 2001; Moreno & Coad, 2015; Syverson, 2011). Recent OECD results from 18 countries over the period 2001–2011 showed that young, small firms make a disproportionate contribution to job creation and that there are significant differences among countries in the capacity of these firms to survive and grow (Criscuolo et al., 2014). Hendrickson and colleagues (2015) confirmed that Australian firm employment dynamics are similar to that observed in other countries: between 2006 and 2011 startups (firms aged 0–2 years) added approximately 1.44 million jobs to the

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Australian economy whereas all older firms (3+ years) shed just over 400,000 jobs over the same period. Understanding the motivations, entrepreneurial activities and framework conditions that drive these high-growth dynamics would therefore be expected to lead to better policy outcomes (see Aghion & Roulet, 2014; Mason & Brown, 2011; Nightingale & Coad, 2013; Shane, 2009).

One explanation for the presence of high-growth, productive, and innovative firms is superior or strategic management capability (Moreno & Coad, 2015). Through a combination of motivation, creativity, resources, and timing, a firm can opportunistically build or leverage a competitive advantage to achieve and sustain high growth (Bloom et al., 2013; Bloom & van Reenen, 2010; Davidsson & Wiklund, 2013; Foster et al., 2011). In Australia, strong management and leadership skills have been shown to be correlated with increased firm innovation, productivity, and growth, as well as overall increased employee engagement, satisfaction, and wellbeing (Boedker et al., 2011; Green, 2009). Recent empirical work by Bloom and colleagues (2014) suggests that one-quarter of cross-country and within-country multifactor productivity gaps can be accounted for by management practices.

Innovation management is critical to business competitiveness (Dodgson, 2014). Studies of firms in the United Kingdom and Australia argued that innovation is a significant driver of firm growth with innovative firms growing two to five times faster than firms that do not innovate (Department of Industry, 2014; NESTA, 2009). Lentz and Mortensen (2008), working with a Danish firm panel from 1992–1997 found that 74% of aggregate productivity growth came from reallocation of employment to innovating firms through both entry/exit dynamics (21%) and growth through capture of market share (53%).

Until now, our capacity to understand these firm dynamics and its impact in Australia has been limited by a lack of integrated micro-aggregate data. This article outlines our recent efforts to bring the concepts of strategic management and employment growth dynamics closer together by determining whether strategic management characteristics are more common in high-growth Australian startups.

Methodology and Results

The Australian Department of Industry, Innovation and Science partnered with the Australian Bureau of Statistics (ABS) to create the Expanded Analytical Business Longitudinal Database (EABLD; tinyurl.com/zncglzn). The EABLD is a census of firms over the period 2001 to 2012. Any firm with an Australian Business Number (ABN) or Australian Company Number (ACN) is included. In 2001, there were 1.70 million firms in the database accounting for 7.12 million full-time equivalent jobs, $570 billion value added, and $2.39 trillion total sales output, of which $173 billion came from exports. In 2012, there were 2.83 million firms in the database accounting for 8.96 million full-time equivalent jobs, $1.3 trillion value added, and $4.48 trillion total sales output, of which $352 billion came from exports. The EABLD also includes a substantial number of firms (approximately 10,000 per annum) with detailed business characteristics. This information enabled us to cross-reference startup financial performance with firm business characteristics that relate to strategic management capability.

We followed five cohorts of micro-sized startups (i.e., fewer than 10 employees) over the five years following their entry into the economy (i.e., starting 2002, 2003, 2004, 2005, and 2006). We analyzed micro-startups as a representation of organic or de novo entrepreneurship, avoiding the influence of mergers/acquisitions by large firms influencing the result. After five years, we compare the financial performance of those surviving firms in the startup cohort that stayed in the same size range (0–9 employees) with those in the cohort that grew in employment into 10–19 and 20+ employee categories. In this article we label these latter firms as medium- and high-growth, respectively.

Micro-startup financial performance

Figure 1 shows that a very small fraction of the surviving micro-startups are responsible for most of the job creation by all micro-startups over a five-year period. Although representing only 3.2% of all micro-startups, they accounted for 77% of gross job creation by surviving micro-startups over five years. This result is very similar to results for other OECD countries (generally less than 5%; Criscuolo et al., 2014). For most sectors of the economy, these firms grow dramatically after five years to more than compensate for the job destruction of exiting micro-startups.

Figure 2 shows that the disproportionate contribution of high growth micro-startups varies by industry (62.5% to 93.6%). For example, micro-sized mining firms that both survived and grew into a higher size class totalled 8.3% of all micro-entrants in that sector and also accounted for 93.6% of micro-firms' contribution to total employment growth for that sector. The

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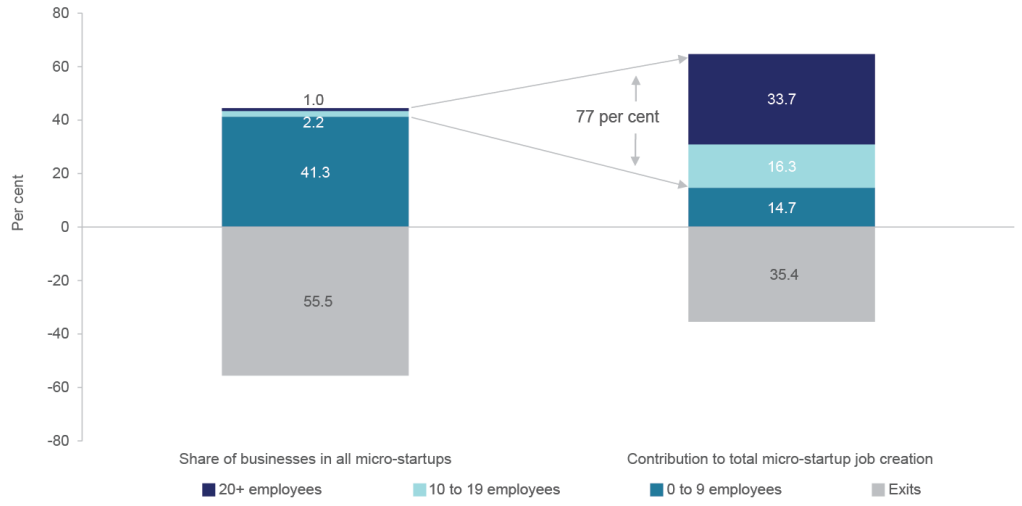

Figure 1. Five-year post-entry dynamics of micro-startups by share of firms for all sectors from 2002–2011.
Source: Hendrickson et al. (2015).

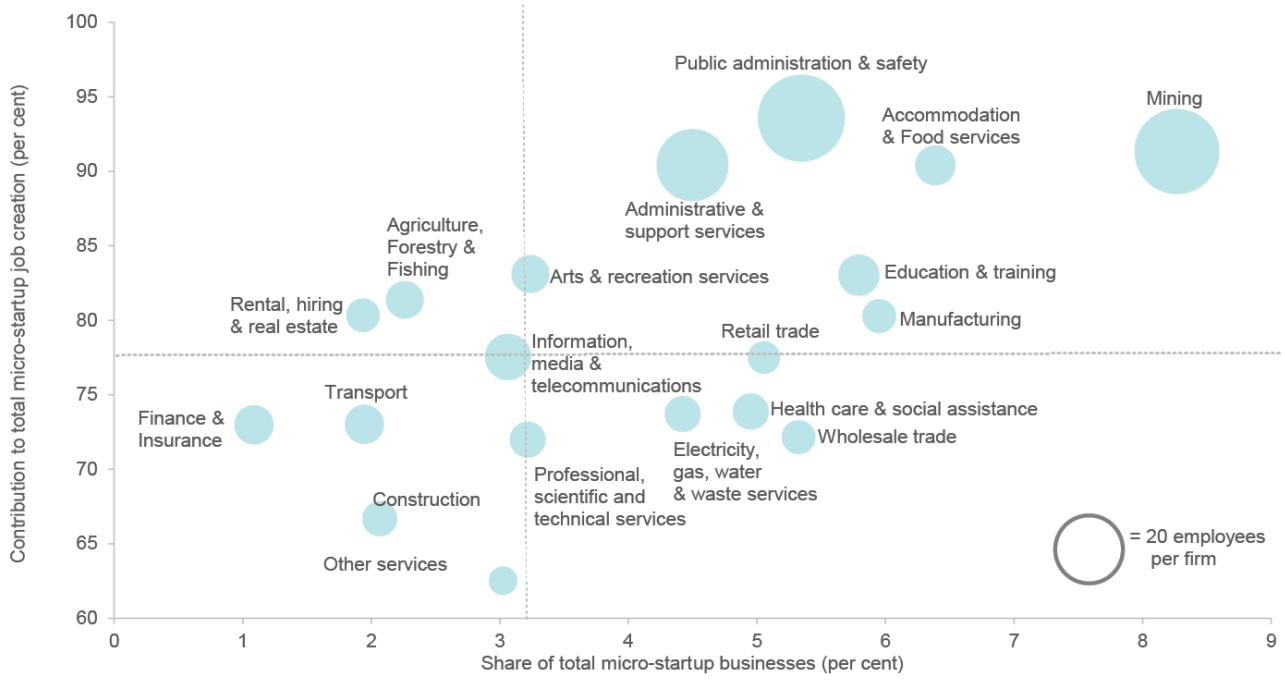

Figure 2. Five-year post-entry dynamics of micro-startups by share of firms, by industry from 2002–2011. The size of the bubbles represents the number of employees created per high-growth firm over five years.
Source: Hendrickson et al. (2015).

construction industry is at the other end of the spectrum with a lower percentage of high growth micro-startups and, perhaps not surprisingly, a lower contribution to employment growth for the sector.

