Technological Forecasting & Social Change xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Technological Forecasting & Social Change

journal homepage: www.elsevier.com/locate/techfore

Stimulating technological innovation through incentives: Perceptions of Australian and Brazilian firms

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ARTICLE INFO

Keywords:
Innovation
Incentives
National innovation system
Knowledge-based economic development
Knowledge economy
Technology firms
Australia
Brazil

ABSTRACT

Innovation has been the main driver of economic growth as it plays an increasingly central role in firm performance. Incentivising innovation by governments is essential to stimulate investment by companies, covering part of their R & D costs, and minimising their financial risks. There is, however, limited understanding of how innovation incentives are perceived by the companies. This paper examines the perceptions of technology firms, and the views of key actors about public incentive schemes for innovation in Australia and Brazil. The study finds that: (a) Direct incentives are perceived as critical for increasing innovation capabilities of firms; (b) Where tax incentive and infrastructure development schemes are the most preferred incentive programs among the firms; (c) However, despite the former two findings, effectiveness of existing incentive programs has been marginal in fostering innovation significantly in the studied countries. These findings imply that Australian and Brazilian governments should further focus on the design, promotion, and delivery methods of the innovation support mechanisms.

1. Introduction

Today's most advanced economies are fundamentally knowledge-based (Baum et al., 2009; Carrillo et al., 2014; Dunning, 2000). As Burton (1999) indicates, under the knowledge capitalism the gap between rich and poor countries is rapidly expanding; where knowledge-intensity is also leading to a growing gap within our societies. Promoting innovation through research and development (R & D) is seen as a useful method to narrow this gap (Byun et al., 2017; Yun et al., 2016). Many scholars see innovation as the main driver to establish a competitive edge and generate economic growth (Cooke and Leydesdorff, 2006; Pancholi et al., 2014, 2015). The growing dependency of wealth creation on intangibles is making the global economy more fluid and volatile, and the capacity to access and combine new and existing knowledge effectively for innovation has become highly important for the competitiveness of firms, cities/regions, and nations (Huggins, 2011; Lonnqvist et al., 2014; Wolfe and Bramwell, 2008).

Innovation provides a company with a relative advantage over the competition (Betz, 2003). Beyond an advantage, particularly in the global knowledge economy, for many firms innovation is the key to survival (Doran and Ryan, 2012). Since innovation leads to more innovation, firms that invest in R & D and build technological and organisational capabilities are likely to induce further innovation (Baumol, 2002). However, stated by Guan & Yam (2015, p.273), "investors are usually anxious to obtain quick and safe returns on their investments, and the high R & D costs and risks involved in research keep many investors away". Therefore, government innovation support mechanisms—such as government regulations, grants, subsidies or other financial incentives—are critical for many firms to invest in innovation generating activities (Leiblein and Madsen, 2009; Scotchmer, 2004). The governments of OECD member countries fund about 30% of R & D expenditure by companies in their countries (Thomson and Jensen, 2013). While the rationale for government intervention is strong, the ability of governments to effectively support innovation through incentives remains a daunting challenge (Norberg-Bohm, 2000). Furthermore, many firms do not take advantage of the available incentive programs due to various reasons such as unawareness of the support programs available, complex application procedures, or low success rates (Sabatini-Marques et al., 2015a, 2015b).

Although there have been considerable literature on technological

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http://dx.doi.org/10.1016/j.techfore.2017.05.039
Received 5 August 2016; Received in revised form 27 May 2017; Accepted 30 May 2017

innovation and the role of incentives, our understanding on the firms' perceptions on incentive programs remains limited. It is against this backdrop that the study analyses Australian and Brazilian technology firms and the key policy actors'—i.e., government departments, professional bodies, and eminent innovative entrepreneurs—views on the public incentive schemes for innovation. Since a case study research (Eisenhardt, 1989; Yin, 2003) allows in depth understanding of the logical or causal drivers of phenomena—rather than statistical generalisation—, it is reasonable in this study to examine the case of Australia and Brazil by surveying technology firms and interviewing the key actors. The study findings generate insights on the innovation ecosystems of Australia and Brazil, and describe how incentive mechanisms are perceived, and what the contributions of these incentives to firms' innovation performances are in these countries.

2. Literature review

Improving innovation performance is fundamental. Innovation is placed at the heart of countries and firms' drive to raise productivity and economic growth. It is a broad concept that relates not only to the generation and commercialisation of new ideas, but also to the process of diffusion and adoption of existing knowledge and technologies by all firms (OECD, 2016). Schumpeter (1934) was one of the first to acknowledge the importance of innovation by underlining innovation as the market introduction of a technical or organisational novelty, not just its invention. He perceived innovation as a power to lead change. Nonaka and Takeuchi (1995) indicate that the firm is a repository of knowledge with potential to innovate. Schumpeter (1934) considers the innovative entrepreneur in a firm as an economic agent that by developing new products generates new markets. But beyond this, innovation creates competitiveness, breaks barriers, opens new markets, generates exports by bringing foreign capital into the country, and produces qualified jobs with higher pay. This results in a greater purchasing power, and forms the basis for knowledge-based economic development (OECD, 2016).

In the knowledge economy, for a country to become and stay competitive, it is necessary to build its own innovation ecosystem and invest in people and firms (Dedehayir et al., 2016; Silva et al., 2017). Such an ecosystem is defined by the Australian Government (2014, p.14) as “an open network of organisations that interact with each other and operate within framework conditions that regulate their activities and interactions”. In many countries national innovation systems—consisting of a network of institutions whose activities initiate, import, modify and diffuse new technologies, and provide the framework within which governments form and implement policies to influence the innovation process—form the backbone of their innovation ecosystem (Carayannis et al., 2017; Jiao et al., 2016; Taddeo et al., 2017).

