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# Australian Innovation Ecosystem: A Critical Review of the National Innovation Support Mechanisms

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and Eduardo Moreira da Costa<sup>\*\*\*</sup>

## **Abstract**

*Innovation is understood as the combination of existing ideas or the generation of new ideas into new processes, products and services, and widely viewed as the main driver of growth in contemporary economies. In the age of the knowledge economy, successful economic development is intimately linked to a country's capacity to generate, acquire, absorb, disseminate, and apply innovation towards advanced technology products and services. This development approach is labelled as knowledge-based economic development and highly associated with a capacity embodied in a country's national innovation ecosystem. The research reported in this paper aims to critically review the Australian innovation ecosystem in order to provide a better understanding on the potential impacts of policy and support mechanisms on the innovation and knowledge generation capacity. The investigation places Australia's innovation system and national-level innovation support mechanisms under the microscope. The methodology of the study is twofold. Firstly, it undertakes a critical review of the literature and government policy documents to better understand the innovation policy and support mechanisms in the country. It, then, conducts a survey to capture Australian innovation companies' perceptions on the role and effectiveness of the existing innovation incentive programs. The paper concludes with a discussion on the key insights and findings and potential policy and support directions of the country to achieve a flourishing knowledge economy.*

**Key words:** *Innovation; innovation ecosystems; national innovation systems; incentive programs; knowledge economy; knowledge-based economic development; Australia.*

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## 1. Introduction

Innovation basically means changing the way we do things (Zhao, 2005; Pancholi et al., 2015). Australia's economy is at significant risk due to its lack of innovation-driven industries. This includes those sectors related to information and communications technologies (ICT), sciences, creative industries (e.g., media- and design-based industries) and others that rely on high levels of knowledge and human capital. It is widely accepted that innovation has a significant influence upon economic growth (Porter, 1990; Glaeser, 2011; Caragliu & Nijkamp, 2014; Romer, 2014). It is estimated that innovation can boost economic growth by as much as 50% (OECD, 2010). However, Australia currently struggles to capitalise on the innovation opportunity and heavily relies on knowledge and innovations generated overseas (OECD, 2012). This poor performance is evident in the recent Global Competitiveness Index, where in the innovation category Australia only ranks 19th out of 34 OECD countries (WEF, 2014). Compounding the lack of innovative industries, there is limited industry diversity and an overdependence on commodity exports in the country. This condition creates a significant risk to Australia's medium- and long-term productivity growth and the sustainability of its economy (DoIS, 2013). Recognising these challenges, the Australian government has recently called for a new agenda for industry innovation and competitiveness (Commonwealth of Australia, 2014).

Although since the 1990s Australian government has prepared a number of policy initiatives for seeking to diversify economic activities and improve the use of innovation as a tool to achieve global competitiveness (Yigitcanlar et al., 2008a, 2008b), the strength in the resource-based economy held back most of these efforts to establish robust knowledge economy foundations in the country. Australia, especially during the latest mining and energy boom era (2005-2013)—due to heavy demand on Australian iron, coal, uranium, and gas—was one of the world's fastest growing economies. During this boom period, a confluence of events has boosted world mineral prices and mining investments. This has significantly increased the citizens' purchasing power—raising per capita household disposable income by 13% and real wages by 6%, and decreasing unemployment by 1.25 percentage points. The large volume of export performance achieved during this period has impacted Australian economy to grow faster (Downes et al., 2014).

Australia, today, invests and supports science, technology and innovation (STI) modestly. Consequently the export of new technologies is insignificant—only producing 3% of world knowledge, and heavily relying on innovations generated overseas (Commonwealth of Australia,

2014). However, the end of the mining and energy boom redirected the attention of government to diversification of the economy and investing on other options to support the innovation ecosystem in the country. Almost in consensus Australian scholars advocate that the only way to sustainable growth of the country's economy is to increase individuals and businesses' competitiveness levels (see Enright & Petty, 2013). This is to say, with policy and support mechanisms well designed and distributed, such as in Finland (see Satarauta, 2012), Australian entrepreneurs will be able to enjoy the opportunities created by the global knowledge economy. Otherwise, Australia's global competition in the era of the knowledge economy may be harmed. With this idea in mind, in the 2014-2015 fiscal year the government allocated a budget of about \$9.2 billion for supporting STI education and R&D (for a detailed breakdown see DoIS, 2015). The budget is distributed through the Commonwealth Government's Department of Industry and Science. This department is also in charge of the development of the 'Australian innovation system (AIS)', which an open network of public and private organisations that produce and disseminate knowledge and practices that add economic, social or environmental value to Australian products and services (DoIS, 2014).

Against this background, the study aims to provide a deeper understanding of the role and effectiveness of existing policy and support mechanisms on Australia's innovation and knowledge generation capacity. The research scrutinises Australia's innovation ecosystem thoroughly by reviewing the literature and government policy documents, and surveying Australian innovative companies. The study concentrates on the national scale, and undertaking explorations at the state and local government level policy and incentive programs are beyond the scope of this research—that is a limitation of the study. The results of the review and analysis generate insights on the innovation policy and national-level innovation support instruments along with Australian innovation companies' perceptions on the innovation incentive programs. Furthermore, the findings pinpoint potential policy and support directions of the country to achieve a flourishing knowledge economy performance.