When we further analyzed the financial performance of medium- and high-growth micro-startups created in 2006 (aggregating all sectors), we found that these firms exhibited superior average sales, gross operating profit, employment, value added, and capital expenditure compared with surviving micro-startups firms that were stable or grew marginally over the same period (low-growth micro-startups). Figure 3 illustrates this trend for growth in sales for three sectors). Although

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the lower ranges on these performance measures were often similar, the upper ranges were significantly different. These results were common to all industry divisions in Australia and across earlier cohorts studied (data not shown).

Firms were asked the question: *During the year, to what extent did the business focus on the following when assessing overall business performance?* Figure 4 reports the percentage of firms that ticked "Major extent" for each of the six possible performance assessment categories. Figure 4 shows that the medium- and high-growth micro-startups in our study were significantly more likely to assess their performance across a wider range of measures compared with their low-growth counterparts. High-growth micro-startups appeared to pay more attention to cost, financial, and operational measures of performance than their medium-growth counterparts (Figure 4). Medium- and high-growth micro-startups were significantly more likely to increase their range of goods and services offered, have some form of foreign ownership, and be seeking debt or equity finance over the first five years of their life (Figure 5). Figure 6 shows the proportion of firms that reported introducing an innovation over a five period. Four different types of innovation are reported as defined by the OECD/Eurostat Oslo Manual (OECD, 2005). Figure 6 shows that medium- and high-growth micro-startups were significantly more likely to be innovating in any given year across the four main types of innovation: products, processes, organizational/management methods, and marketing methods. In particular, high-growth micro-startups exhibited significantly higher operational process and organizational/managerial innovation and double the likelihood of foreign ownership than medium-growth micro-startups (Figures 5 and 6).

Conclusion

Startup activity is critical for employment growth in Australia. It is a very small fraction (3%) of surviving startups that go on to generate most (77%) of the employment growth in young firms. These high-growth micro-startups occur in every industry sector of the economy. Job creation by these high-growth micro-

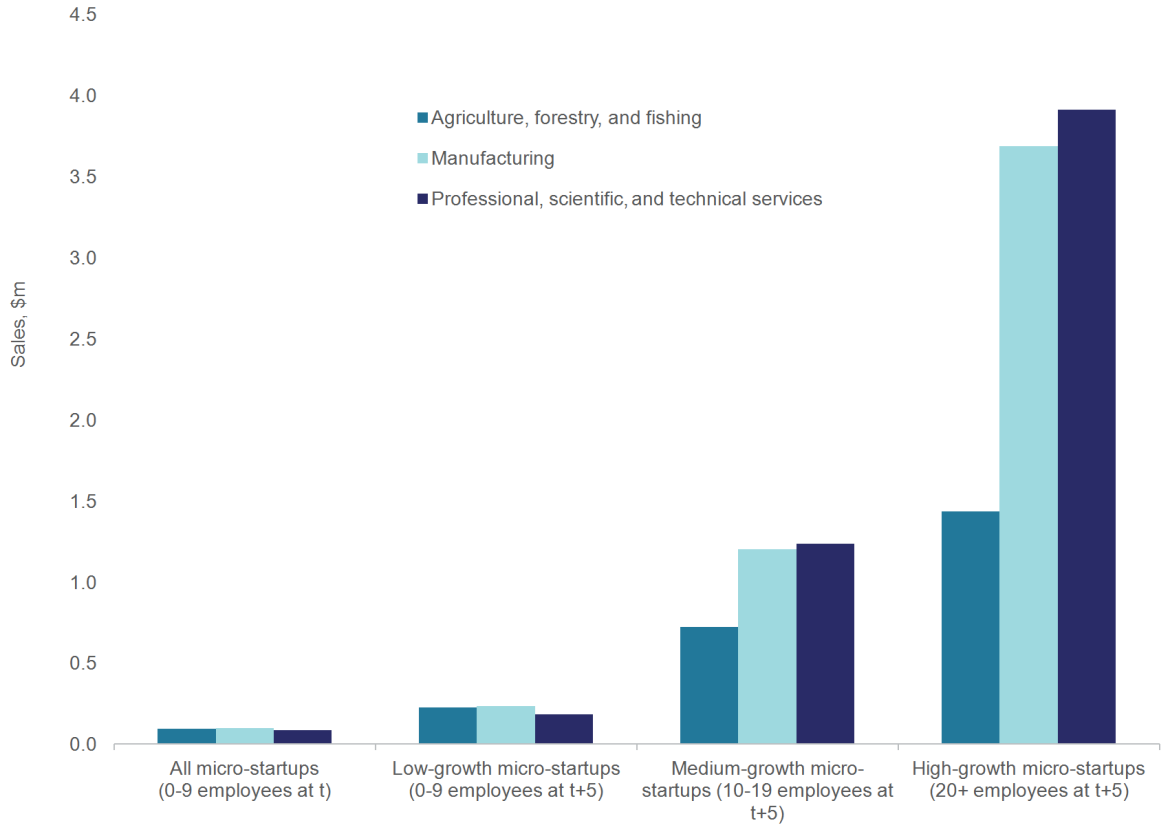

Figure 3. Mean sales at micro-startup stage and size class achieved after five years, by selected industry sector from 2006–2011. Source: Hendrickson et al. (2015).

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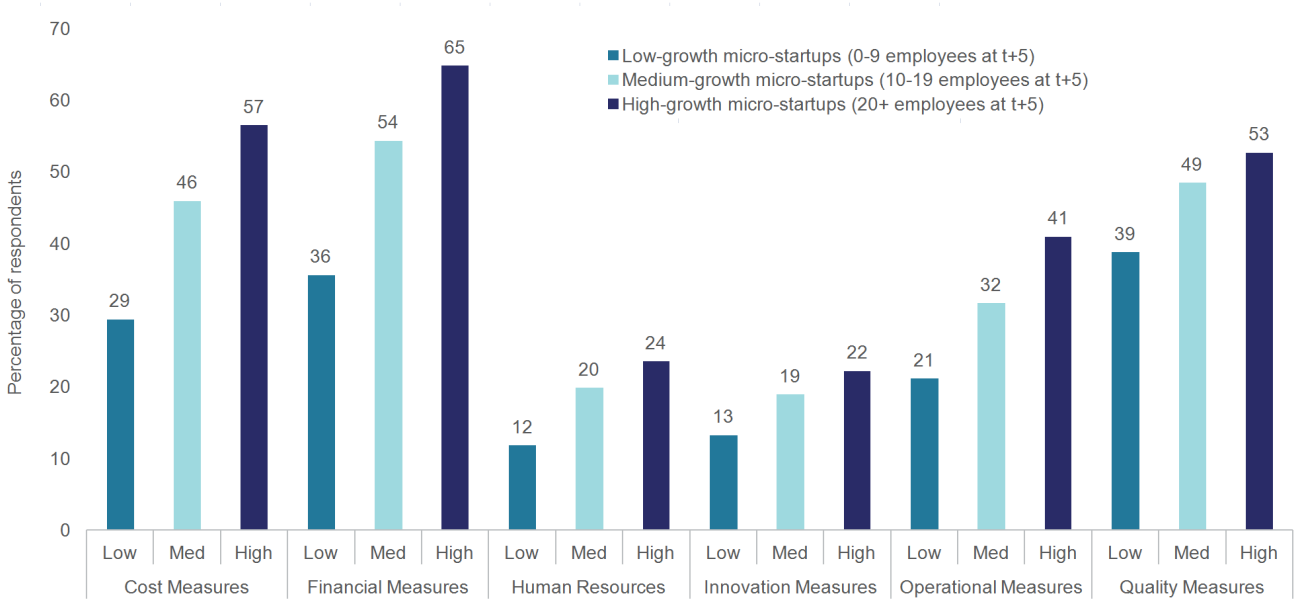

Figure 4. Startup business performance assessment, by five-year growth outcome (low, medium, high) from 2006–2011. Source: ABS (2015).