Under the framework of national innovation systems, governments develop various strategic approaches to promote innovation and foster new innovative firms (Hewitt-Dundas and Roper, 2010; Kang and Park, 2012). For example, these strategies include: (a) Empowering people to innovate; (b) Unleashing innovation in firms; (c) Creating and applying knowledge; (d) Applying innovation to address global and social challenges, and; (e) Improving the governance and measurement of policies for innovation (Ioppolo et al., 2012, 2016; OECD, 2010). These generic strategies have a positive effect on innovation activities. For example, Carboni (2017) finds in a comparative study of seven European countries that public grants have a positive effect both on firms' investment and R & D, implying that recipient firms spend more than they would have without public aid. However, the analysis also reveals heterogeneity across the studied seven countries—meaning context matters. While countries have tried innovation-fostering strategies to boost their national innovation capacities, not all have been successful. In a study of 17 European countries, Proksch et al. (2017) have identified different paths or innovation strategies that lead to differential innovation capacity. This implies that, rather than a universally generic strategy, countries should choose appropriate strategies on the basis of their capabilities and conditions— meaning precondition matters. In a study on Turkish small and medium enterprises (SMEs), Olcay and Bulu (2015) reveal the positive effect of government support funds on SMEs' innovation. They also find that relatively larger firms located in industrial zones and technology development centres produce outputs with higher level of innovation—meaning company size matters. The findings suggest that different strategies need to be tailored for increasing innovation performance of smaller companies. While these strategies are all well and good (Huggins and Izushi, 2013; Yigitcanlar et al., 2016), for firms to become innovative and competitive, governments also need to share a reasonable portion of the innovation financial risks through providing decent amount of incentives (Kaufmann and Tödtling, 2002; Nonaka et al., 2008).

Firms seek support to stimulate their learning and innovation, and share risks with partners in investing in costly R & D activities (Rasiah et al., 2016). Public sector incentives, thus, play an important role in increasing innovation capabilities of firms (Cohen et al., 2002; Veloso and Soto, 2001). Governments provide incentives to firms in several ways. The first method is the provision of financial subsidies, where the funds provided by the government do not return back to the financing agency. The second one is the provision of low-interest and long-term loans, where companies are given some lead-time to bring innovation to the market before repaying back the debt. The third method is tax reduction, which provides tax offsets for promoting innovation and ideas boom (Guellec and Potterie, 2003; Lerner and Wulf, 2007).

Incentives are also provided for different purposes. Some of the programs support individual firms' innovation endeavours (Heydebreck et al., 2000), some provide aid for firms to cluster with others in innovation hubs (Aquilani et al., 2017; Bröcker et al., 2012), and some supply funds for the university-industry collaboration (Ponds et al., 2010), and establishment of triple helix model partnerships (Leydesdorff and Etzkowitz, 1998). Recent studies investigated the effects of these government incentives on firms' innovation performance in different country contexts (Guan and Yam, 2015; Radas et al., 2015). These studies particularly revealed that incentives cause increased R & D expenditure in firms.

The literature argues that innovation and technological development are crucial for knowledge-based economic development and for the competitiveness of firms and countries. Moreover, supporting innovation activities through public sector incentive mechanisms are essential to increase the innovation performance. There has been, however, so far no research looking into how firms perceive available innovation support programs, particularly by using a cross-country comparison method. Existing literature mainly utilises innovation surveys conducted nationally (Salazar and Holbrook, 2004), and mostly looks into the issues of innovation's nature, impact, productivity, employment generation capacity and so on (Crespi and Zuniga, 2012; Evangelista et al., 1997; Hashi and Stojčić, 2013; Zuniga and Crespi, 2013) or investigates firm perception only on a specific area of innovation—i.e., eco-innovation (Doran and Ryan, 2012). The study at hand, with an aim to bridge this gap in the literature, undertakes an empirical investigation for depicting the perceptions of technology firms on innovation incentives in Australia and Brazil.

3. Empirical investigation

This research applied a case study method for the empirical investigation. The method was considered appropriate for this research because it allows to define the topic more broadly (i.e., to identify the perception of technology firms) by taking into account contextual issues in each case and relying on multiple sources of evidence (Yin, 2011). The two most common approaches of case study research include inductive approach based on the Grounded Theory (Glaser and Strauss, 1967) and deductive/testing approach (Yin, 2003). The basic difference between the approaches is that while the Grounded Theory relies on

data to generate new theories (there is no initial preconceived framework of concepts and hypotheses), the other approach develops a theory at the beginning of the research and focuses on testing and validating the theory in case settings. Another approach proposed by Eisenhardt (1989) lies in-between these two approaches—i.e., aligns with the Grounded Theory approach—that is inductive, but there are elements that follow a more planned approach. Given the rich literature on the role of incentives on innovation, this research follows the deductive approach to test the perceptions of technology firms on innovation incentives.

3.1. Case studies

Following Yin (2003), cases were selected at the beginning of the research study, i.e., in the design phase, based upon the theory (see Section 2) and expected results. Two cases, Australia and Brazil were selected to satisfy the replication logic of the deductive approach. The two cases have both similarities and differences when it gets to supporting innovation generating activities. More precisely the reasons for the selection include: (a) Traditionally both countries are strong resourced-based economies, however, in the last few years both of them are making significant efforts in moving towards a knowledge economy; (b) In recent years, both countries introduced a new national innovation system with incentive programs attached to support innovation activities systematically; (c) Australia is a developed economy with a much smaller population, and produces higher socioeconomic performance; in contrast Brazil is an emerging economy with a large population, and produces lower socioeconomic performance; (d) The lessons in success and failure learned from these countries could inspire other developed and emerging economies with similar characteristics.

