MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Deepening our understanding of business innovation

Main report from a study based on interviews with New Zealand businesses

July 2019

New Zealand Government

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
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Abstract

This report presents the findings of a qualitative study which aims to deepen understanding of business innovation and research and development (R&D) in New Zealand. The study is based on in-depth interviews with a diverse set of 30 New Zealand businesses, and focuses on businesses' views about the meaning of, motivations for, constraints to, and government support for, innovation and R&D. It finds that businesses tend to think of innovation as changes to products or operational processes, rather than changes to marketing methods or managerial processes which are also included in standard definitions of innovation. Money, time and skills are the main constraints to innovation and R&D identified by businesses. Despite the constraints that many businesses described, most businesses that want to innovate are able to do so nonetheless. Businesses' awareness of government support for innovation and R&D is limited.

JEL classifications: O31, O38

Keywords: *Innovation, research and development, innovation policy, research and development policy*

Executive summary

Background

Innovation is a key driver of economic growth. Governments support business innovation and research and development (R&D) in recognition of the widespread benefits from these activities.

This report presents the findings from a qualitative study aimed at deepening understanding of business innovation in New Zealand. The study explores the meaning(s) of innovation and R&D according to businesses themselves. The study also examines businesses' views about the motivations for, constraints to, and government support for, innovation and R&D. The ultimate aim is to help inform future research and policy about innovation.

The study comprised interviews with 30 New Zealand businesses. The businesses covered a diverse range of industries, sizes, and levels of involvement in innovation and R&D. One common characteristic, however, is that the businesses were generally well established.

What do 'innovation' and 'R&D' mean to businesses?

- **Innovation often means adopting and adapting others' innovations.** While some of the businesses we spoke with develop their own novel products and processes, many adopt and adapt ideas from elsewhere. In particular, suppliers of equipment and intermediate goods are a key source of information and innovations.
- **Innovation often means improving operational processes.** System and IT improvements are a key innovation activity for many businesses. Improving production processes is a focus for manufacturers in particular.
- **Businesses tend to think of 'innovation' as product or operational process innovation.** None of the businesses we spoke with mentioned – unprompted – the other two standard types of innovation ie marketing methods or organisational/managerial process innovation. When prompted, some businesses said they do in fact undertake these latter two types of innovative activities. This suggests that these types of activities are not what come to mind when businesses think of innovation.
- **R&D tends to mean 'D' rather than 'R'.** The small number of R&D-performing businesses we spoke with said they undertake product and process developments rather than exploratory research. For example, some software companies said they build on previous developments, either by themselves or others.

What are the motivations for innovation and R&D?

- **Businesses seek a number of benefits from their innovation and R&D activities.** The ultimate aim is to improve the business' bottom line and/or ensure its survival.
- **Competition is a spur to innovation.** For example, exporting manufacturers (and some other businesses) talked about the need to innovate in order to differentiate themselves from overseas competitors.
- **Non-innovating businesses see little reason to innovate.** This may reflect, for example, a lack of competition in a business' industry.

What are the constraints to innovation and R&D?

- **A lack of time, money and staff with the right skills were the most frequently cited constraints to innovation and R&D.** These findings broadly align with those from surveys about innovation.
- **Businesses identified things they themselves can do to overcome the constraints,** such as prioritising innovation activity within their businesses.
- **The constraints to innovation and R&D do not appear to be insurmountable.** This reflects a number of findings, including that despite the constraints to innovation and R&D that many businesses described, most businesses that want to innovate are able to do so nonetheless. In addition, the reason businesses do not innovate appears to be because they consider they have little need to do so, as opposed to facing especially strong constraints.

What more can government do to support innovation and R&D?

- **Around half the sample businesses said they were not aware of any government support available for innovation and R&D.** In particular, some R&D grant recipients appeared to be unaware of the (forthcoming at the time of the interviews) R&D Tax Incentive.
- **Those businesses that were aware of government support appreciate it.** Callaghan Innovation's R&D grants, and especially New Zealand Trade and Enterprise's (NZTE's) services, were generally well received.
- **Businesses believe that government can do more to support innovation.** Their suggestions included that government should:
    - improve the skills system to better meet industry's needs
    - provide more information, including about what government support is available and government's direction and strategies
    - broaden the definition of R&D in the R&D Tax Incentive (note that since the interviews this has happened)
    - ensure that regulations support innovation
    - accelerate the depreciation of machinery and equipment
    - improve and digitise government's own processes.

Conclusions and implications

From a policy perspective, there appears to be an opportunity to raise awareness among businesses of what government support is available for innovation and R&D, as currently awareness appears to be quite low.

Businesses identified a wide range of things that they believe are important in terms of government support for innovation and R&D. In addition, the findings imply that policies in relation to organisational culture, businesses' abilities to absorb ideas from elsewhere, and competition, are important for innovation.

From a research perspective, the findings should help researchers better understand what businesses mean when they report innovation and R&D activities in surveys.

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1. Introduction

Motivation

Innovation has widespread benefits and is a key driver of economic growth (Hall et al 2009). Government policies aim to increase research and development (R&D) and innovation activity, to lower the gap between private and social benefits.[1] This reflects that innovating firms do not capture all the benefits from their R&D and innovations.[2] A recent development in New Zealand was the introduction of a R&D Tax Incentive with effect from April 2019.[3] Future evaluations of the R&D Tax Incentive are likely to draw on information from Stats NZ's Business Operations Survey (BOS).

A core assumption underpinning government policies is that increasing R&D and innovation will lift productivity and contribute to other economic outcomes. International studies have found a strong relationship between innovation and productivity (Hall et al 2009). However, the very small number of New Zealand quantitative studies that have been undertaken on this topic have struggled to find evidence of a relationship between reported innovation and productivity at the firm level (Wakeman and Conway 2017; Chappell and Jaffe 2018). Some of the possible explanations for this somewhat surprising finding are discussed in section 2.

Qualitative research seeks to find meaning in how people make sense of their experiences. As such, qualitative research can potentially shed light on the findings from previous quantitative studies about innovation in New Zealand, as well as deepen our understanding more generally of the state of innovation and R&D in New Zealand. This study takes a qualitative approach.

Objectives

This qualitative study seeks to address the following questions:

- What do 'innovation' and 'R&D' mean to businesses (including when businesses report these activities in the BOS)?
- Why do (or don't) businesses innovate and/or undertake R&D?
- What are the constraints to innovation and/or R&D?
- What more can government do to support innovation and R&D?

The study seeks to complement previous studies about innovation and R&D in New Zealand. The ultimate aim is to inform future research on innovation, and to help MBIE and other organisations design better policies aimed at encouraging innovation.

Method

The research comprised in-depth interviews with 30 businesses in New Zealand.

We used a 'maximum variation' sampling method to select the businesses. A maximum variation sample is constructed by identifying key dimensions of variation and then finding cases that vary from each other as much as possible (Suri 2011; Patton 2002). We chose this sampling method as it can help to understand how different contexts or characteristics of firms may affect firms' views about innovation and R&D.

[1] See Appendix B for information about government's direct support for innovation and R&D.
[2] Note that we use the terms 'business', 'firm', 'company', etc. interchangeably in this report.
[3] https://www.mbie.govt.nz/info-services/science-innovation/funding-info-opportunities/rd-tax-incentive

The dimensions of variation we used were firm size, industry, and investment in innovation and R&D (see Appendix A for the rationale). The achieved sample of 30 businesses was broken down across these dimensions per Table 1 below. For example, three firms were small, in a low-innovation/R&D intensity industry, with high investment in innovation and R&D.

TABLE 1: ACHIEVED SAMPLE

		Firm size						**Total**
		Small (<20)		**Medium (20-99)**		**Large (100+)**		
Industry	**Low intensity**[1]	Low Inv[2] 1	High Inv[2] 3	Low Inv 1	High Inv 1	Low Inv 1	High Inv 2	9
	Medium intensity[1]	Low Inv 2	High I 2	Low Inv 1	High Inv 2	Low Inv 1	High Inv 2	10
	High intensity[1]	Low Inv 1	High Inv 3	Low Inv 1	High Inv 2	Low Inv 1	High Inv 3	11
Total		12		8		10		30

Notes:
1) 'Low intensity' industries are those with comparatively low innovation and R&D rates reported in the BOS; 'medium intensity' industries are those with medium rates; 'high intensity' industries are those with comparatively high rates. See Appendix A for the list of industries in each category.
2) 'Low inv' businesses are those which had not done any activities to support innovation, and had not spent anything on product development related activities, as reported in the BOS; 'high inv' businesses are those which had done one or more of these activities, or had spent something on product development related activities.