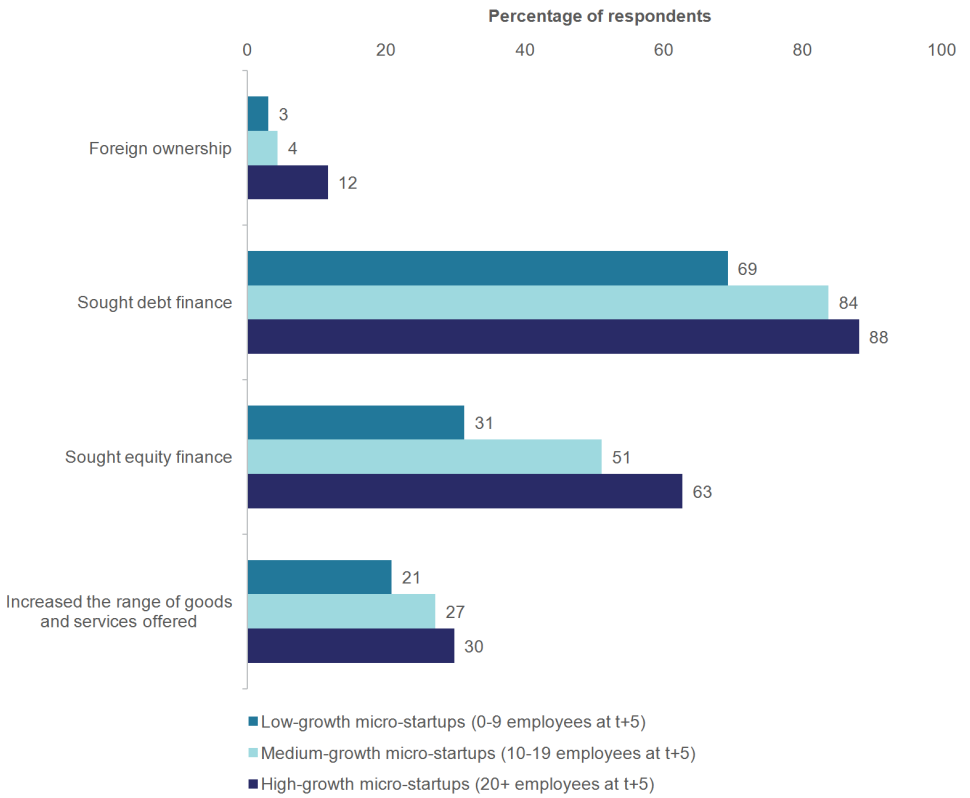

Figure 5. Mean percentage of startups reporting any foreign ownership, seeking of external finance, and annual increases in the range of goods and services offered by the firm, by five-year growth outcome from 2006–2011. Source: ABS (2015).

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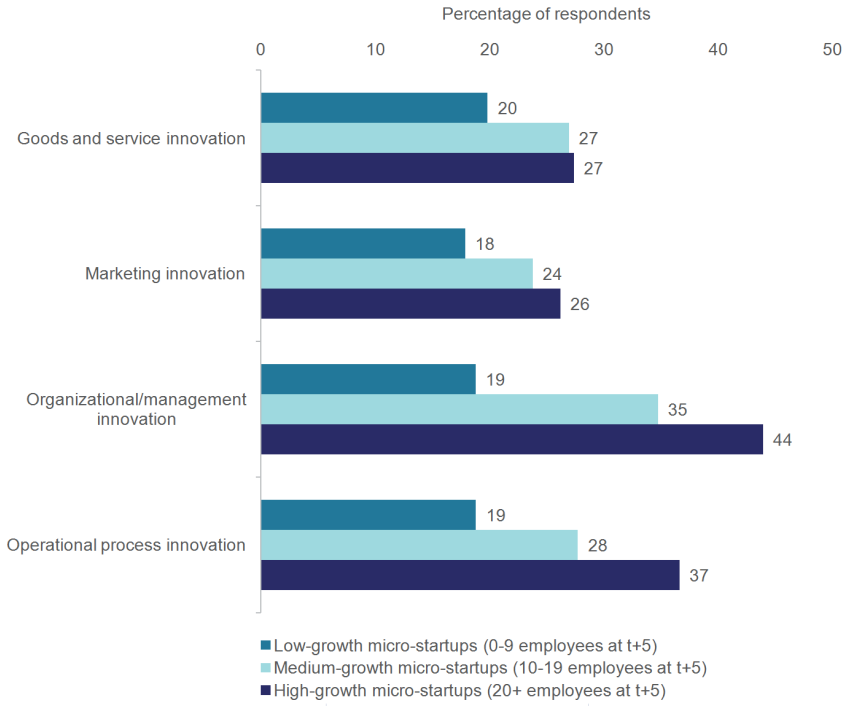

Figure 6. Mean innovation activity of low-, medium-, and high-growth micro-startups from 2006–2011. Source: ABS (2015)

startups is more than enough to compensate for gross job destruction by exiting startups and downsizing mature firms. Our preliminary findings on the characteristics of Australian medium- and high-growth micro-startups confirms that these firms are significantly more innovative and more focused on performance assessment than lower-growth startups. We therefore suspect that our observed variation in financial performance and employment growth are, in part, explained by strategic decisions of startup management and leadership. Similar to the conclusions of Foster and colleagues (2011), we argue that high-growth startups are more likely to exhibit superior management are therefore are able to develop a sustained and unique market advantage, which in competitive markets is likely to come from investment in innovation (Davidsson et al., 2013; Fagerberg, 2013). Our data suggest that this innovation appears more likely to come in the form of new business models and processes rather than new goods or services.

Our findings have implications not only for firms themselves but potentially government policy: high-growth startup activity requires strong strategic management capability. The Australian Government has since 2008 run a management capability building initiative in its Entrepreneurs' Programme (tinyurl.com/hev6bc8) and recently introduced a "growth services" component, but it only supports established small and medium-sized enterprises (SMEs) in specific sectors. Our evidence also agrees with the OECD (2015a, 2015b) argument that equity finance is critical to high-growth startups. Unfortunately, Australia's venture capital industry appears to be focused on lower risk, later stage equity investments (Alinejad et al., 2015).

Our future research within the Department of Industry, Innovation and Science is broadening the scope of this study to determine the characteristics of high-growth firms of all ages using a more widely accepted definition of high growth (OECD, 2015b). We are also collaborating with the Australian Bureau of Statistics, the University of Technology Sydney, and Stanford University to assess the management capability of firms across Australia. The results from this work may further inform government policy as to whether Australia's firm management capability is an impediment to growth.

Employment Dynamics of Australian Entrepreneurship: A Management Perspective

Luke Hendrickson, Stan Bucifal, Antonio Balaguer, and David Hansell

About the Authors

Luke Hendrickson is Manager of Innovation Research in the Australian Government's Department of Industry, Innovation and Science, where he is focused on innovation and measuring the performance of the national innovation system. He is principally responsible for delivering the Government's annual Australian Innovation System Report (industry.gov.au/innovationreport), which is now in its seventh year. Luke's general work interests are in the areas of productivity and competitiveness and how innovative entrepreneurship drives these outcomes across all sectors of the economy. He also has a particular interest in the economics of complexity, measuring management capability, and business eco-innovation. Luke holds a PhD from the Australian National University in Canberra.

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Recommended Reading

- *The Employment Dynamics of Australian Entrepreneurship* (Hendrickson et al., 2015)
  tinyurl.com/hpyoqoe
- *Australian Innovation System Reports* (Department of Industry, Innovation and Science, 2015)
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Revealing Hidden Innovation: Patterns of External Innovation Investment in Australian Businesses

Kieran O'Brien

> *"Invention, using the term most broadly, and imitation, are the two legs, so to call them, on which the human race historically has walked."*
>
> William James (1842–1910)
> Philosopher, psychologist, and physician

Recent theory and literature suggests that many businesses now innovate based on the adoption and modification of knowledge, technology, and innovations sourced externally rather than developed in-house. Yet, little is known about the value and economic impact of expenditures on outsourced innovation activities, which are often referred to as "hidden innovation" by many scholars. The issue is due largely to a lack of consistent measurement, available data, and analyses of expenditures on hidden innovation. In contrast, there is a long history of cross-country data collection on in-house research and development (R&D) activities and costs, and much research focuses on innovations involving in-house R&D effort. This study reviews results from a survey aimed at collecting new economy-wide data on external innovation investments in Australia. The results estimate total unmeasured or "hidden" investment in external innovation activities by Australian businesses at $3.5 to $4 billion in 2014, an amount large enough to stimulate important economic activity and warrant future research. This article discusses the implications of these results for policy, business strategy, and future research on innovation.