Table 1 illustrates the salient characteristics of Australia and Brazil. Furthermore, Fig. 1 illustrates the comparative performance of Australian and Brazilian national science and innovation systems benchmarked against the OECD country averages, where out of 22 areas Brazil outperforms Australia only in one—i.e., international co-patenting. Australia's better performance in innovation in comparison with Brazil is further evidenced by Australia hosting 15 headquarters and 2664 subsidiaries of the world's top R & D performing companies, where these figures for Brazil are only eight and 1798 respectively (EU, 2015). Nonetheless, in recent years both countries have made significant attempts to increase their innovation edges. For example, Australia introduced a new national innovation agenda with funding attached—i.e., Australian National Innovation and Science Agenda (Australian Government, 2015). Similarly, Brazil provided a significant share of the national budget to R & D to support its new national innovation agenda—i.e., Brazilian Innovation System (CMSS, 2016). However, the effects of these policies on significant innovation and economic growth in both countries have yet to be materialised. Moreover, the literature suggests that both countries need to strengthen the effectiveness of their public policies for innovation (OECD, 2016; Sabatini-Marques et al., 2015b). In this journey, Australia seems to be facing lesser challenges compare to Brazil due to its higher human development base. Even though Brazil has made remarkable economic and social progress during the last decade, which contributed to reductions in poverty and inequality; Brazil still has a very long road to include the poor masses in the economic system, establishing a fair social justice system, and balance its massive regional development disparities (Azzoni, 2001). Nevertheless, both countries showcase ambition to improve their global standing by investing in knowledge economy activities and thus form interesting contexts for investigation. Therefore, the selection of the two cases meets the replication logic so that it either: (a) predicts similar results (a literal replication) or; (b) produces contrasting results, but for predictable reasons (a theoretical replication).

3.2. Methodology

This research employs both descriptive and explanatory case study methods. The descriptive analysis identifies the perception of the technology firms on innovation incentives, whereas the explanatory analysis portrays cause and effect relationships (Yin, 2011). Both analyses follow a qualitative methodological approach for the empirical investigation. The scope of the research is limited to Federal government incentive schemes—excluding state or local government schemes. As for the targeted companies, only technology firms are included in the study, since they are affected more directly from the incentive schemes.

Firstly, the study conducted an online survey to capture Australian and Brazilian technology companies' perceptions on the role and effectiveness of their innovation incentive programs. The survey contains seven questions (Table 2) and circulated through the Survey Monkey online tool to the directors of Australian and Brazilian technology companies. The questions in the Australian (in English) and Brazilian (in Portuguese) versions of the survey only had some minor paraphrasing differences to better capture responses in each country following the replication logic, which implies validation testing and that each case study should cover the same exact research questions and approach. Australian survey was conducted between May and August 2015, where Brazilian one took place between August and September 2014. In Australia, contact details of the technology companies were obtained from the Australian Business Directory, and in Brazil from the Brazilian Association of Software Companies. In order to increase the response rates, the survey link was also sent to member firms through email by Australian Information Industry Association, Australian Cooperative Research Centres Association, and Brazilian Association of Software Companies. Furthermore, some of the technology company representatives were also approached through LinkedIn. In Australia, in total 75 valid responses were received out of 379 companies (19.79% response rate), where in Brazil, valid responses were 312 out of 976 (31.96%). The cumulative response rate was 28.56%.

Secondly, the study conducted comprehensive interviews, with an aim to validate the results of the survey, and anticipate the contributions of Australian and Brazilian government incentive programs to

Table 1
Salient characteristics of case study countries.

	Australia		Brazil	
	Value	Global rank	Value	Global rank
Area in 2015	7692.024 km^2	6	8,515,767 km^2	5
Population in 2015	23.78 million	51	207.80 million	5
GDP nominal in 2015	US$ 1.34 trillion	12	US$ 1.81 trillion	9
GDP per capita in 2015	US$ 46,270	19	US$ 15,391	77
Global innovation index in 2015	0.552	17	0.349	70
Human development index in 2015	0.939	2	0.754	79
Tertiary education attainment rate in 2015	0.485	9	0.150	40
Scimago country h-index in 2015	709	10	412	23