## **2. Australian Innovation Support Programs**

Australia was ranked as the 12th largest economy in the world with an estimated GDP of around \$1.5 trillion in 2014, and the 6th largest country with an area of over 7.5 million km<sup>2</sup>. Amongst the developed countries, Australia positioned itself 5th in terms of its per capita income, and took the 2nd position in the 2013 Human Development Index (HDI). On the one hand, Australia is relatively disadvantaged globally due to its small population of slightly under 24 million people making it only the 51st most populated nation. This population size brings

limitations for the consumption economy and talent base of labour force. However, with immigration policies, particularly the skilled migration scheme, Federal government targets to support the required talented workforce and population increase. On the other, a reason for Australia's such a high ranked position was that about 60% of productivity growth in the country was driven from intangible capital investment—that is skills development, design and organisational improvements and spill over effects. However, when compared to the other OECD member countries, Australians are more likely to invest on machinery and equipment than investing on intangibles (OECD, 2014). The main reason is that innovation in Australia is generally practiced as concentrated efforts focusing on consolidating the competitive advantages of sectors such as mining and agriculture, as opposed to investments on ICT, biotechnology, nanotechnology and so on (Martinez-Fernandez, 2010). In other words, so far no other industry in Australia has achieved a greater significance in economic development as much as mining and agriculture. Particularly mining industries have built a national infrastructure throughout the country for more than a century and Australia's mining boom has produced generations of mining technology services companies. Despite this innovation focus, one of the strengths of Australia is the ability to rather quickly transform its innovation governance and legislation systems in order to be at par with the world trends (OECD, 2015). With such capability at the end of the mining and energy boom Australia still has the potential to make its transformation into a knowledge economy.

## **2.1 Governance of Innovation in a Nutshell**

In Australia, a number of governmental organisations play a pivotal role in delivering the innovation agenda. In an attempt to better understand how Australian innovation system works, these organisations that have been providing innovation incentives to companies are introduced to understand their roles in delivering the country's innovation policy.

*The Department of Industry, Innovation and Science (DIIS):* The mission of this administrative office is to establish the connections between businesses, research institutes, tertiary education bodies, government departments, and the society at large. Its main objective is to sponsor and support productivity growth in Australia by means of developing human capital. This department has seats in several national innovation committees to promote these networks, according to the Australian Public Services Innovation Action Plan. The plan focuses on the following four action areas: (i) Developing an innovation consciousness with the Australian public services; (ii) Building innovation capacity; (iii) Leveraging the power of co-creation, and; (iv) Strengthening leadership so there is courage to innovate at all levels. The aims of this plan

are: (i) Recognise innovation as a process that can and should be systematically pursued; (ii) Involve the users and citizens in the design and development of services and policies; (iii) Pursue open processes that encompass a wide range of experience and expertise; (iv) Generate results through involvement utilising partnerships and collaboration; (v) Facilitate the creativity inherent in organisations, and welcome tests, pilots and experiments; (vi) Recognise risk as an inherent part of innovation; (vii) Promote and celebrate innovation successes; (viii) Acknowledge that not all innovation will succeed, but we can also learn from failures; (ix) Use procurement to spur the generation and uptake of innovative solutions, and; (x) Be accountable for delivering and implementing the plan and successor initiatives (see <http://www.industry.gov.au>).

*The Australian Research Council (ARC):* ARC is the main office of the Australian government for the investment on research and training in all fields of science, including social and human sciences. It is also responsible for mediating the relation between researcher communities and the industry, government, non-profit organisations and the international community. The ARC aims to integrate researchers and the industry. ARC manages the following programs as major incentive sources to develop knowledge, associated with research scholarships for the formation of researchers, and with the universities: (i) The Linkage Projects scheme aims to set up or develop strategic long-term research alliances between higher education institutions and other organisations, including the industry and users; increases the scope and focus of researches in National Research Priorities; sponsor opportunities for researchers to develop internationally competitive researches in cooperation with organisations out of the higher education sector; and produce a national network of world-class researchers to meet the broadest demands of the Australian innovation system; (ii) The National Competitive Grants Program (NCGP) is one of Australia's major investment mechanisms for R&D. This program grants scholarships for basic and applied research, apart from funding research training in all academic areas except clinical medicine and dentistry—the National Health and Medical Research Council (NHMRC) looks after this area. (iii) The Excellence in Research for Australia (ERA), in turn, is the program for evaluating the quality of researches conducted by the higher education institutions of Australia. The ERA aims to guarantee the excellence of the conducted investigations. This office publishes, for example, a comparison between the levels of researches carried out in the country with international standards in each field (see <http://www.arc.gov.au>).

*The Commonwealth Scientific and Industrial Research Organisation (CSIRO):* CSIRO aims to offer innovative solutions to the industry, society and the environment through the development of cutting-edge science. The organisation employs over 6,500 workers and researchers, distributed into 57 centres all across Australia, which dedicate to four programs: (i)

The national research flagships are multidisciplinary partnerships for large-scale research that use the international-level expertise to serve the national priorities. The program commenced in 2003 and is one of the biggest efforts Australia has ever put into researching, with a total investment of over \$1.5 billion in the fiscal year of 2010-2011. The main sectors that has received support are: climate adaptation, minerals down under, energy transformed, preventive health, food futures, sustainable agriculture; future manufacturing, water for a healthy country, wealth from oceans and light metals. (ii) The core research and services program comprises a series of research portfolios that do not match the flagships. In 2010-2011, five CSIRO research groups managed 12 portfolios, in the fields of energy, environment, food, health, life sciences, information sciences, manufacturing, materials and minerals. (iii) The science outreach: education and scientific publishing is a set of science education programs for primary and secondary school students and teachers, as well as the general public. The maintenance of the CSIRO Discovery Centre in Canberra is part of this program, and; (iv) National research infrastructure: national facilities and collections is the CSIRO program responsible for the administration of two kinds of research infrastructure: national research facilities and national biological collections. Apart from these infrastructures, CSIRO comprises 30 other research installations, such as the Australian Resources Research Centre (in Perth) and the High Resolution Plant Phonemics Centre (in Canberra), and more than 30 collections of national importance, including the national tree seed collection, the national soil archive and the cape grim air archive (see <http://www.csiro.au>).

*The Chief Scientist for Australia:* Apart from a large number of researchers focusing on various R&D activities, Australia also has an Australian Chief Scientist, who provides high-level independent counselling to the Prime Minister and other ministers on the issues related to STI. The person in position, currently Professor Ian Chubb AC, is a defender of Australian science worldwide and disseminates to the community and government the importance of STI, research and empirical evidence. The Chief Scientist for Australia is also a spokesman for science to the public in general, with the aim to promote the understanding, contribution and pleasure of science as well as evidence-based reasoning (see <http://www.chiefscientist.gov.au>).