Introduction

Over the past decades, empirical innovation research has widened in scope to incorporate a broad definition of innovation that includes the business introduction of new or improved products, processes, organizational, or marketing methods (OECD, 2005). However, government policies and empirical studies of business innovation investments invariably focus on in-house research and development (R&D) expenditures as the main type of investment (Damanpour & Aravind, 2012; Demirel & Mazzucato, 2012).

In-house R&D expenditures cover the internal *production* of new knowledge and technology by businesses for the development of product and process innovations. However, for many businesses, the development and implementation of innovations involves the *adoption* of knowledge and technology produced by other businesses or organizations. Organizational or marketing innovations, for example, may require little or no in-house R&D activity or investment, but expenditures on different types of activities such as system design and testing, staff training, or the purchase of technology licenses, equipment, or consulting expertise. Similarly, not all product and process innovations require R&D as an input (Barge-Gil et al., 2011). Yet, despite non-R&D modes of innovation being dominant in many large industries such as services or traditional low-tech sectors (Hansen & Serin, 1997; Hirsch-Kreinsen, 2008), much of the policy and research focus remains on the *production* of new technology via R&D, rather than its effective absorption, integration, modification, and use (EBRD, 2014). To date, R&D support policies remain the most popular innovation policies across the OECD countries (OECD, 2006). In Australia, for instance, Government expenditure on business R&D support programs in 2015–16 accounted for approximately $2.9 billion and 30% of the entire science, technology and innovation budget (DIIS, 2015).

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Non-R&D-based innovation investment is typically understudied due to a lack of consistent or adequate measurement, and limitations with existing data (Kleinknecht et al., 2002). Previous research identifies this as a problem of "hidden innovation" (Barrett et al., 2007; Harris & Halkett, 2007; Miles & Green, 2008). Harris and Halkett (2007) give the example of the oil and gas sector in the United Kingdom, where innovation activity can involve billion dollar investments that are not reflected in industry innovation metrics. This is because innovation projects in this sector often draw on R&D activity dispersed across a variety of actors and locations, and innovative exploration activities are not counted as R&D (Harris & Halkett, 2007). Similarly, Barrett and colleagues (2007) cite the construction sector as an industry where much innovation activity is hidden at the project level or in general organizational development. In short, the main problem is that, for a large proportion of businesses that make up the bulk of most advanced economies, hidden innovation involves investments that are currently not measured or understood very well, neglected in empirical studies, and often receive relatively little policy attention.

This hidden innovation problem provides the rationale for this article, which seeks to address the need for better measurement and understanding of the value of firm investments in external innovation development activities, drawing on new evidence from a 2015 survey of 1600 randomly selected Australian businesses. The following section provides the context for this study by briefly discussing some historical background behind the issue of hidden innovation and the measurement of business innovation investments. The article then examines the patterns and value of external innovation investments in Australian firms. The concluding discussion considers the implications of the survey results. Throughout the article, the terms "hidden innovation" and "external innovation investments" are used interchangeably.

Measurement of Innovation Investments and Hidden Innovation

Much of the traditional economic literature on innovation has focused on high-tech innovation driven by internal R&D (Santamaria et al., 2009). This is often seen as a hangover from linear or science-push theories of innovation that view scientific discovery as the starting point of any innovation (Godin, 2000). These views were dominant around the first half of the 20th century when manufacturing accounted for a much larger share of activity in the western economies, and innovation often began in the R&D departments of large industrial firms.

However, the past few decades have seen a rapid decline in the share of manufacturing in the advanced economies while at the same time, the size and economic importance of service sectors has increased. Services firms now make up the bulk of businesses (over 70%) in most developed economies (OECD, 2013). For businesses in the services industries, innovation is often characterized by new design processes or marketing techniques, adopted and modified information technologies, service customization, and knowledge sourced from customers and embodied in routines, procedures, and organizational methods (Gallouj & Weinstein, 1997; Sundbo, 1997). Such innovation can often involve little or no in-house R&D activity or investment, and remains largely undetected or "hidden" in the long tradition of R&D and innovation statistics (Barrett et al., 2007; Harris & Halket, 2007; Miles, 2005). This is because many productivity enhancing innovation investments by services firms involve technology acquisition, integration, or modification rather than in-house production through R&D. An example is a small to medium-sized accounting firm that implements a new, more efficient back-office processing platform based on a cloud computing solution purchased from a software provider.

A similar situation is found in traditional or "low-tech" industries such as mining or agriculture. In low-tech sectors, the most common type of innovation is the introduction of new processes requiring investments in new equipment or machinery. Such innovation embodies R&D conducted by equipment suppliers (Kirner et al., 2009; von Tunzelmann & Acha, 2005) and often involves no direct in-house R&D by the innovating business. An example is the mechanization of pruning and harvesting in the wine industry – a process innovation enabled by the purchase of new machinery (Smith & Marshall, 2007).

For many industries in modern economies then, much innovation is based on inputs purchased from technology-producing industries, and in many countries, the "high-tech" producing industries are typically much smaller contributors to the overall economic structure in terms of output and employment. In Australia, for example, high-tech manufacturing consistently accounts for less than 1% of total economic output (Arundel & O'Brien, 2009). The entire manufacturing sector only accounted for 6.8% of output in 2015, down from 11.3% 10 years earlier (ABS, 2015).

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Academic research has recognized these structural changes across many advanced economies and the different modes of innovation that have emerged. New theories of "open innovation" emphasize the value of innovations that are brought in from outside of the firm (as well as spun out) (Chesbrough, 2003; van de Vrande et al., 2010) or that develop from customer insights or ideas rather than in-house R&D (von Hippel, 2005). Results from economy-wide business surveys suggest that non-R&D innovation activities and investments are widespread in many industries and make up a large share of overall business innovation activity (Arundel et al., 2008). For example, in an early study of innovation expenditures in the Netherlands, Brouwer and Kleinknecht (1997) found that approximately half of all product and service innovation expenditure was on fixed assets for innovation, and these types of investments were higher in services industries compared to manufacturing.

Yet, despite these developments, there remains limited empirical research on the extent of investments in innovation activities apart from in-house R&D. Equally, despite a burgeoning literature on open innovation, there is limited work on the costs of open innovation strategies (Huizingh, 2011). Key reasons for this are a lack of measurement, a lack of available data, and limitations or quality problems with existing data (Kleinknecht et al., 2002). In Australia, for example, statistics on R&D currently provide the most comprehensive source of data on business expenditures related to innovation. R&D activity and investment is crucial to innovation, but the notion of hidden innovation suggests that we are missing much of the picture in terms of business investments in non-R&D innovation activities. Developing new measures and data is a first step towards better understanding economic outcomes from these activities.

This article tackles the issue of hidden innovation and addresses the need for better data on innovation investments, contributing to the limited literature in this space. The focus is on understanding the size and structure of hidden innovation investments in Australia. Developing a better evidence base in this respect is crucial to understanding different types of business innovation expenditures, their impact on innovation success and economic activity, and the potential role, if any, that policy might play in stimulating, facilitating, or enabling innovation investment.

This study is motivated by the central research question: *What is the magnitude of investment in external activities for innovation in Australian businesses?*

Research Methods

This article uses data from a 2015 survey of the innovation activities and investments of Australian businesses. The survey covered a random sample of 1600 businesses selected from a national business register, and was part of a research project undertaken for the Australian Department of Innovation, Industry and Science (http://industry.gov.au). The survey questionnaire was administered using both mailed and online questionnaires. Of 1600 selected businesses, 359 responded, giving a response rate of 22.4%. No evidence was found of non-response bias, suggesting that the results are representative of the broader population of Australian businesses. The survey questionnaire design was based on the national Business Characteristics Survey (BCS) conducted by the Australian Bureau of Statistics (ABS). Given that the BCS design is based on guidelines provided by the OECD (2005), the study results are relevant for other countries conducting innovation surveys based on the same guidelines.

The survey questions covered firm activities in the 2014 calendar year. Of all respondent firms, 77% are in services, 15% are in primary resources, and 8% are in manufacturing. As with the overall business population in Australia and many countries, the large majority of respondent businesses are SMEs: 65% have fewer than 200 employees (including 17% with 0–4 employees) and 35% have 200 or more employees (including 10% with 200–299 employees and 25% with 300 or more employees).

To measure the level of external innovation investment by businesses (hidden innovation), the survey questionnaire asked businesses to report their 2014 expenditure on four external innovation activities (Box 1).