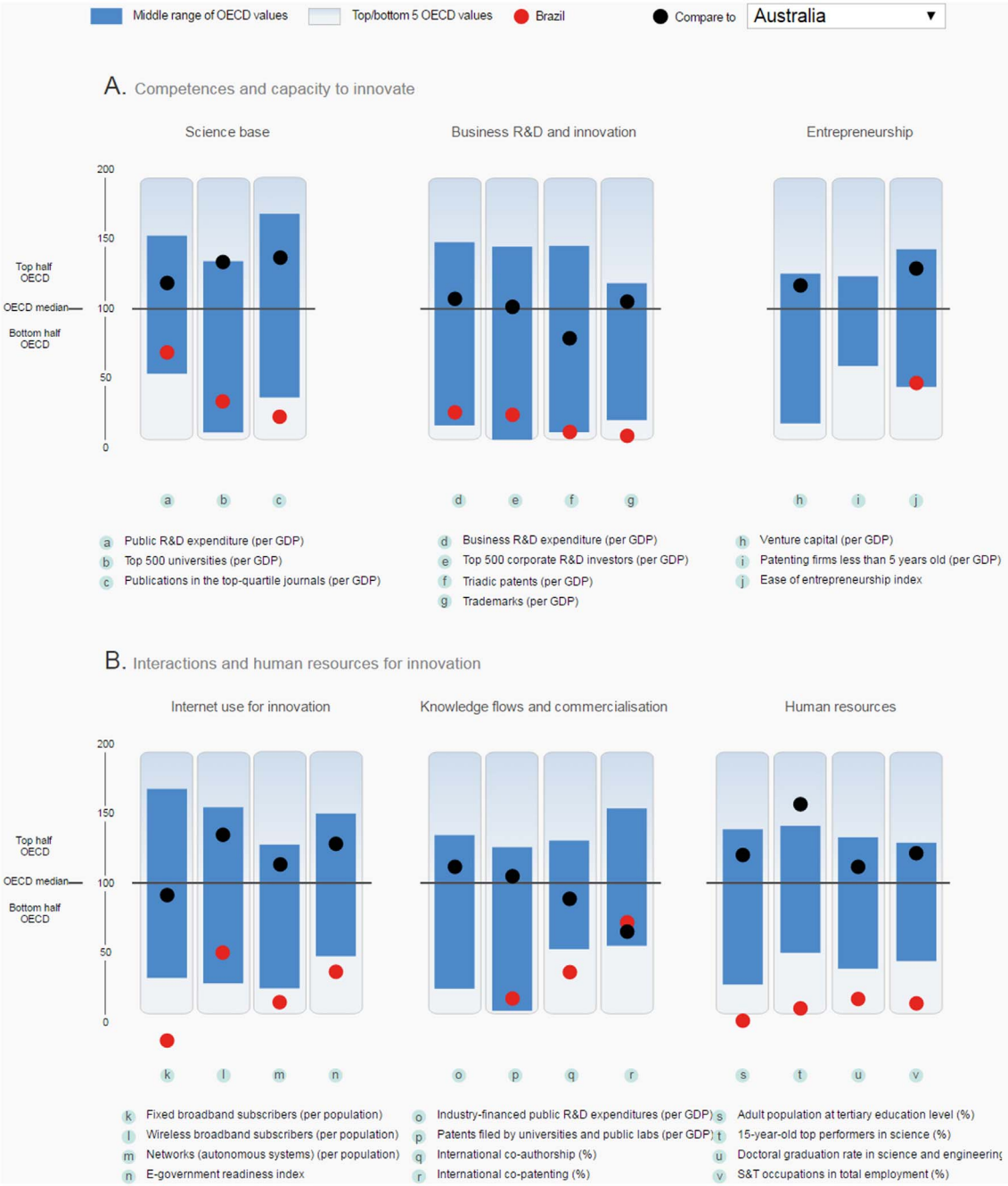

Fig. 1. Comparison of Australian and Brazilian science and innovation systems (OECD, 2016).

Table 2
Survey questions.

Survey questions
Q1. Are you aware that Australia/Brazil has an industry innovation and competitiveness agenda?
Q2. Are you aware of (non)refundable and subsidised incentives offered by the government for innovation and R & D?
Q3. Has your company ever received an incentive for innovation and R & D from the Federal government?
Q4. What type of incentive has your company received for innovation and R & D?
Q5. If you have applied for incentives but have not been successful, please indicate the reasons.
Q6. For what purpose is your firm interested in receiving support for innovation and R & D?
Q7. Would you consider applying to the innovation and R & D incentive programs in the next five years?

Table 3
Interviewee details.

Category	Country	ID
Federal government executives	Australia	Interviewees #1–3
	Brazil	Interviewees #3–6
Professional association managers	Australia	Interviewees #7–8
	Brazil	Interviewees #9–10
Prominent innovative entrepreneurs	Australia	Interviewee #11
	Brazil	Interviewee #12

firms' innovation performance. In total 12 interviewees were selected among the key actors from the federal government, and national professional associations in Australia and Brazil along with some of the most innovative entrepreneurs of these countries. Table 3 lists the

Table 4
Interview questions.

Interview questions
Q1: Do survey findings represent a correct and reliable picture of firm perspectives on innovation incentives?
Q2: How do you interpret the survey findings in overall and specific areas?
Q3: What can be done to increase the firms' interest in innovation incentive programs?
Q4: Do you think incentive programs are contributing to firms' innovation performance, and if so how much?
Q5: What can Federal government do to increase university-industry collaboration for innovation?
Q6: How effective is the national innovation policy, and what can be done to improve its effectiveness?
Q7: Do you have any additional issues or concerns to raise or comment on?

profiles of the interviewees. Government executives from both countries were selected among the key actors that were involved in the formulation of either the national innovation policy or an innovation incentive program. Managers of the following professional associations were selected for the interviews: Australian Information Industry Association (AIIA), Australian Cooperative Research Centres Association (CRCA), Brazilian Association of Software Companies (ABES), and Brazilian Association of Information Technology and Communication Companies (BRASSCOM). Additionally, two eminent innovative entrepreneurs—CEOs of SMEs with at least two prestigious (inter)national innovation award received during the last three years—were invited to participate in the study. Semi-structured interview approach is adopted, where the interviews started with sharing the survey findings with the interviewees, and followed by a set of predetermined questions (Table 4). Additional questions were directed only if further clarifications were needed on a response to the set questions. Due to geographical distance and meeting scheduling challenges, interviews were conducted in three different modes—i.e., face-to-face, Skype video, and telephone—and in English in Australia and in Portuguese in Brazil. Each interview took between 45 and 60 min. All interviews are recorded and then transcribed to text manually.

3.3. Perceptions of technology firms on innovation incentives

The results of the survey on the perceptions of technology firms on innovation incentives are presented in Table 5 and discussed below. The results are presented in a comparative way following the principle of case study research so that the replication logic (i.e., the validity of findings) can be deducted for generalisation.

The first question focused on the awareness levels of the respective national innovation policy—i.e., Australian National Innovation and Science Agenda, and Brazilian Innovation System. According to the findings slightly over half (51%) of Australian technology firms were aware of the national level innovation policies compared to their Brazilian counterparts with only just over 39%.

The second survey question concerned of depicting the awareness levels of firms on innovation incentives provided by their government. Close to two-third of the firms (64%) were indicated their awareness on the available incentive opportunities in Australia. This is higher than the figure of 54% in Brazil.

The next survey question investigated firms' current or past government incentive use. The survey results indicate a much higher use of incentive programs in Australia (47%) in comparison to Brazil (17%) by the technology firms.