We used the BOS itself to construct the sample for this study.[4] One of the main benefits of using the BOS as a sampling frame for qualitative research is that the survey responses can be used to select businesses with specific characteristics. In addition, the characteristics of selected firms can be compared with the BOS population as a whole, which provides some sense of how the sample differs from the wider population of firms. One disadvantage is that the BOS population does not include very small businesses (with less than six employees).

Despite using the maximum variation sampling method, one common characteristic of the 30 businesses was that many were well established; over two-thirds were 20 or more years old. This characteristic partly reflects that the BOS only includes firms with six or more employees, which are likely to be more established businesses. Essentially this means that the sample businesses represent incumbents in their industry rather than new entrants. This point is important when interpreting the findings from this study, as young firms tend to be more innovative than old ones (see section 2). Young firms are also likely to have different perspectives and experiences with innovation compared with established firms.

Within each of the 30 businesses, we interviewed the person who had completed the BOS 2017 questionnaire, and (where applicable) the senior person responsible for innovation and R&D. These people were both interviewed at the same time. The interviews were conducted by two MBIE researchers. Each interview lasted around one hour. Most of the interviews were conducted face-to-face, with a few conducted by phone.

The fieldwork period was June to July 2018 – almost a year after respondents had completed the BOS 2017 questionnaire. This period was just after the consultation process for the R&D Tax Incentive proposal had closed.

More details on the method, including its limitations, are provided in Appendix A.

[4] We could do this because the BOS includes a question about respondents' willingness to participate in follow-up research by MBIE.

2. Background and literature review

This section provides some background information to help interpret the findings from this qualitative study – some information about the BOS, some standard definitions of innovation and R&D, and some findings from previous New Zealand studies about innovation and R&D. Background information on government support for innovation is contained in Appendix B.

Key points are identified below.

- The BOS is the prime source of information on business innovation activities in New Zealand. It is an annual survey of businesses with six or more employees.
- The implementation of something new or improved is common to definitions of innovation.
- The generating of new knowledge is common to definitions of R&D.
- A New Zealand business' likelihood of innovating and/or undertaking R&D depends on some internal factors (such as the business' size, age, exporting activity, and industry) and some external factors (such as market size and competition).
- To date, the very small number of New Zealand studies that have examined the relationship between innovation (as reported in the BOS) and productivity have found that the relationship is weak, which is in contrast to the findings from international studies.

The Business Operations Survey

Stats NZ's BOS covers a wide range of business practices and activities. It is the primary source of data about business innovation activities in New Zealand, and together with Stats NZ's R&D Survey is a key source of data on R&D activity. The BOS is an annual survey of around 7,000 businesses with six or more employees and includes questions on a wide range of business practices and performances.

The main module (module A) of the BOS questionnaire is repeated every year and contains a number of questions about innovation and R&D. Innovation is the specific focus of a two-yearly module (module B), the most recent of which was administered in 2017.

The questionnaire asks whether respondents agree to have their 'company name, contact details and survey responses passed to MBIE' for the purposes of a 'follow-up study based on the results of this questionnaire'.[5] This allows the BOS to be used as a sampling frame for qualitative research. MBIE previously completed two such studies – one on business strategies and skills (Kaye-Blake et al 2012) and one on international engagement (Deakins et al 2013). One of the objectives of this present study was to test the BOS as a sampling frame for qualitative research – see companion paper (Pells and Howard 2019).

Information about innovation and R&D drawn from the BOS is used for a number of purposes, such as monitoring, research and evaluation. Previous studies include ones that have:

- described innovation and R&D activity (Hong et al 2013; Wakeman and Le 2015)
- identified the effects of innovation and R&D on business performance (see for example Chappell and Jaffe 2018; Wakeman and Conway 2017)

[5] Note that the follow-up question could be used by other agencies that contribute to the funding of the BOS and that want to undertake follow-up research.

- examined the effects of policies on innovation (see for example Jaffe and Le 2016; Ministry for Economic Development 2011).

Definitions

Innovation is about implementing something new or improved

The most widely used definition of innovation is that from the 'Oslo Manual' (see OECD/Eurostat 2018). The manual defines business innovation as follows.

> *A business innovation is a new or improved product or business process (or combination thereof) that differs significantly from the firm's previous products or business processes and that has been introduced on the market or brought into use by the firm.*

Compared to the previous edition of the Oslo manual, a major change for the definition of business innovation in the 2018 manual has been the reduction in the complexity of the previous list-based definition of four types of innovation (product, operational process, organisational and marketing), to two main types: product innovations and business process innovations.

The question about innovation in module A of BOS 2017 followed the definition in the *previous* version of the Oslo Manual reasonably closely.

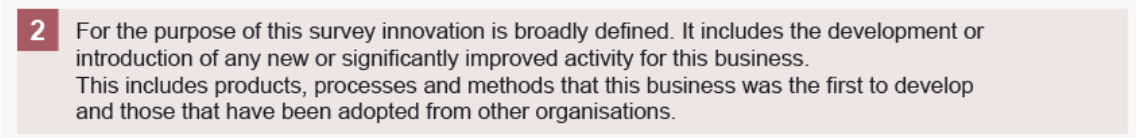

22 In the last financial year, did this business develop or introduce any new or significantly improved:

- goods or services
- operational processes
- organisational or managerial processes
- marketing methods?

1 yes
2 no
3 don't know

A2200

The innovation module (module B) of BOS 2017 contained a slightly different definition.


2 For the purpose of this survey innovation is broadly defined. It includes the development or introduction of any new or significantly improved activity for this business.
This includes products, processes and methods that this business was the first to develop and those that have been adopted from other organisations.

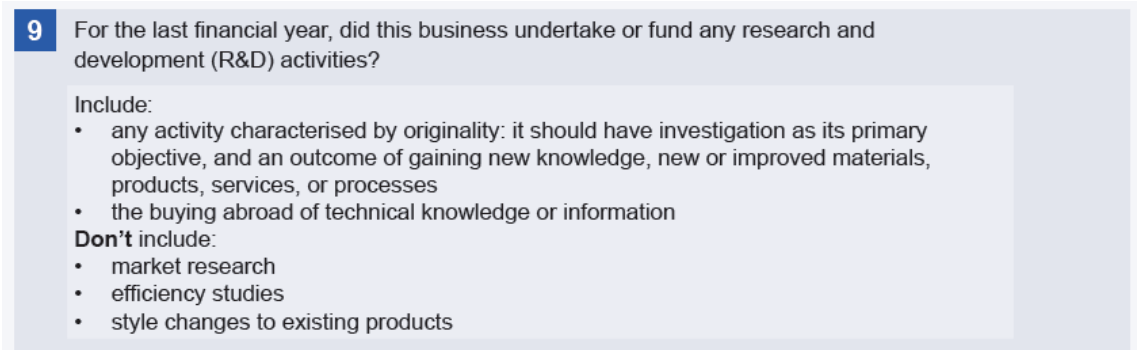
R&D is about new knowledge, and is an activity that supports innovation

R&D is one of a number of activities that firms can undertake in pursuit of innovation (OECD/Eurostat 2018). Other such activities include engineering, design and other creative work activities, marketing and brand equity activities, intellectual property (IP) related activities and employee training activities.

A widely used definition of R&D is that from the OECD's 'Frascati Manual' (see OECD 2015).

> *Creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.*

R&D was defined in the main module of BOS 2017 as follows.



R&D is also defined for the purposes of eligibility for government direct support for business R&D (see Appendix B). Note that a relatively narrow definition of R&D was originally proposed in the consultation document for the R&D Tax Incentive, and this definition was broadened following the consultation process. The narrower definition was the one being considered at the time the fieldwork for this present study was conducted.

Findings from previous New Zealand studies

New Zealand has a comparatively low level of business expenditure on R&D

Over the period 2005-13, around 40% of New Zealand businesses on average each year reported in the BOS that they undertake one or more type of innovation, and approximately 8% reported engaging in R&D activity (Wakeman and Le 2015).

New Zealand's performance regarding innovation varies depending on the specific measure used. Compared with other OECD countries, New Zealand ranks higher on some of the inputs to innovation (science base, human resources, and internet use) than on the outputs (rates of patenting and reported engagement in innovation) (Wakeman and Le 2015).

However, one innovation activity in which New Zealand performs comparatively poorly is R&D. Business expenditure on R&D (BERD) was 0.64% of GDP in 2016 (Stats NZ 2017), compared with 1.64% in the OECD as a whole. This difference has been a particular source of concern for successive governments in New Zealand over many years and has resulted in a series of targets for BERD as well as associated government policies. Appendix B summarises government's current direct support for business R&D.

Possible reasons for New Zealand's low BERD include New Zealand's small domestic market, industry structure (Crawford et al 2007), preponderance of small businesses (Hong et al 2016), and the low returns to R&D and innovation (Wakeman and Conway 2017). Competition also affects R&D activity. An inverted U-curve relationship between competition and R&D spending has been found in New Zealand (Fabling 2008), in line with findings from international studies. In other words, moderate levels of competition generate more R&D than very low or very high levels.