Survey Results

External innovation investment by activity

Figure 1 shows the distribution of total reported external innovation investment by expenditure category for all innovative respondent firms in 2014, as calculated by summing the individual values reported across the four activities in Box 1. An "innovative firm" is defined as a firm that introduced at least one new or significantly improved product, process, organizational, or marketing method in 2014. The total amount reported was approximately $1.8 billion. The purchase of new machinery, equipment, or technology for innovation clearly accounts for the greatest share of the total (88.3%). Purchases of design, marketing, or training ser-

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Box 1. Survey question used to calculate total external investment by Australian businesses

During the year ended 31 December 2014, approximately how much did this business spend on the following external activities to develop, or introduce new or significantly improved goods, services, processes or marketing methods?

a. Purchase of machinery, equipment or technology (including hardware and software) with functions or capabilities that were new or significantly improved for this business $_____

b. Purchase of research services from other businesses $_____

c. Purchase of design, marketing or training services from other businesses $_____

d. Purchase of licenses to use patents or other types of intellectual property owned by other businesses or organisations (exclude licenses to common software such as Microsoft Office) $_____

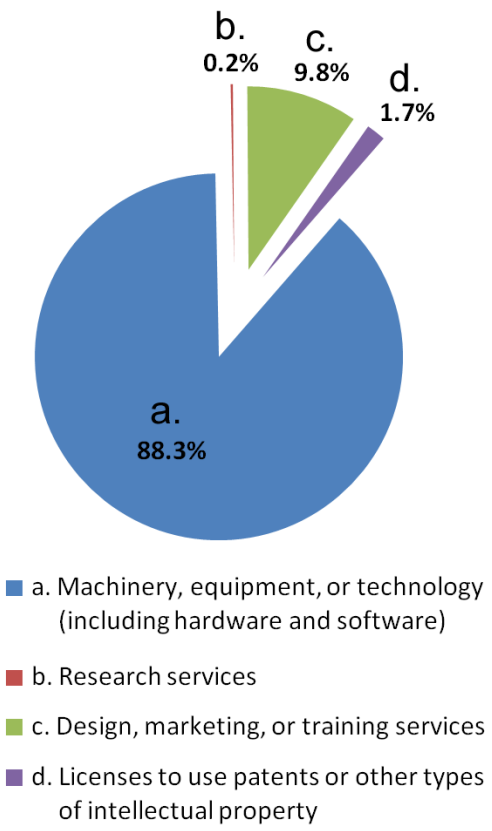

Figure 1. Distribution of total external innovation investment by expenditure category for 225 innovative Australian firms

vices account for 9.8% and research services and licences less than 2%. Of note, though results by industry are not shown here (see Appendix A), businesses in services account for 87.3% of the total amount of investment reported, which is in line with the proportion of all responding businesses that are in services (77% of respondent firms). Though manufacturing and primary resources industries accounted for less than 15% of total reported investment (reflecting their share of the total number of business respondents), the median external innovation investment values in these sectors were substantially higher than in services (more than three times larger in primary resources and five times larger in manufacturing).

In Table 1, total investment is broken down by firm size, showing total external investment expenditure as well as median investment expenditure for all innovative respondent firms. Businesses with 200 or more employees account for 98.2% of total investment. As expected, smaller businesses are relatively more constrained in their external innovation investments.

Estimating external innovation investment for all Australian businesses

To estimate the total value of external innovation investment for all innovative Australian businesses, survey data from Table 1 is combined with national figures from the 2013–14 business survey conducted by the Australian Bureau of Statistics (ABS, 2014a). This national data provides an estimate of the total number of innovative businesses in Australia in each firm size group. (Full information on the national business register population was not available for this study, so estimating the total number of innovative Australian businesses was not possible using the survey data.)

Given the total number of innovative businesses in Australia (ABS, 2014a), we can generate an estimate of total investment for all Australia by assuming the median investment value reported in Table 1 for each innovative Australian business:

- The median value for external innovation investment (from Table 1) is multiplied by the number of innovat-

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ive firms in each size group (from the Australian Bureau of Statistics national survey) to provide an estimate of the national external investment for each size group. The median value is used because it provides a conservative estimate that is less impacted by the skewed distribution of investment expenditures in each group.

- An estimate of total external investment for all Australian businesses is then calculated by summing individual estimates for each size group. A full description of the method used to impute upper and lower bound investment figures for all Australian businesses is provided in Appendix A.

The results in Table 2 are indicative only – they do not incorporate any response bias, population weightings, nor do they feature standard errors. Despite these limitations, this approach is sufficient to build a picture of the size of hidden innovation investments in Australia and address the question motivating this study. What the figures show is that the total investment in external innovation activities by Australian businesses in 2014 is $3.5 billion at the lower range and $4 billion at the upper range. These amounts are certainly large enough to warrant attention. To provide some context, the latest Australian data estimates total business expenditure on R&D for innovation at $18.9 billion in 2013–14 (ABS, 2014b).

Conclusions and Implications

The main objective of this article was to examine the issue of "hidden innovation" and provide an empirical picture of the nature and magnitude of hidden innovation investment in Australia. This task was approached by examining new data from a 2015 survey of the innovation investment activities of 1600 randomly selected Australian businesses.

Table 1. Total external innovation investments by employment size category

	Number of Respondents		Total Expenditure		Median Expenditure
0–4 persons	28	12.4%	$4,767,000	0.3%	$3,500
5–19 persons	45	20.0%	$3,100,000	0.2%	$7,000
20–199 persons	66	29.3%	$24,022,000	1.4%	$46,500
200 or more persons	86	38.2%	$1,744,218,000	98.2%	$150,000
All firms	**225**	**100.0%**	**$1,776,107,000**	**100%**	**$33,000**

Table 2. National estimates of external innovation expenditure by employment size category

	Lower Range Estimate $ Millions	Upper Range Estimate $ Millions
0–4 persons	$554	$758
5–19 persons	$871	$929
20–199 persons	$1,637	$1,835
200 or more persons	$443	$416
Total	**$3,505**	**$3,938**

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The results estimate total "hidden" investment in external innovation activities by Australian businesses at $3.5 to $4 billion in 2014. This finding in itself is important from a number of perspectives. First, this type of innovation investment is often neglected in empirical studies and policy discussion due to a lack of measurement and analysis and a preoccupation with internal development costs via in-house R&D. By highlighting the substantial size of such investments for all innovative businesses in Australia, this study draws attention to the significant role and cost of outsourced innovation activities. Second, this finding exposes the need for developing new reliable, meaningful, and comparable data sources that can be analyzed to better understand the different types of innovation investments, the associated risks, potential returns, and capabilities required for innovation success. Third, from a business strategy perspective, the results highlight the need for businesses to maintain the right supplier networks and nurture the capabilities required to source and integrate external expertise, knowledge, technology, and equipment for innovation.

Although the results show that the median level of external investment is highest for businesses in manufacturing, businesses in services still account for 87.3% of the total amount of external investments. This is because – as is the case in most other developed economies –over two thirds of businesses in Australia are in service sectors. This also explains why the lion's share of external innovation investment (88.3%) is allocated to purchases of new machinery, equipment, and technology for innovation, as we know from previous research that investment in fixed assets for innovation is relatively more important in services (compared to manufacturing industries) (Brouwer & Kleinknecht, 1997). In addition, survey results show that the bulk of total external investments in Australia were made by businesses with 200 or more employees, a relevant finding for policies aimed at targeting innovation activity in small firms.

Taken together, the results demonstrate that hidden innovation investments are large enough to warrant wider policy attention and are likely to be sensitive to government policy settings (such as taxation incentives and business support programs). Better information on the patterns of business innovation investment by expenditure type, business size, and industry has the potential to help inform and target economic policies aimed at stimulating business investment and innovation activity. R&D support policies, for example, may be of little benefit for much innovation activity in the service sectors, given the amount of investment in machinery and equipment that embeds R&D conducted by suppliers. One implication from this study is that general policies designed to stimulate business investment might benefit from additional conditions tying investment expenditures to innovation activities. Rather than allowing for simple equipment upgrading or refurbishments, non-R&D investment support policies should favour activities that enhance productivity and innovation capability. One limitation in this study is that the categories of external innovation investment examined are by no means exhaustive. Also, the study does not examine the link between different types of innovation investments, innovation outcomes, and firms performance. Both of these limitations should inform future research.

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Kieran O'Brien is a Senior Research Fellow at the Australian Innovation Research Centre (AIRC) at the University of Tasmania, Australia. His role involves ongoing management of the AIRC's Tasmanian Innovation Census (TIC) project and related research. Kieran's research interests focus on innovation measurement and innovation activities in the business sector, particularly in low-tech industries where innovation often occurs through a diffusion-adoption process. Related interests include the different modes of innovation, innovation capability and innovation policy as they relate to economic development. Kieran has previously worked in management, research and policy analysis roles in Commonwealth Government agencies including the Australian Bureau of Statistics and the Australian Department of Education, Science and Training.