The fourth survey question enquired about the types of incentive programs that were used by technology firms. In Australia, the most popular (69%) type of innovation incentive is indicated as the tax deduction program (R & D Tax Incentive Program). This incentive offers a company, making below $20 million in annual revenues, a 45% benefit on any R & D expenditure; if the company is operating at a loss, the 45% benefit will return in cash. This is followed by the R & D collaboration with academia (ARC Linkage, ARC Centres of Excellence, and Cooperative Research Centres Programs), skill development and employment (Industry Skills Fund Growth Stream), infrastructure development (Entrepreneurs' Infrastructure Program), commercialisation and marketing, and networking. In Brazil, incentives are dominantly received for infrastructure development—in the form of machinery, hardware, and software (54%). This is followed by skill development

Table 5
Survey results.

	Australia		Brazil	
	#	%	#	%
Q1. Are you aware that Australia/Brazil has an industry innovation and competitiveness agenda?				
Yes	38	50.7	122	39.1
No	37	49.3	190	60.9
Total	75	100.0	312	100.0
Q2. Are you aware of (non)refundable and subsidised incentives offered by the government for innovation and R & D?				
Yes	48	64.0	168	53.8
No	27	36.0	144	46.2
Total	75	100.0	312	100.0
Q3. Has your company ever received an incentive for innovation and R & D from the Federal government?				
Yes	35	46.6	52	16.7
No	40	54.4	260	83.3
Total	75	100.0	312	100.0
Q4. What type of incentive has your company received for innovation and R & D?				
Tax deduction	24	68.5	0	0
R & D collaboration with academia	4	11.4	8	15.4
Skill development and employment	4	11.4	12	23.1
Infrastructure development	1	2.9	28	53.8
Commercialisation and marketing	1	2.9	3	5.8
Networking	1	2.9	1	1.9
Total	35	100.0	52	100.0
Q5. If you have applied for incentives but have not been successful, please indicate the reasons.				
Complex application process	16	47.1	19	40.4
Lack of adequate guidance	0	0	20	42.6
Lack of detailed information availability	6	17.7	14	29.8
Lack of a budget to prepare a strong application	8	23.5	11	23.4
Lack of a dedicated team to prepare the application	8	23.5	12	25.5
Lack of necessary guarantees	6	17.7	8	17.0
Applied to an unsuitable incentive program	5	14.7	10	21.3
Incentive program terminated or renamed	0	0	22	46.8
No feedback provided	0	0	1	2.1
Total	34	n/a	47	n/a
Q6. For what purpose is your firm interested in receiving support for innovation and R & D?				
Intellectual property	5	7.5	12	6.1
Working capital	20	29.9	72	36.7
Commercialisation	9	13.4	31	15.8
Infrastructure (i.e., machinery, hardware, software)	9	13.4	47	24.0
R & D	42	62.7	151	77.0
Marketing, sales, and fairs	31	46.3	91	46.4
Internationalisation	22	32.8	45	23.0
Engaging young innovators and students	3	4.5	7	3.6
Total	67	n/a	196	n/a
Q7. Would you consider applying to the innovation and R & D incentive programs in the next five years?				
Yes	49	65.3	149	47.8
No	26	34.7	163	52.2
Total	75	100.0	312	100.0

and employment, and R & D collaboration with academia.

The next survey question queried the reasons of firms being unsuccessful in securing a suitable incentive for their innovation activities. In Australia, the most important issue is underlined as the complexity of the application process for the incentive (47%). The main reason in Brazil was incentive program being terminated or name changed during the application (47%). The other significant ones include lack of adequate guidance, complex application process, and lack of detailed information availability. In both countries, the application process to incentive opportunities is seen as bureaucratic in various degrees.

The sixth survey question focused on determining the main areas the innovation incentives intended to be used. In Australia, firms mostly interested to use government incentives for R & D activity (63%). The other areas include marketing, sales and fairs, and internalisation purposes. In Brazil, similar to Australia, incentives requested for dominantly to be used for R & D activities (77%). The other areas include marketing, sales, and fairs, along with establishing working capital.

The last survey question concerned of determining whether firms are interested in reapplying to the available incentive programs in the future. In Australia, almost two-third of the surveyed firms (65%) indicated that they would seek incentive support from government programs in the next five-year period. This figure for Brazil was about half of the participated firms (48%).

3.4. Contribution of incentives to firms' innovation performance

The interview exercise points out to an established consensus among interviewees from both countries that survey findings seem to be reflecting an accurate view of the reality. Interviews in Australia revealed that there is no specific promotion body or national scale campaigns to inform firms about the existing innovation incentive schemes—besides some professional magazines, newspaper articles, and online blogs. On that point, Interviewee #2 states, *"there are dedicated websites for each incentive program in Australia, and it is assumed that companies are retrieving information from these websites to take advantage of available innovation funding opportunities"*. In Brazil, nevertheless, the government employs professional associations (ABES, BRASSCOM) for delivering information seminars on innovation incentive schemes to firms in every region of the country. According to Interviewee #4, *"information sessions help to promote the support schemes to a wider audience; also while increasing firms' interests and competition, they let the government know which firms have the best innovation potential"*. Despite these two views, most of the interviewees agree that in both countries the awareness levels on available innovation incentive programs are quite low.

The interviewed experts suggest a number of mechanisms to increase firm awareness on innovation support schemes. These range from national written, visual, and web-based media advertisements to involvement of professional bodies and chambers of commerce and industry; from free training sessions, conferences or webinars to development of mobile apps; from making incentive program websites more user-friendly to application brokers; and from national telephone hotlines to email lists put together by the national business registry offices. Interviewee #7 recommends, *"using social media and podcasts as effective tools to inform companies about the incentive programs"*.