*The Australian Taxation Office (ATO):* As being the government taxation office ATO is the main office that regulates the incentive programs related to innovation in the country (ATO, 2015). The incentives go through this taxation office takes place through tax reductions—i.e., R&D Tax Incentive Program (see <https://www.ato.gov.au>).

*The Innovation Australia:* Innovation Australia is an independent organisation created to help the Australian government to manage its innovation programs and risky investment plans

designed to support industrial innovation through a number of programs: Clean Technology Food and Foundries Investment Program; Clean Technology Innovation Program; Clean Technology Investment Program; Climate Ready; Green Car Innovation Fund; Re-Tooling For Climate Change; Renewable Energy Development Initiative (REDI); R&D Tax Concession (including the R&D Tax Offset and 175% Premium Incremental Tax Concession); R&D Tax Incentive; Commercialisation Australia Program (CA); Commercialising Emerging Technologies (COMET); Commercial Ready (including Commercial Ready Plus); Industry Cooperative Innovation Program (ICIP) and; R&D Start Program. There are also other similar Australian venture capital programs including: Innovation Investment Fund (IIF); Innovation Investment Follow-on Fund (IIFF); Early Stage Venture Capital Limited Partnerships (ESVCLP); Venture Capital Limited Partnerships (VCLP); Pooled Development Funds (PDF); Pre-Seed Fund (PSF), and; Renewable Energy Equity Fund (REEF) (see <http://www.business.gov.au/grants-and-assistance/innovation-rd/InnovationAustralia/Pages/default.aspx>).

*The Prime Minister's Science, Engineering and Innovation Council (PMSEIC):* The Council is an eminent advisory body for counselling the government about scientific and technological developments. It is presided by the Prime Minister and composed by ministers, the Chief Scientist for Australia and a handpicked group of eminent experts. In 2009, Australian government launched, so-called Powering Ideas: An Innovation Agenda for the 21st Century—a 10-year reform agenda with the aim of making Australia more competitive. This innovation agenda is based on the assumption that there are two action fronts to strengthen the Australian innovation system: strengthening its constituents (businessmen, public managers, researchers, workers, and consumers) and strengthening the connections among these parties. With this in mind, the Australian government has adopted seven National Innovation Priorities to guide its innovation policies. All priorities are considered equally important and complement the Australian National Research Priorities (see <http://www.ausinnovation.org/articles/powering-ideas.html>).

- Public research funding to support high-quality research that addresses national challenges and opens up new opportunities.
- Building a strong base of skilled researchers to support the national research effort in both the public and private sectors.
- Incentive to cutting-edge industries, securing value from the commercialisation of Australian R&D.
- More effective dissemination of new technologies, processes, and ideas to increase innovation across the economy, with a particular focus on SMEs.

- Encouraging a culture of collaboration within the research sector and between researchers and industry.
- More involvement of Australian researchers and businesses in international collaborations on research and development.
- Joint work of the public and private sectors in the innovation system to improve policy development and service delivery.

The Australian government targets to establish its National Innovation System until 2020, in which: (i) The country clearly articulates national priorities and aspirations to make the best use of resources, drive change, and provide benchmarks against, which to measure success; (ii) Universities and research organisations attract the best minds to conduct world-class research, fuelling the innovation system with new knowledge and ideas; (iii) Businesses of all sizes and in all sectors embrace innovation as the pathway to greater competitiveness, supported by government policies that minimise barriers and maximise opportunities for the commercialisation of new ideas and new technologies; (iv) Governments and community organisations consciously seek to improve policy development and service delivery through innovation, and; (v) Researchers, businesses and governments work collaboratively to secure value from commercial innovation and to address national and global challenges, and to measure the progress of Australian innovation system concerning priorities and objectives (see <http://www.ausinnovation.org/articles/powering-ideas.html>).

## **2.2 Innovation Incentive Programs**

Under the leadership of the aforementioned organisations innovation is supported through a number of innovation incentives schemes. These schemes form the backbone of the Australian innovation support mechanism. The incentive programs can be accessed through a single government portal named *Business*. On this portal, entrepreneurs find the necessary information to start a business as well as hints to guarantee the success of their enterprise (see [www.business.gov.au/Pages/default.aspx](http://www.business.gov.au/Pages/default.aspx)). The portal has a grants and assistance area including several incentive programs. These programs are aimed at businesses of various sizes, in order to generate productivity, innovation, competitiveness, and create new jobs. These programmes also contain incentives for R&D, support for small businesses, tax and duty concessions, and assistance for industries in transition. They support invention and technology development in businesses by fostering collaboration between industry and researchers. The main incentive programs include the followings.

*The R&D Tax Incentives Program:* This program the most popular one in the country, is a broad-based, market-driven program accessible to all industry sectors. It provides a targeted tax offset to encourage more companies to engage in R&D and help businesses offset some of the costs of doing R&D. The program aims to help more businesses do R&D and innovate. It is a broad-based entitlement program. This means that it is open to firms of all sizes in all sectors who are conducting eligible R&D (see <http://www.business.gov.au/grants-and-assistance/innovation-rd/RD-TaxIncentive/Program-Information/Pages/default.aspx>).

*The Entrepreneurs' Program:* This program is Australian Government's major initiative to promote business competitiveness and productivity at the firm level. It is part of the Australian Government's new industry policy provided for in the Industry Innovation and Competitiveness Agenda. This Agenda is part of the Economic Action Strategy of the Australian Government. It unites and develops other economic reforms in order to foster Australia's strengths and promote business opportunities (see <http://www.business.gov.au/advice-and-support/EIP/Pages/default.aspx>).