Some firms are more likely to innovate and undertake R&D than others

Compared with other New Zealand businesses, those that innovate are more likely to be:

- large
- young
- foreign-owned
- exporting
- in specific industries (Wakeman and Le 2015, see Appendix A).

We used two of these factors – size and industry – to develop variation in the sample of businesses included in this study.

New Zealand businesses that are more likely than others to undertake R&D have similar characteristics to the above, except that younger firms are not more likely than older businesses to undertake R&D (Wakeman and Le 2015). A further difference between businesses that innovate and those that conduct R&D is that there is more persistence in R&D (Wakeman and Le 2015). In other words, there is a small and relatively stable set of R&D-active businesses, but a much broader set of companies that innovate sporadically.

Some findings from previous studies are somewhat surprising

International evidence suggests that the private returns to firms from their R&D activities are high (Hall et al 2009), as are the returns from innovation (Hall 2011). Productivity tends to be the main benefit or outcome variable used in these studies. In other words, these studies have generally found a strong positive relationship between R&D (or innovation) and productivity.

Only a very small number of quantitative studies have examined the relationship between innovation and productivity in New Zealand, so it is difficult to draw firm conclusions about the strength of the relationship. However, these studies have struggled to find evidence of a relationship at the firm level between innovation reported in the BOS and productivity (see for example Wakeman and Conway 2017; Chappell and Jaffe 2018). There are a number of explanations for this somewhat surprising finding including the following.

- **There is no (or a weak) relationship between innovation and productivity.** This reflects that the benefits to New Zealand businesses from innovating and undertaking R&D may be low compared with firms in other countries, due to factors like the small domestic market and the high costs of commercialising innovation internationally (Wakeman and Conway 2017).
- **There is a relationship between innovation and productivity growth, but previous studies have not picked it up.** Given the very small number of studies that have been undertaken on this topic, more research would be needed to be confident of the finding that the relationship between innovation and productivity growth in New Zealand is weak.
- **Businesses may be in pursuit of goals other than productivity gains.** Indeed, one New Zealand study found that higher 'intangible' investment (which has a number of elements, including R&D) is associated with higher business-reported employee and customer satisfaction, but is not associated with higher productivity or profitability (Chappell and Jaffe 2018). The authors' interpretation was that intangible investment is associated with business strategies related to growth and possibly 'soft' performance objectives, but not to 'hard' objectives like productivity or profitability.
- **The way in which innovation and R&D are measured means that they are not fully capturing 'true' innovation and R&D activity.** For example, BERD may be systematically underestimated in New Zealand, as there is no incentive for businesses to capture this expenditure separately. This is compared with countries that have a R&D tax credit, where businesses have an incentive to classify operating expenses as R&D to reduce their tax bill – the 'relabelling' problem.

This present study aims, among other things, to shed light on some of these possible explanations of the findings from previous New Zealand studies about innovation.

3. What do ‘innovation’ and ‘R&D’ mean to businesses?

This section identifies businesses’ interpretations of ‘innovation’ and ‘R&D’. We asked interviewees what innovation means in practice in their businesses, and for specific examples of innovation within their businesses. We also asked the same questions about R&D.

Key findings are identified below.

- ‘Innovation’ tends to mean adopting and adapting others’ innovations, and improving IT systems and other operational processes.
- None of the businesses we spoke with mentioned, unprompted, marketing methods or organisational/managerial processes.
- Compared with the term ‘innovation’, ‘R&D’ is less familiar and/or is less likely to be a consideration for many businesses.
- For R&D-performing businesses, R&D tends to mean ‘D’ rather than ‘R’. In other words, the focus is on the application of existing knowledge to the development of new products and processes, rather than the generation of new knowledge.
- Most businesses said that the BOS definition and questions on innovation broadly align with their own views on innovation.
- Some feedback we received on the R&D questions in the BOS suggests that the findings from these questions should be interpreted with care.

What innovation means

Innovation often means adopting and adapting others’ innovations

For many of the businesses we spoke with, innovation means adopting and adapting innovations done elsewhere. The innovations are done elsewhere in the businesses’ supply chains, and elsewhere regarding location (ie outside New Zealand).

In particular, suppliers of intermediate goods and equipment are a crucial source of innovations. For example, a couple of equipment-hire companies said that the equipment they import from overseas is continuously changing. A telecommunications company described the need to keep on top of new releases of the radio equipment that it mounts on radio towers.

Some businesses tailor innovations from overseas to the New Zealand context. For example, a window manufacturer said it regularly visits Europe to source key components, and then tests the components and refines and adapts its products to suit New Zealand’s climate and styles of housing. As the owner-manager explained:

> *I come from a science and engineering background. I know the science behind the product is really good. I also know that you can’t take a product out of one country and stick it into another, different type of architecture and expect it to work. You have different climates, different building methods… Our products are fully tested in laboratories here in New Zealand with window engineers to make sure the manufacturing becomes different to the way window are manufactured in the UK and Europe. We’ve had to prove to the market and to ourselves that the way we were going to manufacture these quality products was going to be sustainable.*

A number of other businesses gave similar examples of researching, testing and refining imported equipment and products for the New Zealand context. In several cases, keeping up

with innovations elsewhere required either sending staff abroad for training at the overseas parent company, or else the company came to New Zealand to conduct training for its new products. For most of the New Zealand-based subsidiaries, the underlying innovations typically take place in their multinational company's home base of operation, which in this sample included China, Japan, Korea, Australia and the United States.

Other businesses adapt others' innovations for products aimed at export markets. This strategy was used by some of the software companies we spoke with, which tended to develop open source or cloud-based software and products that integrate with the 'Internet of Things'. These companies described that they build on others' software development and code.

For some businesses, innovation means developing novel products

While innovation means adopting others' innovations for many of the businesses we spoke with, there were some exceptions. For example, two large, high-tech multinational companies based in Auckland were clearly engaged in novel product innovation and R&D and see these as important for their company's survival and growth. They also viewed these activities as significant for promoting New Zealand as a country where innovation and R&D can take place and attract global talent.

Therefore, in some cases, innovation means the business itself developing leading edge products. These businesses aim to be at the cutting or *'bleeding'* edge of changes in their industries. Solid relationships with their customers tend to be a key element of these businesses' innovations. For example, a couple of businesses said they spend a considerable amount of time with their customers to gain a deep understanding of the customers' problems. They then use this information to develop products aimed at solving these problems. For instance, a manufacturer described innovation in practice as *'…understanding what market demands are, or what gaps there are in existing materials or services.'*

Improving operational processes is a further meaning of innovation

Innovation means system changes and process improvements for many of the businesses we spoke with. Some businesses described their previous move away from paper-based systems, and their efforts to reduce paperwork. Others commented that they make ongoing improvements to their IT or computer systems, with significant upgrades taking place every few years. The systems to which they referred include things like payroll, quoting, sales, customer management, accounting and invoicing.

One particularly striking example of a process improvement was implemented by a company that maintains crops for fruit orchardists. Previously, this business used a paper-based timesheet system in the orchards to record its staff's hours. This system had a high error rate and was costing the company in terms of over-payments to staff. The shift to tablet-based, proprietary software not only eliminated errors, but also reduced the time spent on payroll administration, and more importantly allowed the business to monitor and forecast the crop yield in considerable detail.

Improving production processes is a focus for manufacturers. For example, a couple of the manufacturers we spoke with said they themselves develop bespoke machinery to improve their production processes. A medium-sized manufacturing company in Wellington emphasised that their primary focus was on *'processes that deliver on "faster, better, cheaper"':*

> *The whole production process is about doing better. There's a tiny bit of innovation in the product itself, but mainly it's the process. We've taken the different technologies and put them together in a different way.*

Other examples of improved processes include the use of:

- scanners and barcodes by a clothing logistics company to move products as efficiently as possible
- a business intelligence system by an insurance company to improve its reporting
- machine harvesting and dropping fruit by a vineyard to reduce costs
- GPS systems by a furniture removal company and a food distributor to track vehicles
- drones by a surveying company to mock up a 3D model of a site.

Businesses also described more generally what innovation means to them

In addition to specific examples of innovation, some more general descriptions were provided about how businesses think of innovation. Some of the more common phrases used were:

- *'continuous improvement'* – the most frequently mentioned phrase (although one insurance company said that, for them, innovation is something different to continuous improvement – it's about developing an innovative mindset)
- *'meeting customer needs'*
- *'technology'*
- *'making life easier'*
- *'staying ahead of the trends'*
- *'change/something new'*.