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Appendix A. Total external innovation investments by industry

	Number of Respondents		Total Expenditure		Median Expenditure
Primary resources	33	14.7%	$195,636,000	11.0%	$72,000
Manufacturing	16	7.1%	$30,176,000	1.7%	$117,000
Services	176	78.2%	$1,550,295,000	87.3%	$21,000
All firms	**225**	**100.0%**	**$1,776,107,000**	**100%**	**$33,000**

Appendix B. Method for calculating total innovation investments for all innovative Australian businesses

Table 2 shows two sets of indicative estimates for total external innovation investments by Australian businesses. The lower level estimate is imputed using the innovation rates reported in the 2013–14 Australian Bureau of Statistics Business Characteristics Survey (ABS, 2014a). Using this method, we apply the innovation rate reported by the Australian Bureau of Statistics to the estimated total number of businesses (ABS, 2014a) to impute the total number of innovative Australian businesses in each size group. The estimated value of total innovation investment for all Australian businesses in each size group is imputed by multiplying the median investment value by size group from the survey (shown in Table 1), by the estimated number of innovative Australian businesses in each size group from the Australian Bureau of Statistics. For all firms across all size groups combined, an estimate is generated by summing the individual estimates for each size group. This provides an estimate of total external innovation investment for all Australian businesses.

For the upper level estimate, the estimated number of innovative Australian businesses is imputed using the innovation rate reported in the survey from this study multiplied by the estimated number of Australian businesses in each size group from the Australian Bureau of Statistics. Because the innovation rate is higher in the survey from this study, this method provides a higher level estimate. These figures are indicative only – they do not incorporate any response bias or population weightings, nor do they feature standard errors. Despite these limitations, they suggest that the value of undetected expenditures on innovation in Australian businesses is likely to be large enough to warrant measurement.

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Patterns of External Innovation Investment in Australian Businesses

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Outcomes from Applying Design-Led Innovation in an Australian Manufacturing Firm

Peter Townson, Judy Matthews, and Cara Wrigley

> *"Everyone designs who changes existing situations in preferred futures."*
>
> Herbert A. Simon (1916–2001)
> In *The Sciences of the Artificial*

Design-led innovation has recently emerged as an approach that assists companies to develop new capabilities to respond to changing markets. Previous research has shown that the application of design-led innovation to manufacturing businesses contributed to innovation across their business model, often repositioning the business and its offerings in the market. This article presents findings from a study where the researcher was embedded in an Australian firm, working four days per week for 11 months and using action research to apply design-led innovation. Deep insights from stakeholders were translated with the company staff into new value propositions for the company. This research demonstrates the largely untapped potential of an experienced designer as an innovation catalyst to help firms develop customer-inspired innovation as they use design-led innovation to overcome barriers and recognize opportunities within a changing market context. This study contributes new knowledge regarding benefits of design-led innovation in dynamic environments.

Introduction

Companies with prior success with technological innovation are often not aware of new methods of gaining information about the demands for their products and services using customer-focused methods. Design mindsets, philosophies, and principles have been implemented through design thinking (Brown, 2008, 2009), design-driven innovation (Verganti, 2009), and more recently design-led innovation (Bucolo et al., 2012). These approaches represent a powerful way to generate, shape, and deliver new value propositions and innovation in a range of companies.

Much of the literature regarding applications of design thinking, design driven innovation, and design-led innovation has focused on large firms (Brown & Martin, 2015; Kolko, 2015; Smith, 2015; Yoo & Kim, 2015) with an absence of research regarding small and medium-sized enterprises. In addition, although the benefits of design management programs – where design consultants have used processes and methods to assist firms to capture deep customer insights, restructure the business, and increase the firm's competitiveness – have previously been seen (Hollinger, 2012), there is scant research that investigates the use of designers undertaking action research projects as innovation catalysts embedded in small and medium-sized enterprises in the manufacturing sector.

The study described in this article explored possibilities of design-led innovation in small and medium-sized enterprises where a designer using action research acted as an innovation catalyst. The aim was to increase knowledge of the influence and benefits of design-led innovation in assisting companies to generate new ways of working and new possibilities for the company. The research question driving the study was: how can a small or medium-sized manufacturer use design-led innovation to overcome barriers and recognize opportunities within a changing market context? The primary goal was to identify key imperatives to assist the company overcome barriers in implementing design-led innovation into their company culture.

This research builds new knowledge in understanding the practical application of various methods within the design-led innovation framework, and their impact and effect on the company. Action research expressly encourages a collaborative approach with a company that

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is experiencing change, and is particularly important to the research aim of using design-led innovation as a mechanism to bring about organizational change. We begin by considering extant research regarding links between design and innovation before outlining methodology, describing findings, and concluding with practical implications.

Design and Innovation

Design-led innovation is a process that shifts the role of a designer to work across an organization to radically change a company's view of the value proposition offered to customers (Kyffin & Gardien, 2009), to co-design (Chesbrough & Schwartz, 2007), and to generate a unique and sustainable competitive advantage (Bucolo & Matthews, 2011b). With the relative newness of design-led innovation, case study research into the complexities faced by companies with the implementation and integration of this process is quite sparse. To add a new perspective, this research presents a case study of one Australian manufacturing company operating in the mining equipment, technology, and services (METS) sector, and how design-led innovation fits within their family-owned and engineering-driven organizational and cultural framework.

Design-led innovation is broadly defined as a method that allows a company to consider and evaluate radically new propositions from multiple perspectives, typically spanning user needs, business requirements, and technology demands (Bucolo et al., 2012). Key to this process is that design is core to a company's vision, strategy, culture, leadership, and development processes. The design-led innovation framework outlined below (Figure 1), provides a conceptual structure to assist the development of innovation through collaboration across the entire organization; it integrates the operational functions with the strategic vision by combining internal and external sources.

The importance and potential of thinking and working as a designer, popularly referred to as "design thinking", is increasingly being recognized as a valuable process for generating new ways of working and new solutions. Design thinking "uses the designer's sensibility and methods to match people's needs with what is technically feasible and what business strategy can convert into customer value and market opportunities" (Brown, 2008). With this widely accepted notion (Holloway, 2009; Liedtka & Ogilvie 2010; Norman & Verganti, 2012; Verganti, 2010; Ward et al., 2009), design thinking holds a customer-centric view by utilizing human-

Figure 1. The design-led innovation framework (Adapted from Bucolo et al., 2012)

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centred design, experimentation, and concept prototyping as ways for a design to have an impact across the innovation process (Holloway, 2009; Norman & Verganti, 2012; Ogilvie, 2010; Verganti, 2010; Ward et al., 2009). Design thinking as a style of thought is built upon "abductive reasoning" (C. S. Peirce cited in Cross, 1982; Martin, 2004, 2009, 2010). Abductive reasoning is "reasoning in which explanatory hypotheses are formed and evaluated" (Thagard & Shelley, 1997); it is "characteristically 'constructive' thinking… something peculiar to design" (Cross, 1982).

Design thinking uses a method of prototyping to reduce the risk in a business model concept by testing it with the marketplace; it allows for the creative development of an idea. By taking a holistic systems perspective, design thinking creates strong value propositions that interweave through business model development so the value received is greater than the sum of the parts. Design as an innovation mechanism is an iterative process that can assist in both uncovering problems with stakeholders, analyzing some possibilities, and then synthesizing multiple elements to form new solutions. During this process, the practitioner moves between the concrete and abstract worlds of understanding (Beckman & Barry, 2009) to build new value propositions.

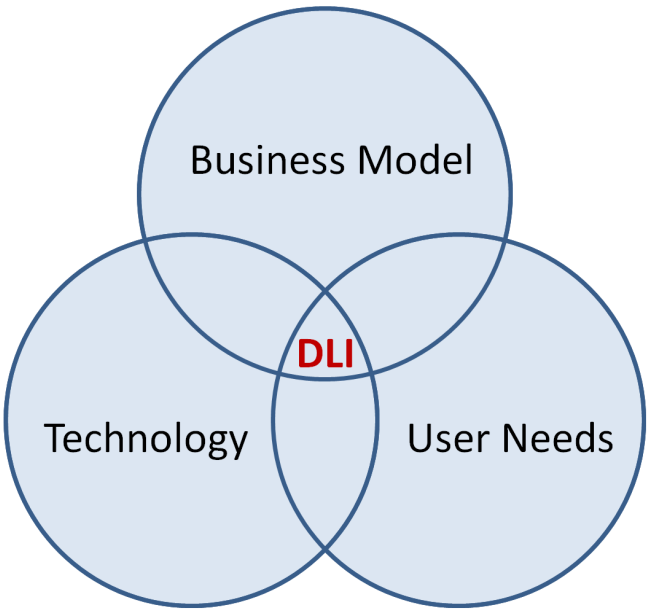

Figure 2. Design-led innovation (DLI) as derived in the intersection of fundamental business elements

Design-led innovation builds on this theory by internally aligning the solution with the company's strategy, resources, and brand. Design and innovation as organizational processes work with the staff who deliver the resultant innovation, not in isolation from organizational systems. Design-led innovation can also align corporate ideologies to fit and potentially leverage the company's internal capabilities, resources, and brand (business model) in order to generate an innovative solution that creates a competitive advantage.