*The Entrepreneurs' Infrastructure Program:* This program counts on a national network of over 100-experienced private sector advisers and it offers support to businesses through three components: (i) Business management, which provides support for business to improve and grow; (ii) Research connections, which promotes the collaboration of SMEs with the research sector as a way to develop new ideas with commercial potential, and;(iii) Accelerating commercialisation, which helps entrepreneurs, researchers, start-ups and businesses face key challenges when trading new products, processes and services. The program uses quality facilitators and advisers with expertise in the industry, to ensure that businesses receive all necessary information to better their competitiveness and productivity. It focuses primarily on providing information—rather than financial assistance—so entrepreneurs can find solutions to their problems. The support offered to businesses includes advice from experienced people from the private sector, co-funded grants to trade new products, processes and services, funding to help businesses grow, and connection and collaboration opportunities (see <http://www.australianbusiness.com.au/entrepreneurs-infrastructure-programme>).

*The Industry Skills Fund Growth Stream:* The \$476 million Industry Skills Fund is a key component in the Industry Innovation and Competitiveness Agenda of the Australian Government and will provide up to 200,000 training places and support services over the next four years. The fund prioritises SMEs, including micro businesses, and is delivered through the single business service, which favours the access to essential information for all Australian businesses. The fund offers assistance to the industry so it can invest in training and support services, as well as

develop innovative training solutions. The fund helps forming a highly skilled workforce that can have access to new opportunities due to business growth, and that can adapt to rapid technological change (see <http://www.business.gov.au/grants-and-assistance/Industry-Skills-Fund/Pages/default.aspx>).

*Innovation and R&D Program R&D Tax Incentive:* It aims to boost competitiveness and improve productivity across the Australian economy by: (i) Encouraging industry to conduct R&D that may not otherwise have been conducted; (ii) Providing business with more predictable, less complex support, and;(iii) Improving the incentive for smaller firms to engage in R&D. The R&D Tax Incentive replaces the R&D Tax Concession for R&D in income years commencing on or after 1 July 2011. The R&D Tax Concession continues to be administered for R&D in income years commencing prior to 1 July 2011.The R&D Tax Incentive provides benefits in two core components (AusIndustry, 2012). A 45% refundable tax offset (equivalent to a 150% deduction) for eligible entities with a turnover of less than \$20 million per annum, provided they are not controlled by income tax exempt entities, and; A non-refundable 40% tax offset (equivalent to 133% deduction) for all other eligible entities. Unused non-refundable offset amounts may be able to be carried forward to future income years (see <http://www.business.gov.au/grants-and-assistance/innovation-rd/Pages/default.aspx>).

In order to give special attention to the technology sector and considering that the tax benefit is open to all sectors, software is subject to the same eligibility tests as other forms of R&D, with the exception of certain software activities, which are excluded from being a core R&D activity. This exclusion covers activities related to the development, modification or customisation of software where the software is for the dominant purpose of internal administration by the entity (or connected entities or affiliates) for which it was developed, modified or customised. Software for ‘internal administration’ includes management information systems and enterprise resource planning software that is for use in the day-to-day administration of a business. The software exclusion does not apply to software developed in-house that is of an applied nature, forming an integral part of an electrical or mechanical device (such as home appliances or industrial equipment). In general only R&D activities conducted in Australia or the external Territories qualify for the R&D Tax Incentive. However in certain circumstances, R&D activities conducted overseas may also qualify. For example, a company intending to claim a tax offset for R&D activities conducted overseas must apply to Innovation Australia for a decision (called a ‘finding’) about the eligibility of these overseas activities. Innovation Australia can issue a finding that overseas activities are eligible for the R&D Tax Incentive (see <http://www.business.gov.au/grants-and-assistance/innovation-rd/RD-TaxIncentive/Pages/default.aspx>).

The government also provides financial support for private firms to conduct innovation projects. Nevertheless, there is less evidence that such investment—about \$1 billion every year—is justified by the extra innovation it helps produce. The largest government support for private sector innovation is the R&D Tax Credit. The largest 3% of innovative firms take in 60% of the credit—over \$1 billion per year. Nonetheless, there is little evidence that this tax credit substantially increases the amount of actual R&D activity in large firms. By contrast, there is good evidence that improving the framework conditions for innovation, particularly by reducing the corporate tax rate, would have a significant impact on innovation in the long run. A lower corporate tax rate encourages foreign direct investment (FDI), which in turn increases innovative activity and encourages the diffusion of ideas from other countries. Australia would probably see more innovation—and increase living standards accordingly—if the R&D Tax Credit for large firms and much of the direct support for private firm innovation were redirected into funding a reduction in the corporate tax rate of up to 1.5%. Whereas governments should support innovation, they should ensure public money is invested where it makes the biggest difference (see <http://www.business.gov.au/grants-and-assistance/innovation-rd/RD-TaxIncentive/Pages/default.aspx>).

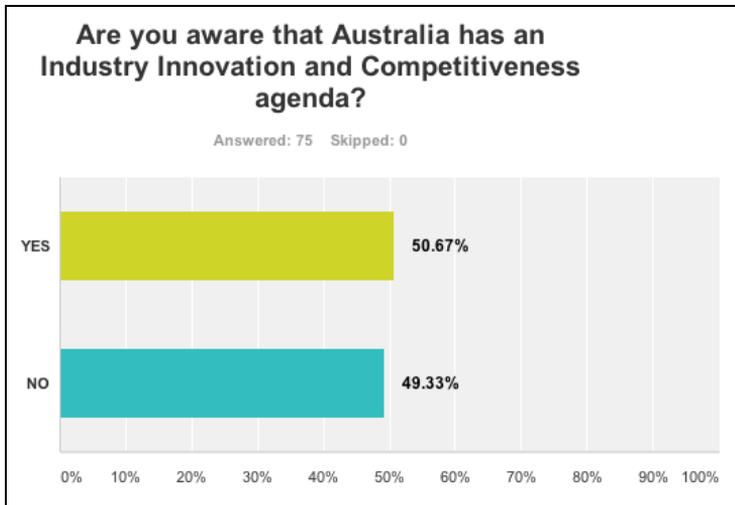
### **3. Australian Firm Awareness on Incentive Programs**

The study undertook an online survey exercise to capture Australian innovation companies' perceptions on the role and effectiveness of the innovation incentive programs. The survey contains six key questions and circulated through Survey Monkey online survey tool (see <https://www.surveymonkey.com>) to the directors of Australian technology and innovation companies. The survey prepared by the authors was sent out to the firms through email with help from the Australian Information Industry Association (AIIA) and the Cooperative Research Centres Association (CRCA) between May and August 2015. Contact details of the targeted companies were obtained from the Australian Business Directory (see <http://abdo.com.au>). In total 75 valid responses received, during the four month period that the survey was open, out of surveys sent to 379 companies (19.79% response rate). The responses to survey questions are presented below.