What R&D means

R&D often does not mean much

Many of the businesses we spoke with do not themselves undertake R&D. So when we asked what R&D means in the context of their business, they said *'not much'* or similar. As one company put it, *'we don't tend to do R&D. We don't do new stuff, we just refine and make existing things better'.*

Others said that R&D means the same thing as innovation, or, when answering our question about R&D, continued with the same examples they provided for our question on innovation.

A few others thought of R&D as something that happens in a laboratory or as a scientific endeavour. Many companies saw themselves engaged in problem solving, rather than engaged in formal R&D activities. For example, in their response to our question about what R&D means in practice, a small manufacturer stated:

> *With our customers, we like to find out what their problems are, what sort of problems they're having on their site, and come up with safety solutions for that. Or we might have a product that someone's using, but we enhance it and reverse engineer it, reconstruct it, remanufacture it to be better and superior to what they had originally. So I'm like a mad scientist tinkering around the workshop with welders and rodders.*

R&D can mean drawing on others' R&D

The primary-sector businesses that we spoke with – and businesses in a few other sectors – commented that R&D in their industry is often done collectively by an industry association or a research organisation (eg, Crown research institute). The businesses then sometimes draw on this information via industry journals and conferences, etc.

Other businesses commented that they benefit from R&D that is done by equipment suppliers to their industry (see 'What innovation means' above). For example, a surveying company said it works closely with a supplier that does pre-production testing with the company. A telecommunications company said that for them, R&D means:

> *Basically just keeping up with the latest technologies and trawling what technologies are coming out. In this environment technology moves really fast, so we can replace gear [on a tower] and eighteen months later… It's about getting new products out there doing better and greater things. So basically it's getting gear in, testing it to see if it's going to work in our environment, if it's good for our business, if it's going to fit with what we do, and working out a plan for deploying in the field.*

For some businesses, the R&D is done by another part of the business, often in another country. For example, a Christchurch manufacturer said most of the R&D is undertaken by its parent company in Australia. The New Zealand company shares the costs and works with the Australian R&D department to tailor products to the New Zealand context.

For businesses that do undertake R&D, R&D often means 'D'

For the businesses we spoke with that said they *do* undertake R&D, R&D often means development rather than research. For these businesses, R&D means applying knowledge and building on (their own or others') previous developments. Some of the manufacturers we spoke with also stated that their R&D is focused on improving their product lines. As one large Auckland manufacturer said:

> *Our business is tied to product development. Most of our R&D work is improving our product line – ie, 'D'. Some is on the 'R' side; it involves researching ways of using and improving the technology. But most of it is product development.*

Some of these businesses said that their definition of R&D does not align with the government's definition for the purposes of providing direct support for business R&D.[6] Examples include software companies developing new software by building on previous developments. This point about the difference between some businesses' definitions of R&D and the government's definition is picked up further in later sections.

A large Auckland software company explained:

> *We research a bunch of different technologies and software solutions. The [product] is part of that. A lot of work we do is fairly known and incremental, so there's quite a bit of development going on. A lot of research is on defining the problem. We go out [with the customer] to see what the problems are. Listening is important, but customers tend to only know what they need to know, so we have to go deeper.*

[6] Note that the businesses we spoke with may have been referring to the definition of R&D proposed in the consultation document for the R&D tax incentive (see New Zealand Government 2018); this definition has subsequently been broadened in the final design of the R&D tax incentive – see https://www.mbie.govt.nz/info-services/science-innovation/funding-info-opportunities/rd-tax-incentive.

Only a few do 'R'

A very small number of the businesses we spoke with undertake exploratory research. These businesses have dedicated R&D teams. For example, one manufacturer said its R&D person was a chemist. A manufacturer of metal equipment said that it is exploring the use of bio-polymers to make its products more environmentally friendly. A software company said that it had started manufacturing some products in which its software could potentially be used, not with the aim of selling the products, but so that it could better understand the technology.

Businesses' interpretation of BOS questions and definitions

After we asked firms about their own interpretations of 'innovation' and 'R&D', we asked them about their interpretation of some of the definitions and questions about innovation and R&D in the BOS. We had a mock-up of the sample businesses' actual responses to some questions from BOS 2017 on hand in the interviews. Note that almost a year had elapsed since businesses had completed the BOS, so in some instances interviewees' recall was limited.

The findings from our questions about the BOS are written up in a companion technical paper (Pells and Howard 2019). The main points are identified in brief below.

- **Most businesses said the BOS questions and definition of innovation broadly align with their own views about innovation.** Most businesses that we spoke with were comfortable with the BOS definition of innovation and felt it accorded reasonably well with their own interpretation, and most said the BOS innovation questions were understandable.
- **However, the businesses we spoke with focused exclusively on product and operational process innovations when they described 'innovation'.** When we asked businesses an open question about what innovation means to them, essentially they mentioned product and operational process innovations; none mentioned, unprompted, marketing methods or organisational/managerial processes. But when we ran through businesses' BOS responses, some indicated that they do undertake these latter two types of innovation.[7]
- **Businesses discussed how they interpret and assess novelty.** Some businesses talked about the threshold they apply to 'new' or 'significantly improved' products or processes; the threshold varied depending on the business' context. Businesses also talked about how they knew their products were 'new to New Zealand/the world'; the most common responses were that they knew this from their market research or knowledge of the market, or from talking to customers.
- **The findings suggest that different parts of the BOS are likely to generate a slightly different overall innovation rate.** While we were running through their BOS responses with them, we noticed that a number of businesses answered 'yes' to the general question about innovation in the main module of the BOS, but 'no' to each of the individual questions about the four types of innovation (product, operational process, managerial process or marketing method) in the innovation module (or vice versa). We probed as to why these businesses had responded differently across the questionnaire. There was no single reason given by all businesses, but instead a number of different reasons (see technical paper for details). The key take-out overall is that a slightly different overall innovation rate for New Zealand will be calculated from different parts of the BOS.

[7] The BOS innovation questions explicitly list 1) goods or services (ie products) 2) operational processes 3) organisational or managerial processes 4) marketing methods – see section 2.

- **There appear to be some caveats with the R&D definition and questions in the BOS.** Definitions of R&D varied across businesses, and some said their own definition of R&D did not align with that in the BOS, or they were uncertain about the definition in the BOS. Some businesses changed their mind or were unsure about their BOS responses about R&D activity, and some suggested that the information they provided on R&D spend in the BOS is very much a rough estimate. While some variation in the interpretation of questions might be expected across survey respondents, in combination (and compared with the more positive feedback from businesses about the BOS innovation questions) these factors suggest some caveats with the R&D definition and questions in the BOS.[8]

Discussion

'Innovation' seems to be interpreted as product and operational process innovations by the businesses we spoke with. None mentioned, unprompted, the other two types of innovation included in standard definitions – marketing methods or organisational/managerial processes. That is not to say that businesses are not changing their marketing methods or organisational/managerial processes, but these two aspects of innovation are not what come to mind for businesses when they think of innovation.

The importance of absorptive capacity is highlighted in these findings.[9] Many of the businesses we spoke with are building on others' innovations and R&D. Therefore businesses' awareness of what external information is available, and their ability to use that information for their own ends, is a key aspect of their own innovative activity. Drawing on ideas from elsewhere would seem to be especially important for a small, isolated country like New Zealand which accounts for a tiny fraction of the world's research. Overall, these factors imply that absorptive capacity is significant from a policy perspective.

It is not surprising that R&D means less to businesses than innovation. This reflects that R&D is less prevalent among businesses than innovation, as outlined in section 2. It is also perhaps not surprising that businesses tend to focus on 'D' rather than 'R', as 'D' is closer to market than 'R' and so presumably the benefits tend to be achieved more quickly and with less risk.

The low prevalence of R&D is consistent with the finding that businesses often adopt and adapt others' innovations. Rather than generating new knowledge to create their own original products and processes, most of the innovative firms we spoke with seem to be incrementally improving their products and processes.

[8] Note, however, that some of the feedback we received about the BOS R&D definition and questions may have been influenced by the consultation process for the R&D tax incentive; the fieldwork for our study took place just after the consultation process for the incentive had closed.

[9] Absorptive capacity is the ability of a firm to recognise the value of new, external information, assimilate it, and apply it to commercial ends (Cohen and Levinthal 1990)

4. Why do/don't businesses innovate and undertake R&D?

This section identifies what businesses told us about their motivations for innovating and undertaking R&D, and for not doing so. As a way into this discussion, we asked businesses about their operating environments and their business strategies. Note that, in general, we have grouped businesses' comments about innovation and R&D together, as the themes for both were quite similar.

Key findings are identified below.