Design thinking is a foundational activity within design-led innovation, by leveraging a creative systems perspective that integrates the design of the business models. Design-led innovation is a philosophy that "examines every core facet of the business, to realign business strategy with customer needs and possible market futures" (Pozzey et al., 2012). Design-led innovation is derived through a creative interrelationship between these fundamental business elements to generate true value for the customer and to capture profits for growth, as shown in Figure 2.

In Australia, the mining equipment, technology and services (METS) sector is comprised of predominately engineering-based organizations (Tedesco & Curtotti, 2005) that "provide technology and services to make the nation's mining industry competitive" (CSIRO, 2003). Exporting over AUD $6 Billion annually (Austmine, 2012), the METS sector has become more profitable than the mining industry within Australia (CSIRO, 2003). With the relative newness of design-led innovation, case study research into the complexities faced by companies with the implementation and integration of this process is quite sparse. This research presents a case study of one Australian manufacturing company operating in the METS sector, and explores design-led innovation within their family-owned and engineering-driven organizational and cultural framework. To maintain anonymity, here we refer to the company as METSCo.

The current Managing Director of METSCo founded the company 24 years ago by manufacturing a disruptive innovation for the mining industry. This medium-sized company of 170 staff with headquarters in Australia and international sales offices develops products and technology services in a business-to-business context. At the time of the study, the CEO and the Top Management Team were seeking the next disruptive idea to take the business to new horizons. The company had sought assistance through a funded government pro-

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gram where a graduate research student could work with the company in a 12-month research program to innovate for growth in a dynamic environment and to generate new insights about the firm and strategic and operational directions.

Methodology

Action research was selected as the method of choice to engage staff within the case organization, and it has been previously used to explore the potential of design (Swann, 2002). Action research is a cyclical process of planning, acting, observing, reflecting, and critically analyzing (Kemmis, 2009), where these cycles inform larger action research cycles (Davis, 2004). The methodology is well-suited to the journey of design-led innovation because both approaches require continuous and balanced engagement with the company in all stages of the cycle (Burns & Brown, 2002). The process assists staff to improve their capacities to solve problems, to develop skills (including professional skills), to increase their chances of self-determination, and to have more influence on the functioning and decision-making processes of the organization.

Adopting an action research methodology, the researcher was embedded within the company, working four days a week over an 11-month period. This longitudinal research specifically investigated the barriers to design-led innovation and opportunities that developed throughout this research. The goal was to understand how the organization and culture of the METS company evolved and how it progressed towards design-led change.

Data were collected using semi-structured qualitative interviews at two distinct points of time during the research project, initially with 15 employees after three months working with the company and with 20 employees after nine months. A focus group and a reflective journal provided further relevant information. Data captured from these methods were analyzed thematically for patterns that informed the barriers, opportunities, and imperatives that resulted from a design-led innovation engagement.

The researcher worked through an iterative process of diagnosing the problem, planning the course of action, taking action with the participants, and evaluating the consequences of the action and specifying learnings, which in turn fed into the next evolution of the action research cycle in this longitudinal study. The researcher worked with the company staff in small groups to demonstrate an approach that could be piloted and then dispersed productively among all employees of the firm. Activities and interventions by the catalyst included capturing deep customer and stakeholder insights, applying these insights in operational and strategic dimensions of the business, and disseminating insights within company. Thematic analysis (Miles & Huberman 1994) was conducted on the combined data sets in order to identify the nature of responses and change processes in the firm and to compare changes over time.

Findings

Prior to the research project at METSCo, the Managing Director had already received sponsored research into design-led innovation as a result of a desire *"to find mechanisms to embed more of that (design-led innovation) thinking more deeply into the whole engineering team so that the place wasn't just dependent on (a few key people)."*

The Managing Director presented his own personal journey in understanding the theory of design-led innovation, describing to the wider company his own continual journey of uncomfortable change, moments of clarity, followed by self-doubt. Participants saw the buy-in from the top as crucial: *"The most successful change in this organization is directly sponsored by the Managing Director. So if he decrees something, then we all get into line and make things happen; if we don't, there is no other mechanism to make that happen."* Additionally, *"The tone of the Managing Director sets the tone of the management team, who sets the tone of the business."*

The vision and foresight of the Managing Director to implement the design-led innovation project enabled not only the senior executives but also all employees to take a customer-centric view of their job and their company. One employee notes that, *"It was his (the Managing Director's) realization about the first-class product being beaten by a second-class business model – that realization alone, is worth everything."* As the company leader, the Managing Director is the culture leader and, by disseminating his own insights, like the one quoted above, encouraged and empowered the engineering-focused culture to look at innovation beyond technology.

As a result of the design-led innovation project, new opportunities were available for METSCo to exploit, to enhance their strategic development with a newfound perspective of innovation. *"A business model is an op-*

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portunity; a product is only a fraction of what we now know we can get, and it is almost an embarrassment." The perspective of the Managing Director *"has matured from the design-led innovation process… for sure it's been part of the catalyst of maturing a vision, which has certainly changed my attitude toward (moving into new areas of innovation)."*

In gauging the impact that the design-led innovation project had on his management team, the Managing Director reflects that design-led innovation, *"Must be there to a greater or lesser degree in all the decision makers in (our company). They must have absorbed something, because we couldn't be going down the directions with the authority that we're going down these directions."*

Within this case study, the managers of METSCo began engaging with design tools and design thinking as a way to quickly prototype businesses models in a rapidly declining economic environment. Specifically, it was the hands-on practical experience of the managers with design-led innovation that helped employees overcome barriers in design language and speculation on its theoretical application.

For METSCo to be able to deliver innovative solutions to create customer value, it was crucial to gain agreement and commitment to an organizational and cultural perspective, which allows and supports a strategic shift such as this. As one participant notes, *"The first step is knowing the customers, but then if you've got to change internally, how do you do that?"* This organizational change perspective is commonly raised in academic literature with regards to business model innovation (Chhatpar, 2007; Zott & Amit, 2010), strategy (Pascale & Sternin, 2005; Porter, 1996), and design-led innovation implementation (Matthews et al., 2012; Pozzey et al., 2012), highlighting its necessity to achieve and sustain breakthrough innovations.

Although the pressure of the declining mining cycle was forcing METSCo to change and look at its business differently, it was the awakening of senior executives to customer pressures that enabled the value of design-led innovation to be understood and experienced: *"We realized that it's okay to prototype. And we started to prototype things to customers finally… that wasn't so bad. That didn't hurt us by putting something to market that wasn't totally 100%."*

From an organizational change perspective, the imperative of having active engagement of employees at all levels with design-led innovation tools and theories, and allowing their experiences become the driver for continuous change in becoming design-led, is clearly demonstrated. From a company that was justifiably focused internally on technology innovation, METSCo now is beginning to see how design-led innovation has taken a change perspective to guide a engineering culture toward the customers "job to be done", allowing the employees to gain new understanding from first-hand experiences to drive change internally.

By developing and managing design thinking capabilities with customer-facing staff, the design-led innovation catalyst was able to gain significant customer insights second-hand, while encouraging and empowering these employees to begin to analyze the market in new ways. Within design-led innovation, the role of the catalyst is one that utilizes design thinking to "translate and facilitate design observation, insight, meaning, and strategy into all facets of the company" (Wrigley & Bucolo, 2012).

Due to the complex and remote nature of the mining industry, the researcher as catalyst (central within the framework) and a design champion in the company relied on the assumptions created and tested by the customer-facing employees and the primary source of customer insights, from where new business concepts are generated. Schön's (1983) seminal work describes a theory of knowledge as a thought process through human perception, or a "reflective conversation with the situation", where problems are framed in order to take action to gain clarity around a situation (Bucolo & Matthews, 2011a). "Competent practitioners usually know more than they can say" (Schön, 1983). Observationally, this work was seen as valuable to rigorously understand METSCo assumptions around customer needs, as highlighted in the literature as a key feature in business model innovation (Casadesus-Masanell & Ricart, 2010; Chhatpar, 2007; McGrath, 2010; Teece, 2010). However, the ability to test, validate, or disprove these assumptions was limited by the personal capabilities of customer-facing employees not trained in divergent learning, let alone design thinking.