*Q1. Are you aware that Australia has an Industry Innovation and Competitiveness agenda?* Of the 75 firms that responded to the survey, 38 claim to know the government's agenda and 37 of them state that they are unaware of this agenda (see [Table 1]). Although the number is balanced, considering that it is a relevant issue for the development of innovative firms, firm owners should be more aware of governmental programs and seek more information about them. It seems to be that the Australian government does not make much effective use of trade

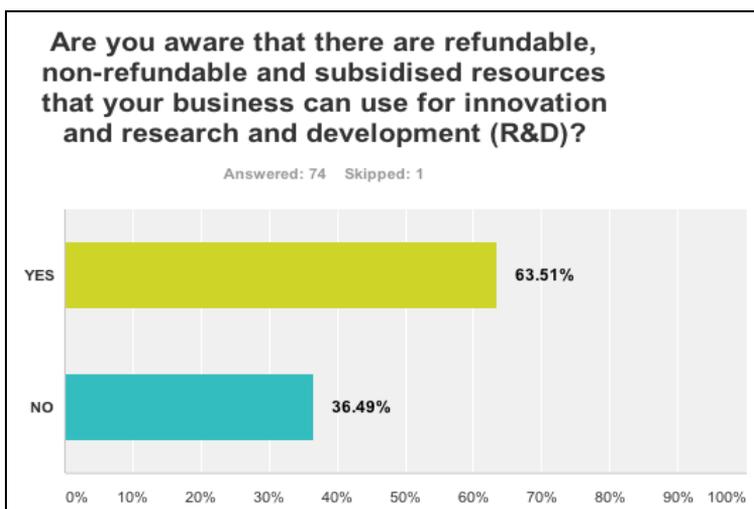
associations to disseminate its programs and plans. The general understanding of the government officials' is that government's website is a good enough source of information. They seem to believe that it is the businessmen's duty to find out about programs and support to which they are entitled.

[Table 1] Results of the Survey Question 1



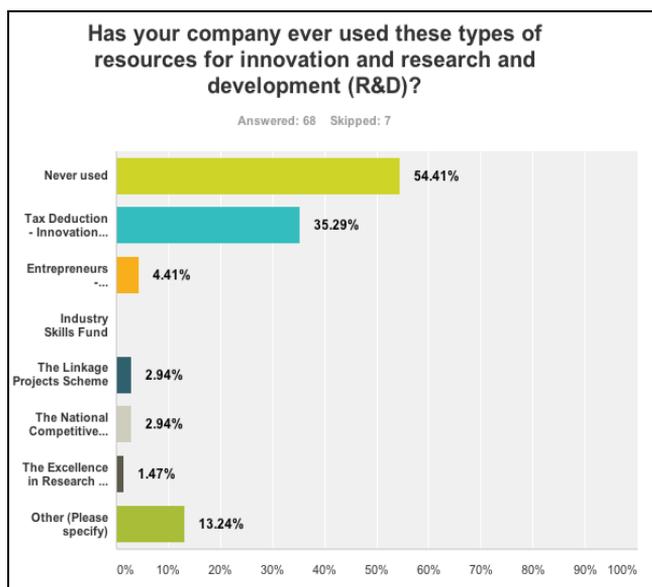
*Q2. Are you aware that there are refundable, non-refundable and subsidised resources that your business can use for innovation and R&D?* Out of 75, 74 firms responded this question. Amongst them 47 claimed to know about the available resources, whereas 27 declared not knowing about the incentive lines (see [Table 2]). The number of firms (63.51%) that know about the availability of Federal incentive programs to innovation is relevant, considering that Australia makes little use of trade associations and barely conducts presentations to firms on this topic. The survey findings show that, although the number is relevant when compared to the little effort put on promotion, the government must focus on spreading the word about its sources of incentive and public policies.

**[Table 2] Results of the Survey Question 2**



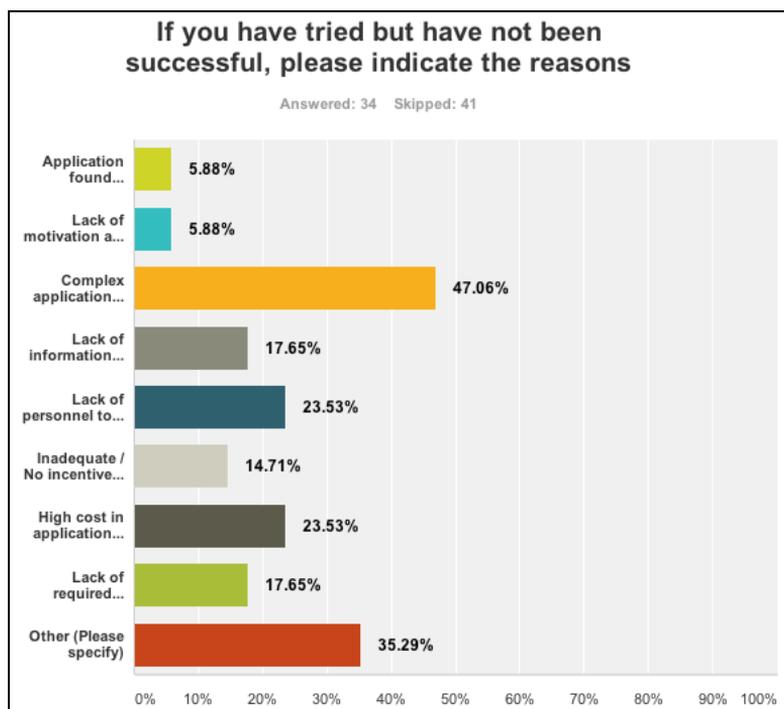
*Q3. Has your company ever used these types of resources for innovation and R&D?* In total 68 firms answered this question, and the alternatives listed Federal programs of incentive to innovation (see [Table 3]). It was also possible to check the answer ‘other’ with an option to specify the program the entrepreneur had used. More than half of the firms that answered the questionnaire (54.41%) do not use the incentive sources, including tax incentives, which is a flagship of the Australian government program. R&D Taxes Incentives is the main program, used by 35.29%; the program is considered simple and not very bureaucratic by government officials for it can be applied for online. The Entrepreneurs–Infrastructure Program comes in third, used by 4.41%. This is a four-pillar line that contributes to the commercialisation of generated goods/services. Lines such as the Linkage Projects Scheme (LPS), The National Competitive Grants Program (NCGP), which are university-related programs, reached a very low rate of response, 2.94% each. The Industry Skill Fund program did not produce any answer (0%). The reason for no one choosing this program in this question is given by the Australian government itself: since the name of the program was changed by the new administration, entrepreneurs did not recognise it when it was renamed (formerly known as National Workforce Development Program). This question gave respondents the choice to include other incentive lines in the field other/specify. Nine answers came up: Export Market Development Grants/Austrade (EMDG), Accelerating Commercialisation, and Commercialisation Australia Early Stage Grants, state programs such as the Canberra Innovation Network, Commercial Ready and Climate Ready. These programs were not originally listed as alternatives in this question since they are not Federal programs with focus on innovation.