- Businesses that innovate and undertake R&D seek a number of benefits, including better meeting customer needs, increasing their revenue, increasing their staff satisfaction and improving their efficiency. The ultimate aim is to improve the business' bottom line or (in some cases) to ensure its survival.
- The reason for not innovating or undertaking R&D (which relates to only a small number of the businesses we spoke with) appears to be that businesses see little need to do so.
- The degree of competition faced by a business seems to play a key role in the extent to which it innovates.
- The timelines between undertaking R&D, innovating, and seeing the results from these activities vary considerably, depending on the type of innovation and the sector.

Role of innovation and R&D in businesses' strategies

Innovation plays a key role in some businesses' strategies

Many businesses that we spoke with (especially the R&D performing ones) said that innovation plays a key role in their business strategies. They used words like *'central'*, *'one of our core values'*, *'critical'* and *'a cornerstone'*. As a Dunedin manufacturer put it:

> *Our strategy is innovation. Without even knowing we're doing it, we do it. We'll go over what we're doing with X, our operations guy, and he'll get us creatively thinking outside the box. 'How do we get there?' is part of our strategy. Our team culture is about creativity and innovation. We're open to ideas and we want everyone to bring their ideas, not just those from the top. Otherwise you stand still.*

These businesses often described innovation as a dynamic process in which the business must continually evolve or otherwise it will stagnate and ultimately die. Some have developed technology roadmaps to help them achieve their business goals. Others commented on the need to stay agile, and that speed is vital. Yet others commented that deep relationships with customers are a key part of their strategies (see section 3).

The role of competition was mentioned by many businesses in which innovation plays a key role, especially those that export. *'Our strategy is to out-innovate our competitors,'* said a large Auckland manufacturer. These businesses talked about the need to stay ahead of their competitors, either by differentiating themselves or by doing things more efficiently. For instance, a small Auckland manufacturer stated:

> *The only way we're going to stay competitive with our large global competitors is to innovate and leapfrog them. It's really critical to what we do. If we just continue to*

iterate, we'll stagnate. If we don't grow, and soon, there's no point in having the business here [in New Zealand].

Innovation is less important to others

Some businesses considered that innovation plays *some* role in their business strategy, but a relatively limited one. These businesses tended to comment that technology does not move that rapidly in their industries. Having said that, these businesses do not all operate in low-tech industries.[10]

We only spoke to a small number of businesses that said they rarely or never innovate.[11] The common feature of these businesses is that they operate in an environment in which there is little need to innovate. For example, a company that provides services to an industry that is highly regulated for safety reasons said that it is extremely restricted in what it can change, as much of the procedures it uses are prescribed. Another example is a services company that operates in a mature, profitable industry which it described as *'an old boys' club'*, and in which it sees little need to innovate.

Benefits

Businesses see a number of benefits from innovation and R&D

Innovation and R&D are seen as having a number of (inter-related) benefits. Note that each firm tended to mention several benefits, including:

- meeting customer needs – address customer's problems, strengthen customer relationships or the business' position with customers
- increasing revenue or market share
- improving product quality
- improving efficiency – streamline processes, save time, reduce errors, reduce costs
- retaining staff – make staff's lives easier, fun/buzz
- increasing competitiveness.

Many businesses commented that the ultimate aim is to help the business' bottom line or profit or to ensure that the business thrives and survives. A Christchurch distribution company identified the following benefits from innovation:

> *…reduced costs, improved profitability, running the place more efficiently, creating a better work environment… making this easier for people to work and less stress. I've seen some benefits over the years. Probably at the moment, with the way the economy is, we need to look at what we can do differently.*

Regarding differences in the benefits cited by different types of businesses, those businesses that face significant competition tended to cite survival and the business' increased competitiveness as the key benefits. For example, one manufacturer of reasonably standardised equipment said that it cannot compete with its Asian competitors on labour costs, but it can compete by making its products more efficiently.

[10] See Appendix for a definition of low tech industries.
[11] Note that while some of the sample businesses reported in the BOS that they had not innovated in the previous two years, most of this group had innovated prior to that.

These benefits are not always realised

A number of businesses commented that innovation and (especially) R&D is risky and expensive. They said they do not always realise the benefits from their innovation and R&D activities. For example, an insurance company described the difficulties it experienced when changing its system: the process was lengthy and costly, and the system did not have all the desired features, despite the company taking steps to manage risks.

A few businesses said that these failures are not all negative, as they learn a lot from the failures, or they are able to pick up the ideas again at a later date.

Triggers

Some triggers are internal

When we asked businesses what the main triggers for innovation and R&D are, many talked about the benefits they receive from these activities (improved efficiency, survival etc). In other words, the trigger appears to be the business itself initiating changes. Again, businesses often cited a number of benefits. Some said that they make ongoing improvements to what they do, implying that there isn't a single trigger.

A typical example of a self-initiated innovation is a system or process change to improve the business' efficiency. For example, an insurance company said that feedback from frontline staff triggers some of its process changes. A telecommunications company similarly identified the trigger for innovation being the staff-customer interface:

> *Making our guys' lives a bit less stressful. These guys are dealing with people all day every day, so it's how to make their jobs easier. And making it easier for customers, so we don't get too many phone calls about problems. Keeping the calls to a minimum, automating our processes.*

Another example of an internal trigger is product changes initiated by the business. For example, one manufacturer described the owner as a *'mad scientist'* with many ideas popping into his head.

Some triggers are external

Ideas sparked from interactions with customers are a trigger for product developments for some businesses we spoke with. As discussed in section 3, a number of businesses described their deep relationships with customers, whereby the business seeks to understand customers' problems to generate ideas for potential solutions to those problems. For example, one specialist manufacturer said that the trigger is a combination of its connectedness to unmet need and its connectedness to the leading edge of technology.

Relatedly, another trigger for innovation from outside the business is changing patterns of demand. For example, an insurance company said that the intermediaries in its market suggest additions to the company's product range. One manufacturer noted that changing demand from its parent company drives its product changes.

Another example of an external trigger is information from product suppliers, as discussed in detail in section 3.

Competition and survival is another trigger for innovation, as a large Christchurch manufacturer highlighted:

> *Innovation is a fundamental driver, going back a very long time. You have to stay ahead of the market, ahead of your competitors. So you're always on the lookout for how to do that. You could almost say the trigger is survival.*

Timelines

We asked businesses about the timelines between undertaking R&D, innovating, and seeing the results in their businesses. The responses varied from *'almost immediately'* to *'10-15 years'*, depending on the type of innovation and the sector in which the innovation takes place.

The shortest timelines often related to system or process changes. For example, a furniture removal company changed its accounting software and said it saw the benefits very quickly. Similar examples were cited by other businesses that had made system upgrades.

Results were also seen in a short timeframe by businesses that bring in innovations from product suppliers. These businesses include equipment hire companies, and service companies that import equipment from product suppliers and use the equipment in the provision of their services.

The timelines for businesses that develop their own new products tended to be longer, with many falling within a two to five-year window. Some businesses talked about the many stages in their product developments such as generating ideas, planning, executing, trialling, readjusting, and building the product. A few mentioned the processes they use to manage the timelines, such as technology roadmaps, or to speed up the timelines, such as 'agile'.

The longest timeframes tended to relate to businesses in or associated with the primary sector. For example, a wood manufacturing company said that it can take 10-15 years to develop new products based on tree varieties that are new to New Zealand. Similarly, a vineyard said it could take eight years between the introduction of a new clone and producing the wine. Long timeframes were also a feature in businesses that are subject to stringent safety requirements.

Discussion

These findings highlight the importance of organisational culture to innovation. For example, some businesses – such as those that see innovation 'failures' as a learning opportunity – appear to have a culture that is conducive to innovation. Others – such as those that see little reason to innovate – appear to have a culture that is less conducive to innovation.

One of the aims of this study is to shed light on the findings from previous New Zealand studies about innovation, including the lack of a relationship at the firm level between reported innovation and productivity. Some of our findings support those of Chappell and Jaffe (2018) – that businesses' objectives from their innovation and R&D activity include some 'soft' objectives, such as increased customer and employee satisfaction. However, many of the businesses we spoke with do expect their innovation and R&D activity to improve some 'hard' objectives such as efficiency (and thus productivity), and ultimately their bottom lines. We would, therefore, expect some effects to show up in quantitative studies of these relationships.

One possible explanation for the lack of a relationship between innovation and productivity may relate to the role of competition in innovation. We found that a competitive environment is a spur to innovation, while an operating environment in which competition is weak is not.

Businesses that face fierce competition may have their revenues and profits squeezed by their competitors, compared with businesses that face less competition. The higher revenues of the latter companies could be incorrectly interpreted in productivity measures as higher output and thus higher productivity, whereas in fact the higher revenues may reflect the greater market power these businesses exert. If this explanation is correct, then more innovative businesses could have higher 'true' levels of productivity than less innovative businesses, but this may not show up in measured productivity levels. If true, this implies that the findings from previous studies may be explained more by the way in which *productivity* is measured rather than the way in which innovation is measured. However, there are a number of alternative explanations for the lack of a relationship at the firm level between reported innovation and productivity (see section 2).