In parallel to the literature—recognising innovation as a major stimulus to economic growth—, the interview findings suggest that in general incentive programs contribute to increasing innovation activities. However, these programs only have a limited impact on company's innovation performances. The nature and quantity of the innovation support schemes in both countries indicate that Brazil is a bigger risk taker in comparison to Australia. As a testament to this, Interviewee #5 says, *"Brazilian government shares the risk with entrepreneurs in the development of innovative products and services"*. However, contrary to the risk taking levels in Australia and Brazil, the innovation returns from both countries do not show big differences. As for Interviewee #8, this might be due to *"support mechanisms not being designed specific to the company needs….if this is done, the effectiveness of incentives will significantly increase"*. Interviewee #9 suggests, *"even if supporting individual firms in their innovation journey with financial aid, tax incentives, staffing or equipment are highly important, what matters more is establishing alliances between start-ups or SMEs with universities. This will bring the biggest return of government investment"*. According to Interviewee #1, *"direct incentives, such as tax or infrastructure support, have a more positive impact on the innovation capabilities of firms than those indirect"*. This view is in line with the literature—indicating direct subsidy programs are intended to support commercial R & D projects with large expected social benefits and encourage private R & D expenditure in companies (Radas et al., 2015). However, most of the interviewees share with confidence that the effectiveness of available incentive schemes in both countries only marginally supporting the expected ideas and innovation boom. Interviewee #6 argues, *"in order to build a healthy innovation ecosystem, a venture capitalist market similar to that in the North America needs to be established"*.

The experts indicate that in Brazil, public policies aim to stimulate university-industry collaboration. These policies include specifically designed subventions. As for Interviewee #10, this is *"an important way of linking researchers and those who have the knowledge to innovate through collaboration schemes with firms"*. Such linkage is much less in Australia and mainly takes place in the form of research collaboration or consultancies. However, due to the recent global financial crisis (GFC) and the end of the mining boom, both countries' academic and private sectors are suffering in getting viable resources for collaboration. Underlined by Interviewee #11, *"R & D collaboration with academia strengthened my company's innovative edge in the past. In recent years, unfortunately, such collaboration has not been possible due to limited government funds and high-level competition for securing one"*. This is a major challenge in Australia where major Federal government funding cuts from universities' budgets are underway. Similarly, the economic downturn in Brazil is hitting hard on the collaboration efforts as well. Furthermore, Interviewee #12 says, *"one of the key problems is the bureaucracy in Brazil that makes it harder to receive government support for innovation collaboration activities with academia…Businessman simply do not have time for jumping through countless bureaucratic hoops"*.

National innovation policies of Australia and Brazil have the required basic foundations for the governance of the innovation ecosystem. However, a closer look into individual policy and support programs reveal a number of challenges—highlighted by the experts. In both Australia and Brazil, the culture of creating an innovation ecosystem is very young. These traditionally resource-based economies have started to diversify their economies by investing in innovation and knowledge generation only relatively recently. Even though the national innovation agendas are providing general guidance and focus, they lack strong funding and policy power. Lack of long-term dedicated approach to innovation support is highlighted as a major challenge. On that point, Interviewee #4 states, *"innovation policy in Brazil lacks a consistent long-term strategic vision, requires institutional reforms, and constantly impacted by the negative macroeconomic developments"*. Interviewee #1 sees the major challenges for Australia as *"insufficient attention to the development of entrepreneurship culture, low-level business R & D expenditure, and research institutions having poor linkages with potential users of research"*. Furthermore, the cost of business is making Australian innovators relocate to other innovation heavens, such as North America, Northern Europe, and South East Asia. Interviewees point out that an urgent attention needs to be paid to fostering and retrieving endogenous innovative companies, along with attracting exogenous ones.

The experts' responses to the question of 'whether incentive programs are contributing to firms' innovation performance' were particularly useful to understand the tricky relationship between perceptions and performance. In the case of Australia according to Interviewee#2, "*the problem is the supply and demand issue. If government cannot establish an innovation ecosystem and shares the financial burden with firms,*

becoming an innovation nation is only a dream…Introduced incentive schemes, I mean the supply, are new and limited, and not to a surprise not many firms are aware of the opportunity. In other words not much demand. Therefore, the innovation performance shows no signs of significant improvement." In Brazil, the view is not much different either. As for Interviewee#4, *"contributions of the incentive programs to innovation outcomes have been much lower than expected…These programs are in their infancy and it will take some time and experience to get it right."* Some of the interviewees' perspectives were highly inspiring. For example, Interviewee#7 indicated that *"innovation performance of Australia has been in a trend of improvement, but not as fast as our competitors. There is no such thing as slow-pace progress in the age of innovation economy… Limited industry-academia collaboration is also slowing down the progress. Our competitors, such as Finland and Singapore, managed to establish such strong collaboration long time ago"*. Interviewee#12 stated that *"as much as policymakers, we [technology firms] should also take self-criticism in the rather disappointing innovation performance of the country… There are many companies that make misuse of the available support…Only the ones with international partners are actually in the game of disrupting innovation"*. In light of the revealed company perspectives and expert perceptions on innovation performances, Interviewees #3 and #6 from Australia and Brazil respectively indicate that governments need to be *"highly sensitive to the strategic needs of firms"* and *"clearly understand the market and companies' actual needs"*. They see that only in this way the most effective support mechanisms for innovation can be formulated.

Other issues raised by the interviewees include establishing a nested ecosystem approach for building strong linkages between national, state and local level innovation support mechanisms, expanding the quantity and quality of the incentive support programs, and attracting venture capitalists to Australia and Brazil. Furthermore, Interviewee #3 raised the issue of limited support for knowledge and innovation clusters by stating, *"Australian government's policy on supporting innovation and entrepreneurial centres such as incubators, accelerators and technology parks is significantly weak in comparison to other OECD member countries"*. In both countries, Federal level programs have the largest funds in comparison to state and local levels. Interviewee #5 argues, *"in Brazil, incentives for innovation must be decentralised. Regional and local authorities that are much closer to the companies than the Federal government should distribute the funds. The role of Federal government should be developing the national policy and allocating funds for regional and local authorities to fund innovation"*.

4. Discussion and conclusion

The study reported in this paper aimed to identify how technological innovation that is being stimulated through incentive programs at the federal level in Australia and in Brazil is perceived. The study generated a number of insights that are listed in Table 6 and discussed below.