[Table 3] Results of the Survey Question 3



*Q4. If you have tried but have not been successful, please indicate the reasons.* Although Australia is not a very bureaucratic country—ranked 11th less bureaucratic country in the world—entrepreneurs believe that government programs are bureaucratic. The alternative complex application process/bureaucracy was checked by 47.06% of the respondents. 34 firms answered this question (see [Table 4]). Two other answers to this question are worth mentioning, each one highlighted by 23.53% of the respondents: the lack of personnel to prepare the application and the high cost in application preparation. The cost of labour in Australia is very high and the incentive program is not attractive since Australians believe the process is highly bureaucratic. The lack of information about the programs and the lack of guarantees were highlighted by 17.65% of the respondents. The reasons presented in the others, with 35.29% are: (i) Registered Research Agency went into administration, and ATO penalised my application; (ii) Each successive program gets smaller and smaller and the return on investment is such I cannot be bothered anymore; (iii) Have not tried; (iv) No time to apply as being a small start-up company; (v) Not tried; (vi) Commercialisation Australia ‘need for funding’ criteria is hard to meet; (vii) Requirements on matching funding are ‘impossible’ to meet. You have to show you have matching funds but why the funders of matching funds cannot meet the whole cost. You cannot use future sales for matching funds; (ix) Unaware of what options were available and how to prepare a successful submission; (ix) 9 of them not applied for; (x) Not know, and; (xxi) I have not tried.

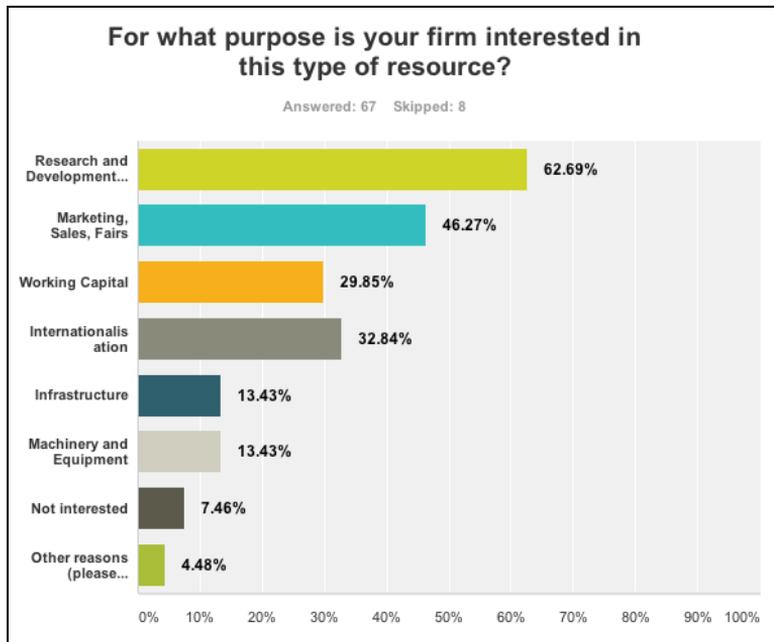
[Table 4] Results of the Survey Question 4



*Q5. For what purpose is your firm interested in this type of resource?* This question is useful to guide legislators that design public policies, since it shows the actual current needs of the firms. This question was attended by 67 of the surveyed firms (see [Table 5]). Support for R&D tops the list of needs (with 62.69%); Marketing, Sales and Fairs activities come in second that demonstrates the importance of support to the commercialisation of goods. This information reinforces innovative firms' high dependency on human capital and know-how. These firms differ from the traditional industry, whose capital is guaranteed by machinery and equipment. Therefore, in the innovation and technology sector, talented labour is specialised and highly costly. Incentives to the R&D of products and services are important in order to guarantee the continuous process of innovation in the firm, very often anticipating the needs of the market. Of all respondents, 46.27% highlighted the incentive to commercialisation. Internationalisation comes in third (with 32.84%). This is an interesting fact that this alternative completes the top two demands—since Australia is a vast country with little population, internationalisation is an important aspect for sending products and services out to foreign markets. Australia has no dedicated development bank (such in the case of many developing nations), so businessmen turn to investment funds for financial resources. Inflation rates are low in the country and traditional banks operate at low interest rates. Working capital comes in fourth in the survey; it was selected

by 29.85% of the respondents. The reasons presented in the others, with 4,48% are: (i) Innovation and entrepreneurship—no one calls it 'R&D' in start-ups; (ii) Developing intellectual property in emerging areas such as cloud technologies, and;(iii) Engaging young innovators and students.