5. What are the constraints to innovation and R&D?

This section covers businesses' views on the main constraints to them innovating or undertaking R&D, and how these constraints can be overcome. Note that the role of government is covered in section 6.

Key findings are identified below.

- A lack of money, time and staff with the right skills were the most frequently mentioned constraints to innovation and R&D. Regulation and a number of other factors were also seen as a constraint by some businesses.
- These findings broadly align with those in the BOS.
- Businesses identified a number of ways in which they themselves can overcome the constraints they face. They also saw a role for government.
- Businesses that innovate often said that they do so despite the constraints they face.
- Businesses that do little or no innovation do not appear to face more constraints than other businesses.
- In combination, the findings imply that the constraints to innovation and R&D are not binding.

Main constraints

Money

The cost involved in innovating and undertaking R&D was mentioned as a constraint by many of the businesses we spoke with. For example, some manufacturers (and businesses in other sectors) talked about the significant cost of acquiring some machinery and equipment. Others talked about the various competing priorities their businesses face for financial resources.

Some firms discussed how they access finance for their innovation and R&D projects. The most frequently mentioned option is that firms self-fund the projects from their operating expenses. Financing through debt is another common option. Other options considered or taken up by firms include floating the business on the stock market.

Some talked about a cycle whereby a lack of investment in innovation reduces the business' ability to develop new products, thus restricting the firm's revenue and profits, which in turn reduces its ability for further innovation.

Having said that, many of the businesses we spoke with said that, given a strong enough business case, they can fairly readily access finance. For example, one software company talked about the *'deep pockets'* of its investors.

Time

A lack of management time was mentioned as a constraint by many of the interviewees, who are themselves managers. They talked about the competing priorities for their time, and that it is easy to get caught up in the here and now. As one Christchurch manufacturer put it, *'everyone involved in R&D here also has a day job'*.

Some commented that their business is reliant on a few key people (often themselves) for ideas. Others said that they need to create space for developing business cases for innovation and R&D projects.

Skills

A lack of people with the right skills was seen as a constraint to innovation and R&D by many of the businesses we spoke with. This has a number of facets.

- **Innovative mindset.** Some businesses said that some of their staff lack an innovative mindset, or that it is difficult for people to break away from the *'business as usual'* approach.
- **Specific skills for innovation.** Some businesses struggle to recruit talent for specific R&D or innovation roles. A number of these businesses say they recruit migrants into these roles as they struggle to find New Zealanders with the right skill sets.
- **Recruitment.** Some businesses said that they struggle to recruit people generally. These businesses tended to be in industries with relatively low skill levels.

One Auckland manufacturer said:

> *We generally don't get people here with any experience of our business. It takes twelve to eighteen months to get a designer up to speed with what we do. India – I have got one to four engineers there – they have good English, engineering background, tooling experience. We're looking at setting up an engineering/design school in India.*

Regulations

A number of businesses mentioned regulations and standards as a constraint to innovation. The most common examples were that firms consider regulations in their industry are too prescriptive or out of date. A couple said that standards in their industry are unclear. A large Auckland manufacturer commented:

> *Standards are very frustrating to us at the moment. They're very much based on past practices; they were developed twenty years ago. They're too prescriptive rather than performance-based. We're finding there isn't a direct link to how the product relates to the standard. The test methodologies are inadequate for what we're doing. That's restricting innovation*.

Other constraints

Other less frequently cited constraints were:

- risks involved with innovation (mentioned by a few)
- lack of scale of the business and the market (mentioned by a few)
- traffic and congestion in Auckland is not conducive to being efficient
- the structure of the business
- the self-interest of other players in the market
- NZ psyche – unwillingness to change.

Many of these constraints align with those reported in the BOS

After we asked businesses an open question about constraints to innovation and R&D, we asked them about their response to the BOS question about factors hampering innovation.

In general, the two aligned reasonably well. For example, businesses that mentioned, unprompted, time and money as the main constraints were likely to have rated 'costs to develop or introduce' and 'lack of management resources (eg time)' as hampering innovation to a medium or high degree in their BOS responses.

How the constraints can be overcome

Businesses identified things they can do to overcome the constraints

Firms identified a number of things that they themselves can do to overcome the constraints they identified. For example:

- prioritising innovation activity within their business was frequently mentioned as a way of overcoming constraints in relation to time and money. For example, a small Auckland food manufacturer said that the constraint to innovation could be overcome by:

  > *Prioritising really. Easier to say, but you gotta have the discipline to do it. I'm lucky that I have a good staff to delegate things to. I can set up a trail, then get the guys to do it. I'll give the guys a bit of leeway; if there isn't enough colour they can amp it up. I trust their judgement.*

- paying higher wages, or recruiting migrants from overseas, were suggested ways of overcoming skills constraints
- having conversations with regulators was mentioned by one business as a way of overcoming regulatory constraints.

They also identified a role for government

Many businesses said that government can play a role in overcoming the constraints to innovation and R&D. In particular, they mentioned that government funding can help address financial constraints.

The role of government is discussed in section 6.

Businesses are innovating despite the constraints

When businesses talked to us about the constraints they face, a number commented that, despite the constraints, they are still innovating and undertaking R&D.

There did not appear to be much difference among different types of firms regarding the extent of the constraints they face. In particular, businesses that do little or no innovation did not appear to face more constraints than other businesses. This reflects the point made in section 4 – that businesses that rarely or never innovate appear to have little reason to do so.

Discussion

In general, constraints to innovation and R&D do not appear to be insurmountable. For example, while cost was cited as a constraint to innovation by many of the businesses we spoke with, often these businesses indicated they could ultimately access finance if needed. In addition, despite citing a number of constraints, most of the businesses we spoke with that want to innovate are able to do so. Those that are not innovating do not seem to face particularly strong constraints; instead, they see little need to innovate. Having said all that, the constraints that businesses face are likely to reduce the amount of innovation activity within businesses that do innovate.

A key point to note when interpreting these findings is that, in the main, the businesses in our sample were established incumbents in their industries. Young, small firms may face quite different constraints to the sample businesses. In particular, difficulties in accessing finance may be much more of an obstacle to young firms (Hall and Lerner 2010; Hadlock and Pierce 2010).

6. What more can government do?

This section covers businesses' views on the role of government in supporting innovation and R&D. We asked businesses whether they think government should play a role, their awareness of what support is available, and what more they think government can do.

Key findings are identified below.

- Unsurprisingly, most businesses we spoke with believe that government should have a role in supporting innovation and R&D.
- Around half said they were aware of at least one thing government does to support innovation and R&D, while the other half said they were not.
- A few current and previous grant recipients seemed to be unaware of the (forthcoming at the time of the interviews) R&D Tax Incentive.
- Those businesses that are aware of government support appreciate it.
- Businesses made some suggestions about how government might better support innovation and R&D:
    - improve the skills system to better reflect industry's needs, increase access to migrants, and strengthen the links between universities and industry
    - provide more information about access to innovation expertise, what government support is available, and government's direction and strategies
    - change the definition of R&D in the R&D Tax Incentive, as some businesses (mainly grant recipients) believe that the definition is too academic and is focused on 'R' rather than 'D'[12]
    - ensure that regulations support innovation – eg that they are not overly prescriptive
    - allow accelerated depreciation of machinery and equipment and make some other changes to the tax system to encourage innovation
    - improve and digitise government's processes.

Should government play a role?

The vast majority of businesses we spoke with considered that government should have a role in supporting innovation and R&D. Reasons included that:

- society benefits from innovation and R&D, and from economic growth and export activity more generally
- government support takes the edge off the risk
- government is already a key player via regulation
- New Zealand is a small country, so it is hard for businesses to compete.

[12] Note that, since the interviews were conducted, the definition of R&D used for the tax incentive has been broadened – see https://www.mbie.govt.nz/info-services/science-innovation/funding-info-opportunities/rd-tax-incentive.

The small number of businesses that disagreed said that companies should pay for their own innovation and R&D activities because they reap the benefits from those activities, or similar. For example, one manufacturer saw the R&D Tax Incentive scheme as useful, but firmly stated that *'you can't expect the government just to hand out money'.*

Awareness of government support

Some are aware – and appreciative – of government support

Around half the businesses we spoke with said they were aware of something government is doing to support innovation and R&D.

Some were familiar with the support that Callaghan Innovation provides, such as grants and the R&D Tax Incentive. Those that had received Callaghan Innovation grants were generally very appreciative of the support. One Auckland manufacturer said:

> *Callaghan, by and large, does a good job. NZTE is world class. These two are doing a good job…Callaghan is a work in progress – this constant changing of policy doesn't help.*

A few said that the reporting disciplines of the previous Growth Grants were helpful. For instance, a small Auckland manufacturer stated:

> *The Growth Grant is extremely helpful, and straightforward. Our accountant can do all the accounting and it's easy to keep track of. The reporting is helpful rather than a problem. The current process is very effective.*

Conversely, a few other businesses said that they had previously considered applying for a grant, but hadn't progressed with the application because of the paperwork involved.