The first issue is the availability of a comprehensive *national innovation policy*. Such policy particularly focusing on innovation is relatively new for both countries, although science and technology policies in a broader sense have been developed in both countries for quite some time. Australia has witnessed some policy changes in the innovation prioritisation since Prime Minister Malcolm Turnbull came to office in September 2015. He has pointed innovation as a government priority and introduced the National Innovation and Science Agenda, Smart Cities Plan, and announced an AUS$1.1 billion plan to increase innovation in Australia. Most recently, the Tax Laws Amendment (Tax Incentives for Innovation) Bill was announced in March 2016 to provide generous tax incentives for innovative start-ups and investors in Australia (Yigitcanlar, 2016). Governments of both countries strongly believe that innovation is essential to increase the competitive edge of their countries. However, they only support innovation activities with relatively limited financial resources. Furthermore, policies lack initiatives to encourage the entrepreneurial culture, to think in innovative ways, and to take/share financial risks.

The second issue is the availability of *innovation support programs*. As the literature (Leiblein and Madsen, 2009; Scotchmer, 2004) and our study findings suggest, direct incentives are critical to increase innovation capabilities of firms. In comparison to Australia, Brazil's programs and legislations on economic development through incentive to innovative firms are much more recent. Brazilian government has been offering support to private firms through incentive programs since 2004—the first national innovation agenda was introduced in the same year (Sabatini-Marques et al., 2015a). In Australia, this dates back to 1986 (Yigitcanlar, 2010; Yigitcanlar et al., 2008)—however, the first national innovation agenda was only introduced in 2009. Innovation support in Brazil has increased, but it is still limited to about 1% of GDP. In Australia, this figure is 2.1%. However, both of these figures are lower than the OECD member country average (2.4%). Both countries need a closer look into innovation funding in order to become more competitive in the global markets. Among the available support programs in Australia tax-incentive schemes, and in Brazil infrastructure development schemes are found to be the most popular ones.

The third issue is the *outreach of the support* programs. Australia and Brazil have well-structured incentive programs. Nevertheless, the analysis revealed that these programs are not promoted and advertised adequately as targeted companies' awareness of the program availability is around 50% in Australia and 40% in Brazil. A more decentralised approach in promoting the incentive programs, perhaps with support from regional and local actors would be helpful. Brazil has tried engagement of national professional associations to bridge this gap and to publicise incentive programs. However, due to the geographical vastness the country, this approach did not provide the desired outcomes. Perhaps more effective involvement of regional and local branches of these professional organisations in the promotion of the programs could be a solution.

The next issue is the *effectiveness of the support* programs. The interviewed experts believe that incentive programs contribute to increasing innovation activities, however, they only to a degree have a positive impact on company's innovation performances. This finding is in line with the literature as stated by Radas et al. (2015, p.28), companies "fund their large and ambitious projects using direct grants, and use tax incentives to support smaller and less demanding middle-of-the-road projects". In Australia, 69% of the surveyed companies benefits from tax incentive programs, which may not be the most effective support mechanism for innovation. This indicates that the centrally planned incentives systems are not as effective as they are hoped to be for enhancing innovation progress for Australian and Brazilian technology firms. Another issue is the limited availability of the support programs, thus, these programs are not capable of achieving a quantum leap and making Australia and Brazil innovative nations. Reporting of successful cases is rare and achievements of incentivised companies are unknown to the general public. Particularly successful cases could be used to promote the programs and also encourage the formation of innovation culture. In order to see the positive results innovation support programs should be strategic, long-term, and apolitical.

The fifth issue is the *problems associated with the programs*. One of the major problems, particularly in the case of Brazil, is the need for a less bureaucratic application processes. Besides, Brazil has been facing a serious issue with its public organisations due to corruption in the government, which naturally causes allegations in incentive awarding. Another issue that was brought up in the case of Brazil is the lack of transparency. The selection process for providing incentives to companies should be more transparent. In Brazil (through the National Program for Business Incubators and Technology Parks) the priority seems to be given to stimulating accelerators, incubators, and technology parks—as innovation clusters. This may hinder the development of companies located outside of these clusters. Contrary to Brazil, in Australia, innovation and entrepreneurial centres—such as incubators, accelerators and technology parks—do not get as much support from

Table 6
Summary of findings.