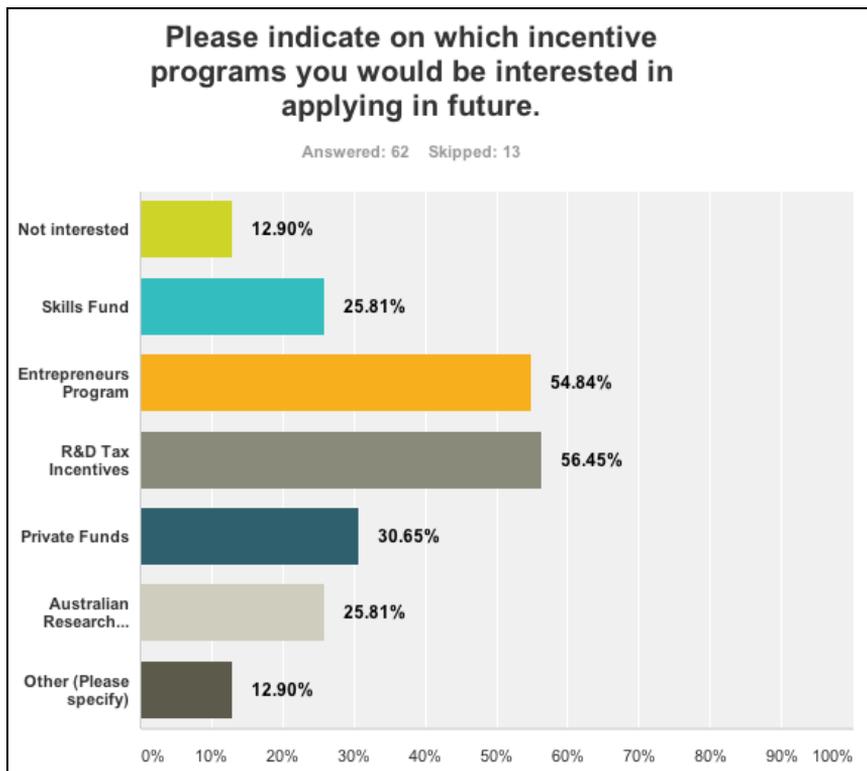
[Table 5] Results of the Survey Question 5



*Q6. Please indicate on which incentive programs you would be interested in applying in future.* This is another answer that can guide the Federal government and contributes to designing policies, since it demonstrates the firms' expectations towards the incentive lines they intend to use in the future. In total 62 firms answered this question (see [Table 6]). R&D Tax Incentive is still the government's master program, according to the results of question 3. Answered by 54.84% of the respondents, Entrepreneurs Program comes in second, although this program was selected by 4.41% in question 3. This shows that it is little used at the moment but entrepreneurs are interested in knowing it better. Private Funds comes next, selected by 30.65%, which shows that it is possible to integrate investment funds and firms through trade associations, by organising Seed and Venture Forums. As mentioned earlier, in question 3 the program focused on Skills Funds was not used widely (0% of responses) because the program name was changed by the new administration. However, since 25.81% of the firm owners' highlighted this answer, it demonstrates an interest in using it in the near future. The same occurs with the Australian Research Council's programs that reached a 25.81% rate of interest and demand by firm owners.

Nevertheless, these days it is used by only 1.47%. A reasonable number of entrepreneurs (12.9%) did not show interest in having access to incentive lines. It can be noticed that the firm owners or managers have not been seriously considered the benefit of incentive, through programs such as the R&D Tax Incentive. The main reason for this is that they are not being able to spare time from their business and clients to allocate time for an application preparation. The open-ended feedback section of the question, ‘other/specify’, originated 12.9% of suggestions of state programs, commercialisation and exportation, as well as feelings about the programs and disbelief in the government: comments were, as written by respondents: (i) Accelerating Commercialisation, QLD State Grants; (ii) Would not bother unless totally reformed to take into account available resources of start-ups; (iii) The Entrepreneurs Program is hopeless and full of all the wrong organisations; I am not the person responsible for this within the company, so I am not able to speculate; (iv) I would love this information to be disseminated properly; (v) Commercialisation Australia; (vi) Too much bureaucracy and therefore a waste of time. Also, I do not trust the government to choose whom to give the grant to. Would only be interested in automatic self-selection grants; (vii) EMDG, and; (viii) Do not know enough about them to decide.

[Table 6] Results of the Survey Question 6



## 4. Conclusions and Discussion

The review of the literature indicates that throughout the history knowledge—outcome or product of intellectual capital—has always been an important driver of growth and development (Carrillo et al., 2014). In the age of knowledge economy, the role of knowledge generation and innovation has even become more prominent (Pancholi et al., 2014). Today innovation through generation of new marketable knowledge is a primary driver of growth, both growth of nations and growth of businesses (Brown, 2010; Drucker, 2014). Especially, today rising expectations about future demand for new technologies increase the incentives for investments in innovation by enlarging payoffs to successful innovations (Nemet, 2009). At present, many governments around the world that aim to replicate the success of innovation nations—e.g., the USA, Japan, Germany, Finland, Israel, Estonia, and Korea—are making sure innovation activities are incentivised and a sound innovation ecosystem is established (Wallsten, 2000; Coates & Holroyd, 2007; Kao, 2007; Wandersman et al., 2012; Breznitz & Ornston, 2013; Makkonen & Inkinen, 2014). As underlined by Maxwell (2015), firms perform innovation in order to reduce risk, reduce costs, increase market share, increase margins and create new market opportunities, which leads to increased profits and enterprise value. Furthermore, today, it is highly rare that a firm can flourish or even survive without continuous innovation (Maxwell, 2015).

The review of the Australian innovation support schemes reveals that Australia has the required basic foundation and infrastructure for the governance of the innovation ecosystem. However, a closer and deeper look into individual policy and support programs along with the results of the Australian technology company surveys reported in this paper reveal the following invaluable insights on the opportunities and constraints of the Australian innovation ecosystem.