Some firms were aware of the R&D Tax Incentive; the consultation period for the R&D Tax Incentive had just closed at the time of the interviews. Of these firms, some thought that Tax Incentives are a good thing, and others (mainly grant recipients) did not. This point is discussed further later in this section.

A few businesses mentioned NZTE's services to help them develop new markets and to export. This service was seen as very helpful and the feedback received was positive.

Other types of government support for innovation and R&D that were mentioned include:

- research undertaken by universities and publicly funded research organisations
- research undertaken by industry associations
- initiatives by local economic development agencies.

Many are unaware

Around half the businesses we spoke with said they were unaware of what support is available for innovation and R&D. As one Christchurch manufacturer said:

> *To be fair, I'm not too sure what government incentives there are out there. There isn't much information out there, and we don't have much time.*

We were unable to identify any patterns in levels of awareness across different types of firms. For example, a low level of awareness was not just restricted to businesses in low-tech industries, or ones that do little or no innovation or R&D.

In particular, a number of R&D-performing businesses said they were unaware of what support is available. In addition, a few of those that had previously received Callaghan Innovation grants seemed to be unaware of the R&D Tax Incentive.

What more could government do?

Businesses made a number of suggestions about what more they think government could do to support innovation and R&D; the main themes are identified below. Many of the suggestions respond to the constraints that firms identified (see section 5).

Improve the skills system

Many firms commented on improvements they would like to see from the skills system.

- **Better reflect industry's needs.** Some businesses felt that more could be done to make the education and skills system more in tune with industry's needs. More (incentives for) training and apprenticeships was one suggestion. Addressing specific capability gaps, such as in relation to digital expertise, was a further suggestion.
- **Increase access to migrants.** Some businesses discussed the importance of migration in their ability to access the right skills. This reflects that a number of firms said they struggle to recruit New Zealanders with the skills they need to support their innovation activity.
- **Strengthen links between the education system and industry.** In particular, some businesses would like to see stronger links between businesses and universities. For example, one manufacturer said it would like to see an approach similar to that used in Germany, where a placement in industry is part of a degree, and where research institutes have an integrated approach between labour, skills and training.

Provide more information and clarity of direction

Many businesses said they would like government to provide more and clearer information.

- **Provide access to innovation expertise.** Some firms would like a fresh pair of eyes cast over their businesses to identify improvements they could make to their processes, etc. For example, a few businesses said it would be useful to have a service similar to that which NZTE provides for accessing new markets available for innovation. A long-established distribution company in Christchurch had introduced a number of innovations to its operational processes and marketing methods a while ago, and felt that it would now benefit from someone outside coming in to identify further improvements:

  > *We're very limited in our knowledge and information. If someone came along and asked us what we could do to improve our service that would be good.*

- **Provide access to more information about innovation**. Relatedly, some businesses said it would be useful to access more information about how to lift innovation. They suggested

things like holding industry conferences, providing information about what other companies have done, or accessing overseas expertise.

- **Provide more information about government support.** Some businesses would like more information about what support for innovation and R&D is available from government.
- **Increase clarity of direction.** There was a desire among some businesses to know more about government's direction and strategies. For example, a company that provides services to the utilities industry said it would like to see greater clarity of government's direction with regard to fossil fuels. In general, this reflects a desire for more certainty, including around regulations (see below). For example, an insurance company said:

> *Certainty – just be specific. The neoliberal type approach is that the market will determine the results. The idea is to create freedom, but this means things are open to interpretation, as you see in Australia. This is risky.*

Change the definition of R&D, and some other aspects of direct support

Some businesses commented on the grants and R&D Tax Incentive. As noted above, grant recipients appreciate the grants they have received. Some other firms (mainly non-grant recipients) supported the introduction of a tax incentive, for reasons such as its wide availability and that it avoids government *'picking winners'*.

A few businesses that were unaware of the R&D Tax Incentive suggested some sort of tax incentive as a way of overcoming financial constraints to innovation and R&D.

However, a number of grant recipients that were aware of the R&D Tax Incentive expressed some degree of uncertainty or worry about the changes. In particular, some firms said that their own definition of R&D was not the same as government's for the purpose of eligibility for government direct support for business R&D. These firms considered that the government's definition is focused on 'R' rather than 'D', is too academic, is focused on science, or similar. For example, one Wellington manufacturer stated that government's R&D definition *'…definitely works for unis, but not for businesses. Innovation isn't an academic exercise'.*

Some software companies said they develop new software by building on previous developments, and that this does not align with government's definition. An equipment manufacturer said that it develops bespoke machines from available components to produce its products. It argued that it breaks the boundaries of engineering by combining the components in new ways. However, it has been told that this does not fall within government's definition.

Other comments about the R&D Tax Incentive included:

- that the minimum threshold ($100,000 spend on R&D per annum) is considered high
- that it does not cover loss-making businesses
- the desire by some current grant recipients to retain the grants.

Note that, at the time of the interviews the consultation period for the R&D Tax Incentive had just closed, and the Incentive was not yet in force. Since the interviews were undertaken, the design of the R&D Tax Incentive was changed. In particular, some of the suggestions above – such as about the definition of R&D, and about the minimum threshold – were addressed in response to public consultation (see Appendix B).

Ensure that regulations support innovation

Some suggestions were made in relation to regulation.

- **Address industry-specific regulatory issues.** A number of businesses considered that regulations are stifling innovation in their industry, and that the regulations are out of date or overly prescriptive. These businesses operate in a number of industries. For example, one telecommunications company said that there are a number of historical rules and regulations in the industry, and that the rules struggle to keep up with changing technology. A wood manufacturing company said that standards in that industry are based on past practice, and are prescriptive rather than performance-based.
- **Reduce unnecessary bureaucracy.** Some businesses would like to see less regulation in general. Suggestions included that government should reduce the bureaucracy, take a hard look at specific regulations and ask if they are really needed, and simplify regulations.
- **Be clearer about compliance requirements.** Greater clarity about rules and standards – what is acceptable and what is not – was suggested by some.

Change the tax system and provide other incentives

A few suggestions were made about the tax system:

- allow accelerated depreciation of machinery and equipment (the most frequent suggestion about the tax system)
- simplify and clarify the tax rules, such as about what is tax deductible
- introduce a capital gains tax to encourage investment in productive assets
- introduce interest-free loans for innovation and R&D
- align tax laws with the rest of the world, especially regarding depreciation rates and tax write-offs.

Improve and digitise government processes

A few businesses suggested that government should be more innovative itself by improving its processes and making greater use of digital technologies. Suggestions included:

- more agile/on-line government processes
- more integrated systems and processes across government
- e-forms for surveys
- a common government portal.

Discussion

A significant proportion of the businesses we spoke with appeared to have no/low awareness of the direct government support available for R&D. Given that the businesses in the sample were more likely than the broader population of business to be innovating and undertaking R&D, this seems somewhat surprising. In particular, some R&D-performing businesses, and even some grant recipients, appeared to be unaware of the R&D Tax Incentive. Thus, there seems to be an opportunity to increase awareness of what support is available, and especially to increase awareness of the R&D Tax Incentive.

Some businesses that *were* aware of the R&D Tax Incentive expressed some degree of uncertainty or nervousness about the changes. Since we spoke to businesses, the design of the R&D Tax Incentive has changed in ways which address many of the points raised by the sample businesses. More generally, it is perhaps not surprising that businesses were worried about the loss of the Growth Grants; it is well known that people tend to value things they have lost more than things they have never had.

Additional information in some shape or form is a common theme of many of the suggestions made by businesses. One suggestion that seems particularly relevant is to provide businesses with access to innovation expertise, similar to NZTE's services for access to expertise on entering new markets. The reason is that this expertise could help diffuse existing technologies among businesses, and so potentially lift the performance of the long tail of low-productivity businesses in New Zealand identified by Conway (2016). So from a policy perspective it may be worthwhile investigating the merits of this type of service if it is not currently available. If this type of service is already available, then promoting the service more could be beneficial.

Overall, the breadth of businesses' suggestions about what more government could do to support innovation is a key implication. Businesses did not just focus on direct government support for R&D, but instead identified a wide range of things that government does that affects business innovation.

7. Conclusions

From a policy perspective, a key implication from this study is that there is an opportunity to raise awareness among businesses of what government support is available for innovation and R&D. At the time the interviews were undertaken, awareness appeared to be quite low. Where there was awareness, the support was appreciated, suggesting that government can play a positive role in fostering an innovative economy.