	Australia	Brazil
National innovation policy	▪ Introduced innovation agendas have had only limited impact on creating a vibrant innovation ecosystem. ▪ Major limitations of the agenda include limited industry-university collaboration, the lack of a strong dedication to clustering of innovative companies, and negative impacts of the global economic downturn. ▪ With the new government, innovation agenda has become one of the country's top priorities. However, a strong funding has not been allocated.	▪ Introduced innovation agenda has generated some progress, but still not sufficient enough to establish a vibrant innovation ecosystem. ▪ Major limitations of the agenda includes; short-termism, the fragmentation between the subsystem of education and research and the subsystem of production and innovation, very low, business expenditure on R & D, high-level bureaucracy, requires important institutional reforms in the taxation and regulation of business, and negative impacts of the global economic downturn.
Innovation support programs	▪ Limited innovation support funds are available for companies. ▪ The application procedure is simple and straightforward enough. ▪ R & D tax incentive scheme is the most popular program. ▪ Government needs to take a bigger risk in the innovation process by providing new programs and more funding.	▪ Limited innovation support funds are available for companies. ▪ Application procedure needs to be simpler and less bureaucratic. ▪ Infrastructure development scheme is the most popular program. ▪ Government is willing to take the risk but struggling to provide enough funds for innovation due to economic downturn.
Outreach of the support	▪ Government needs to promote the support programs better, as countrywide significant portions of the companies are not aware of the programs. ▪ There is not a difference in awareness of the programs whether the company is located in a cluster or not.	▪ Government needs to promote the support programs better, as countrywide almost half of the companies are not aware of the programs. ▪ Almost all firms located in a cluster are aware of the support programs indicating the better circulation of information. Awareness levels are very low for those located outside.
Effectiveness of the support	▪ R & D tax incentives have positive impact on increasing innovation activities. Yet, many companies have not sought this opportunity due to unawareness of the program. ▪ Being located in a cluster has not made much difference in terms of effectiveness of the incentive. In general the impact is marginal.	▪ The support programs have shown positive outcomes particularly for companies located in a cluster—technology parks, and incubators. ▪ Relatively a much lower number of companies located outside these clusters have received incentives and outcomes have been less successful. In general the impact is limited.
Problems associated with the programs	▪ Most of the required info is available for applicants at the incentive program websites. However, much of the potential users are not aware of these programs. ▪ The change in some of the programs' names confused potential applicants thinking these specific support programs are no longer available. ▪ The process of 'picking the winners' is not clear and the selection process is not transparent enough to the applicants and general public.	▪ Tax incentives program is new, and not many companies are aware of the opportunity. ▪ The split between direct and indirect support is 40%–60%, but indirect support is expected to grow even more since tax incentives are planned to be offered more extensively in the near future. ▪ There is a lot of bureaucracy around the applications, and also there is long waiting period to receive approved support. ▪ The lack of transparency is causing rumours of corruption.
Partnerships for innovation	▪ During the last decade, Australia introduced national research priorities to support, national priorities for university and industry collaboration. This is a step towards determining strategic areas to develop collaboration. ▪ Since the beginning of GFC, education and R & D budgets have been subjected to major cuts, leaving funds extremely competitive, small in size and highly limited.	▪ There are available incentives, but limited, to support university and industry collaboration. However, these funds are not strategically aligned. Introduction of national research priorities would be useful to increase collaboration in critical areas. ▪ Research and business cultures are so different in the country that in many cases university-industry collaboration is not smooth and effective.
Sharing the risk of innovation	▪ Australia is losing its talented entrepreneurs to abroad, because of the low-risk taking policy in funding innovative companies/ideas. Continuum of this trend may create bigger economic challenges in the future.	▪ Brazil seems to take more risk to support innovation. However, declining economic outlook of the country along with raising social unrest is challenging further radical funding attempts for innovation in the future.

the government.

The sixth one is government support for *partnerships for innovation* between companies and universities. Six of the most prestigious universities (top-100) in the world are located in Australia. However, university-industry collaboration even in these prestigious universities is not at the desired level. This is mainly due to the limitations of the entrepreneurial culture in the country along with the lack of effective and generous support programs (Sabatini-Marques et al., 2015b). In Brazil government promotes university-company collaboration through public funds that are larger than in Australia. Nevertheless, as mentioned by interviewees, companies in Brazil complain that academics are not highly motivated to collaborate; rather, they are interested in consultancies or publishing research outcomes.

The final issue is *sharing the risk of innovation*. Promoting innovative entrepreneurship implies in sharing the risk of innovation with them. As a result of Australian government not taking much risk in investing in innovative firms, many Australian entrepreneurs move overseas, such as the USA, Canada, and some Asian and European countries, that incentivise firms through public funds or venture capitalists. In Brazil, compared to Australia, there is more support for start-ups through incentive programs, and thus government takes a greater risk. As a result, the number of firms that participate in the innovation and entrepreneurship ecosystem increases every year. However, the current economic outlook of the country along with social conflicts risks the government taking further radical measures to support innovation.

Overall, the empirical results show both similarities and differences in the perception of the firms on innovation incentives and their causal mechanism. The findings justify the application of replication logic in terms of their validity. As Yin (2003) underlined, findings may be considered yet more potent if two or more cases support the same theory but do not support an equally plausible rival theory. However, in interpreting the specific findings of the research, the reader must be aware of the following limitations: (a) Federal level policies and incentive programs are taken into consideration only; (b) Technology firms are targeted and surveyed, hence, the study only provides insights on this sector; (c) The response rate of conducted surveys, particularly in Australia, is much lower than expected; (d) The views of only a dozen key actors are captured to interpret the survey results and provide commentary on the performance related issue; (e) There might be an unconscious bias at the interviewee selection; (f) Despite our knowledge on large and small firms innovate in different ways, company size have not been considered, and; (g) Firms' perceptions on incentives are only indirectly compared to the measurable effects of such incentives on firms' innovation performances through interviewed experts. Further studies need to be conducted to overcome these limitations.

The extant literature indicates cross-country differences in the

performance of innovation are shaped through institutions and institutional arrangements (Cui et al., 2016; Rao-Nicholson et al., 2017). Hence, in conclusion, the overall findings suggest that regardless of the developed or emerging nature of economies establishing a vibrant innovation ecosystem is a highly challenging task. Therefore, Australian and Brazilian governments should further focus on the design, promotion and delivery methods of the support mechanisms, and consider particularly matching the strategic directions of different enterprises and the market. It is essential for national innovation incentive schemes in any country to be carefully designed as strategic, simple, straightforward, consistent, impactful, transparent, less bureaucratic, long-term, inclusive, and apolitical programs. Australian and Brazilian governments, hence, need to revisit and reformulate all of their public policies that are directly aiming or indirectly supporting the goals of establishing a healthy innovation ecosystem, and strengthening the effectiveness of the incentive schemes to achieve disruptive innovation outcomes. Lastly, the findings revealed in this paper not only relevant and useful to the investigated two countries, but also others with similar characteristics.

Acknowledgement

The authors wish to thank Queensland University of Technology, Federal University of Santa Catarina, and Ministry of Education of Brazil in jointly supporting the research project (CAPES-PDSE: 99999.004527/2014-03). Participation of technology companies and experts in the survey and interview, and the support of national professional associations in circulation of the survey are greatly appreciated. The authors also acknowledge constructive comments of the editor, Prof Tugrul Daim, and anonymous reviewers that helped improve the paper.

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