Firstly, both Federal and State levels policy documents indicate that innovation is not at the forefront of the development agenda. Furthermore, there is no policy targeting to raise awareness within the public and business circles to invest in the innovation economy. Australia needs to communicate what innovation is, and start a national conversation, involving more people, government, associations, universities and the broader society. The investigation has shown that half of the innovative companies are not involved with the innovation conversation and this is a serious problem. For instance, some of the successful initiatives or projects can be used as communicating systems to create a culture of innovation and performance (see Johannessen & Olsen, 2011).

Secondly, almost all of the universities in the country are public universities; nevertheless, their research activities are not well integrated with companies and the innovation sector and their

priorities. Most of the Australian universities have no real incubators; as they are seen as ‘white elephant’—a business or investment that is unprofitable and is likely to remain unprofitable (Roberts, 1996). Universities, with financial support from government, and collaboration with industry and businesses, should play a more active role in developing knowledge and innovation spaces—such as incubators, accelerators, and knowledge precincts—for innovation in the country to take off. This is to say, the way of conducting research at the universities has to change and evolve into collaborative activities with government, industry and community—i.e., quadruple helix model research partnership (Alfonso et al., 2012). Currently available incentive programs are not aligned well with the universities, communities and companies’ needs. The required mechanisms are not in place for university professors and researchers to engage and work closely with businesses for new product, process or service development; rather the system motivates and awards scholars for their academic writings. Creatively employing funding to universities in order to support innovation is needed (see Millard & Hargreaves, 2015). Investigation of Finnish model innovation collaboration would create some pathways for Australia (see Uotila et al., 2012).

Thirdly, Czarnitzki and Lopes-Bento’s (2014) research on the effectiveness of innovation support in Germany finds that innovation subsidies increase innovation intensity and performance. However, in order to apply and receive the funding entrepreneurs need to know about available schemes. This can be challenging at times. For instance, it is common in Australia that with every new administration in office many of the departments are restructured. This restructuring also applies to the innovation support schemes. These rather frequent changes leave entrepreneurs with confusion and not much knowledge about the new innovation incentive programs. For those who are keen to apply, the application process causes spending longer time in search of to find the new schemes and their eligibility to apply. The outcome of these frequent changes is entrepreneurs’ lack of knowledge on the innovation support programs; and, therefore, lesser applications to the programs—for instance the Industry Skills Program.

Fourthly, today, the way firms are chosen to receive support is not transparent to entrepreneurs. Some are chosen to grow—i.e., pick winners—where this model is considered as political and to a degree biased. There needs to be more transparency at the selection criteria and how the applications are evaluated against these criteria. Australia loses its talent and innovative entrepreneurs to other regions of the world, such as South East Asia, Europe and North America, where they can find more lucrative and more transparent innovation support programs. Unlike Australia, some other governments share the risk of investment with the firm owners.

Fifthly, it can be said that the major reason of innovation failure in the country is the lack of innovation culture and a healthy ecosystem. Australia’s tolerance for business risk of failure is

very low, and this is reflected in the fact that there is a general reluctance of talented scientists and researchers to make a move from the tertiary education sector to private R&D sector organisations. For instance to support the innovation culture and knowledge-based economic development in the country, Australia can develop new programs to attract bright minds to become entrepreneurs similar to those in Canada and Chile—Quebec First (<http://www.quebecfirst.com/en/>) and Start up Chile (<http://www.startupchile.org>), respectively—since attracting and retaining talented people is directly associated with the raise in job creation and economic growth.

Sixthly, the lack or limited support to innovation in many countries, including Australia, has led entrepreneurs to investigate new ways to support their marketable ideas. Crowdsourcing is a new method to fill the void of funding need to innovate, especially for open innovation—during the last few years open innovation has gained increasing attention as a potential paradigm for improving innovation performance (see Marjanovic et al., 2012; Chebulski, 2013). This new funding mechanisms can also be supported by Federal policies and incentives as part of the efforts in forming a prosperous innovation ecosystem in Australia.

Seventhly, even though the importance of innovation to generate competitiveness is acknowledged, the government confesses that currently Australia's support to innovation is still poor (see DoIS, 2014). Therefore, in addition to abovementioned insights, we conclude the paper with some strategic suggestions for the country to advance its innovation ecosystem, and moving economic focus from resource-based economy to knowledge economy:

- Australia must develop or adopt a more informed and systematic approach for building innovation and creativity in the country (Baum et al., 2009). This is to say; Australian innovation system needs to be design to work more effectively, if the country really desires to maintain the standard of living achieved during the recent resources boom period.
- Australia needs to further invest on its talent base and endogenous assets (see Lonqvist et al., 2014; Yigitcanlar, 2014),and work more focused to maintain its global economic position in a world of rapidly emerging economies and tough competition. Australia can learn from the other countries, such as the US, Germany, Singapore, and Finland (Yigitcanlar, 2009; Yigitcanlar &Lonqvist, 2013; Yigitcanlar et al., 2015), that are taking risks with their entrepreneurs to further advance their innovative edges.
- In order to improve the effectiveness of the Australian innovation ecosystem, the gap between scientific research and market needs to be mapped carefully. That is getting the right high value added products out of the brains and laboratories and placing into the global market place. This requires further human and intellectual capitals investments in

the forms of financial and infrastructural support for higher education, R&D institutes, and innovation companies particularly in the fields of STI. Rather than recently introduced budget cuts to these critical sectors by the Federal government (Daley et al., 2013), further support is crucially needed to establish a global competitive innovation edge.

Lastly, the new Prime Minister Malcolm Turnbull's National Innovation and Science Agenda is a welcome initiative, bringing hope to Australian entrepreneurs, researchers and innovators in general. After a few years of lacking direction in this space, we might begin to see the light at the end of the tunnel. Although, it is too early to comprehensively assess the impact the new agenda will have on the Australian economy, one thing is certain that this initiative gives hope that Australian economy will again accelerate and catch up with most developed digital economies in the world (CiDE, 2015).

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