The focus group captured the employee realization of the potential that channelling customer information and insights into their company could have on their job, their interaction with their colleagues, and ultimately their customers. Enabling customer-facing employees to communicate their reflective knowledge provided direct input on customer situations to progress and effectively build multi-perspective observations.

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Prototyping as a mechanism for customer-facing employees to bring customer insights back to the catalyst was crucial for the project to continue moving forward. The purpose of the prototype was to engage customer-facing employees of METSCo to work through design methods while at mine sites and to generate customer insights and reflect on them with the catalyst.

The interaction and communication with mining customers was a significant factor in changing perspectives. METSCo had traditionally placed a priority in establishing and maturing organizational processes to support their primary business in meeting market demand. Engaging customer-facing employees to prototype holistic forms of knowledge management highlights two aspects within the data: i) METSCo showed commitment in capturing and translating customer insights and ii) METSCo developed its understanding of the importance that customer-facing employees play within such a dispersed and isolated industry. By developing employee and management capabilities in "design thinking", METSCo began to holistically address its customer insight processes with an employee knowledge base that was empowered and capable to deliver new knowledge to the company.

Discussion and Contributions

Our findings show that a small or medium-sized enterprise that embraced a design-led innovation responded to the catalyst using design-led innovation processes and practices to explore and learn about their customers and to capture these insights and reconfigure their capabilities to deliver new more strategic directions and increased competitiveness. These findings contribute to a deeper and broader understanding of the implementation of design methods and processes as contributions to strategic renewal of small and medium-sized enterprises. The research identifies three specific design principles or "imperatives" derived from the data to guide a design team in implementing design-led innovation within a METS company:

1. Design-led change within an engineering-focussed organization should encourage the company leadership to engage with, reflect upon, and disseminate their personal journey with design-led innovation.

2. Company management and employees should experience design-led change first-hand to positively influence company engagement and commitment and project traction in the organizational culture.

3. Internal design-thinking capability should allow METS companies to sustainably generate insights through their limited but valuable customer engagement.

The significance of these findings is shown in the combined implementation of the design imperatives leading towards design-led change at all business levels of an organizational structure. These imperatives are illustrated in Figure 3.

This research highlighted three levels of organizational change at the leadership, management, and employee levels that occurred as a result of the 11-month embedded design-led innovation engagement with the researcher acting as a catalyst for change within this Australian METS company. Changes observed throughout the organization include the company vision, leadership, innovation, problem solving, customer centricity – all of these aspects demonstrated a shift from an engineering culture to a new more inclusive, customer-centric way of thinking and operating. The design-led change model brings together three elements: i) the level in the organization in which design-led change was being applied, ii) each design imperative that emerged from each paradigm of business, and iii) the change that emerged as a result, as shown in Figure 4.

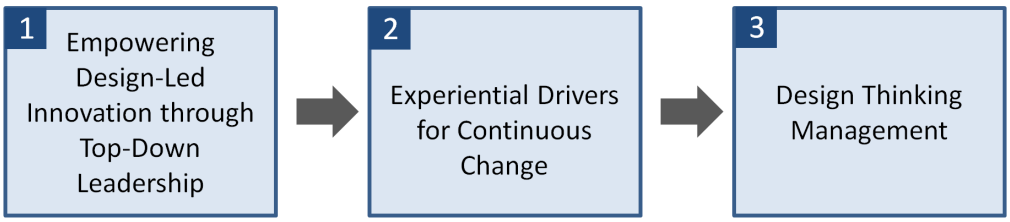

Figure 3. Three design imperatives (principles) for a design-led innovation engagement within the mining equipment, technology, and services industry

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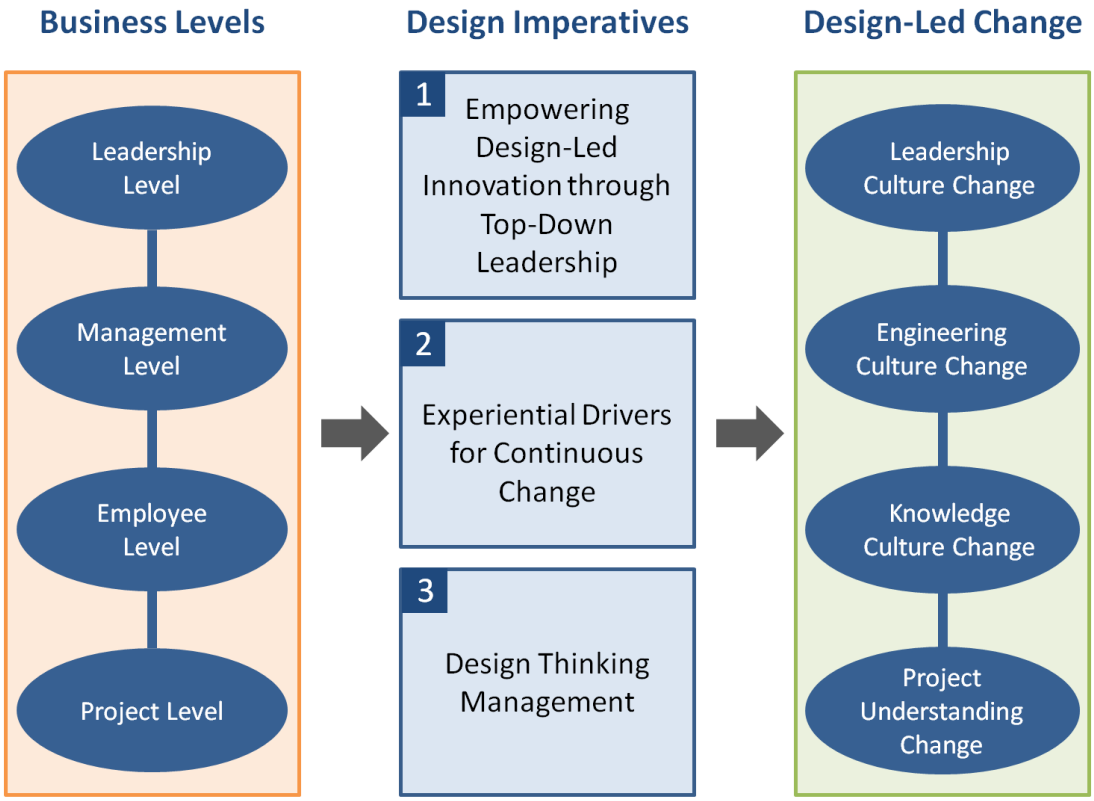

Figure 4. The design-led change model

For METSCo, a deeper understanding of their customers was a large part of the value offering of the catalyst. The researcher was perceived to be creating value in relation to the firm, the industry, and academia. For example, the company linked the introduction of a design-led approach to developing a new customer-focused business model and to the shift of the organizational culture from an engineering culture to a more customer-focused innovation culture. The researcher's role was respectively described by employees as a change catalyst, a knowledge disseminator, and an organizational culture reformist.

Conclusions

This research contributes new knowledge regarding the possibilities that design-led innovation brings to organizations seeking to continuously innovate in dynamic markets. It also highlights the important role of designers as innovation catalysts in building strong links to existing and potential customers. Working with the company and engaging and educating organizational members with design tools and approaches through direct experience has taken the company some distance on the journey with design-led innovation. The practical application of various methods of the design-led innovation framework had a positive impact on the firm's interactions with customers and generated new business opportunities with these customers. Action research's unique and collaborative approach to working with the participating company also contributes to the research aim of using design-led innovation as a mechanism to bring about organizational change.

The research identifies three specific design principles or "imperatives" that guide a design team in implementing design-led innovation within a company. This study explores the processes of introduction, implementation, and integration of design-led innovation within a manufacturing company driven by engineering innovation in a sector dominated by product and process improvements.

Companies engaged in a design-led program have to develop strategies for capturing the value from new knowledge generated through customer insights. Practical implications for the firm as a whole include the benefits of bringing new ways of thinking and working into technologically focused company with a tightly defined engineering culture.

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Implications for designers engaged in design-led innovation within exisiting firms seeking to change their understanding include the importance of designers with a deep understanding of innovation acting as innovation catalysts. As an active and trusted member of the company, the designer led the capture of insights from multiple customers, became a translator of information from customer insights, and also contributed to organizational change. The designer as innovation catalyst gathered and generated meaning from the customer insights, developed employee capability with the customer-facing employees (who were the main direct contact with the customers on mine sites), and shaped new initiatives for the business and facilitated the translation of customer insights into meaningful business opportunities. This study adds further support to the value of experienced designers acting as innovation catalysts to facilitate organizational transformation through design-led innovation.

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