A further implication is the breadth of suggestions from businesses about how government could further support innovation and R&D. The policy areas include those in relation to innovation and R&D, skills, information provision, regulations, taxation and the digital economy.

In addition to businesses' own suggestions about government support, the findings imply that a number of other areas over which government potentially has some influence are important to innovation. These areas include organisational culture, businesses' abilities to absorb ideas from elsewhere, and competition.

From a research perspective, this study should help researchers and others interpret what firms mean when they report in the BOS that they innovate or undertake R&D. The study helps clarify firms' *own* views of 'innovation' and 'R&D', as compared to the definitions ascribed by researchers.

We have identified some areas where further research may be useful. One is to undertake some qualitative research, with a similar focus on innovation and R&D to this present study, with a sample of start-ups and young firms. These firms may have quite different perceptions and experiences about innovation and R&D from the established firms we spoke with.

Another possible area for further investigation is quantitative research to examine the relationship between the reported constraints to innovation, and firm innovation activity and performance. Based on the findings from our study, the constraints to innovation do not appear to be insurmountable. Relatedly, further research about the relationship between firms' innovation activity and the environment in which they operate – including the competitive and regulatory environment – may be helpful.

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Appendix A – Method

Qualitative research

The study comprised in-depth interviews with a sample of 30 businesses.

In its ability to probe meaning and context, qualitative research is an appropriate tool for addressing the objectives of this study. Qualitative research offers a rich and in-depth understanding of businesses' motivations and behaviours which complements existing quantitative studies.

Sample

We used a 'maximum variation' sampling method. A maximum variation sample is constructed by identifying key dimensions of variation and then finding cases that vary from each other as much as possible (Suri 2011; Patton 2002). This sampling approach fits well with our objectives of identifying what innovation means to different types of businesses, and why businesses in different contexts do/do not innovate.

The dimensions of variation we used to select the sample were 1) business size, 2) industry and 3) investment in innovation and R&D. The first two of these dimensions were chosen because previous studies have found them to be important characteristics associated with businesses' propensities to innovate and conduct R&D (see section 2). The third dimension was chosen as we wanted variation in businesses' exposure to innovation and R&D. We chose investment in innovation and R&D, rather than innovation and R&D activity per se, on the basis that investment in these activities is likely to be more persistent over time than the activities themselves (see section 2).

We used the BOS 2017 as a sampling frame. This was possible because the BOS includes a question about whether respondents would be willing to participate in follow-up research by MBIE. One of the benefits of using the BOS as a sampling frame for qualitative research is that the survey responses can be used to select businesses with specific characteristics and practices. However, one disadvantage of using the BOS as the sampling frame is that the population does not include very small businesses (with less than six employees).[13]

Of the 6,549 businesses that responded to BOS 2017, 1,210 agreed to follow-up research.

Each business that had agreed to follow-up research was coded to various categories within the three dimensions (see categories at the end of this sub-section). The industry and business size information about each business was obtained from a marketing organisation;[14]

[13] The BOS has a number of other restrictions, including that it only targets firms that have an annual GST turnover figure of greater than $30,000 and have been operating for one year or more – see http://datainfoplus.stats.govt.nz/Item/nz.govt.stats/98568739-f933-4c00-8d56-d523f20e68bb?_ga=2.82860436.363414137.1547412516-257848139.1541479194#/nz.govt.stats/94981ac0-fc80-4535-862d-142ce19b731b.

[14] Note that industry and business size information is available in Stats NZ's Longitudinal Business Database, in which the BOS is contained. However, we were not able to use this information as Stats NZ advised that since industry and business size were not included in the consent question (which covers business name, contact details, and BOS responses) Stats NZ was not legally able to provide that information.

information on investment in innovation and R&D was obtained directly from the responses to BOS 2017.

We then selected a small number of businesses within each of the 18 cells in the table below and phoned them to see if they were willing to participate in the research. We contacted the person in the business who had completed BOS 2017; this was possible because the BOS questionnaire requests the contact details of the respondent. Where that person had moved on from the business, we asked to speak to a senior person in the business who was responsible for innovation and R&D and, failing that, the general manager or equivalent.

The aim with qualitative research is to achieve data saturation ie the stage when further collection of evidence provides little in terms of further themes, insights or perspectives (Suri 2011). We chose a sample size of 30 as being likely to achieve data saturation; this proved to be the case for most topic areas, with the possible exception of why firms do not innovate.

We contacted 72 businesses to achieve the sample of 30. 42 either declined to participate, or we were unable to contact them, or they had closed down in the intervening period.

The achieved sample of 30 businesses can be broken down in the various dimensions/categories per Table 2 below. For example, three of the businesses in the sample were small, in a low tech industry, with high investment in innovation and R&D.

TABLE 2: ACHIEVED SAMPLE

		Business size						**Total**
		Small (<20)		**Medium (20-99)**		**Large (100+)**		
Industry	**Low intensity**	Low Inv 1	High Inv 3	Low Inv 1	High Inv 1	Low Inv 1	High Inv 2	9
	Medium intensity	Low Inv 2	High I 2	Low Inv 1	High Inv 2	Low Inv 1	High Inv 2	10
	High intensity	Low Inv 1	High Inv 3	Low Inv 1	High Inv 2	Low Inv 1	High Inv 3	11
Total		12		8		10		30

Business size categories:

Small (<20) = less than 20 employees in the business

Medium (20-99) = between 20 and 99 employees in that business

Large (100+) = 100 or more employees in that business

Industry categories:

Low intensity = small proportion of businesses in that industry reporting any innovation activity in BOS 2017, and reporting R&D activity, compared with other industries ie:

- A Agriculture, Forestry and Fishing (ex A02)
- B Mining
- E Construction
- G Retail Trade
- H Accommodation and Food Services
- I Transport, Postal and Warehousing
- N Administrative and Support Services

Medium intensity = medium proportion of businesses in that industry reporting any innovation activity in BOS 2017, and reporting R&D activity, compared with other industries ie:

- A02 Aquaculture
- C13 Textile, Leather, Clothing and Footwear Manufacturing, C14 Wood Product Manufacturing, C15 Pulp, Paper and Converted Paper Product Manufacturing, C21 Primary Metal and Metal Product Manufacturing, C22 Fabricated Metal Product Manufacturing
- D Electricity, Gas, Water and Waste Services
- K Financial and Insurance Services
- L Rental, Hiring and Real Estate Services

High intensity = large proportion of businesses in that industry reporting any innovation activity, and reporting R&D activity, compared with other industries ie:

- C Manufacturing (ex C13, C14, C15, C21 and C22)
- F Wholesale Trade
- J Information Media and Telecommunications
- M Professional, Scientific and Technical Services

Investment in innovation categories:

Low Inv (low investment in innovation) = 0 response to Q14 in BOS 2017 'activities to support innovation' ('done to support innovation' category), and 0 response Q15 'expenditure on product development related activities'.

High Inv (high investment in innovation) = positive response to one or more of the items in Q14 in BOS 2017 'activities to support innovation' ('done to support innovation' category), and to one or more of the items in Q15 'expenditure on product development related activities'.

Other characteristics of the sample:

- **Innovation/R&D activity:** reported 'yes' to Q22 in BOS 2017 about innovation activities (24 out of 30 businesses); reported 'yes' to Q9 in BOS 2017 about R&D activity (11 businesses).
- **Region:** Auckland (12 of the 30 businesses), Wellington (seven businesses), Christchurch (six businesses), and other locations throughout New Zealand (five businesses).
- **Age:** 20+ years (21 businesses), 5-19 years (eight businesses), and 1-4 years (one business)
- **Exporting:** non-exporting (18 businesses), and exporting (12 businesses).

Comparison of sample with BOS population

One of the benefits of using the BOS as a sampling frame for qualitative research is that the sample businesses can be compared with the BOS population as a whole. The tables below break down the sample businesses, businesses that agreed to follow-up research, and the BOS population of businesses, by the three dimensions of variation identified above. The key take-out is that, compared with the BOS population of businesses, sample businesses were more likely to be large, in a high tech industry, and investing in innovation and R&D.

TABLE 3: BUSINESS SIZE BREAKDOWN			
Business size category	**Achieved sample #**	**Businesses that agreed to follow-up research # (%)**	**BOS population[1] # (%)**
< 20	12	582 (48.1%)	30,579 (73.0%)
20-99	8	435 (36.0%)	9,634 (23.0%)
100+	10	193 (16.0%)	1,679 (4.0%)
Total	30	1,210 (100.0%)	41,889 (100.0%)
Note: 1) Observations in the full BOS sample are weighted so that they match the observed industry and firm size distribution of the BOS population.			

TABLE 4: INDUSTRY BREAKDOWN				
Industry category		**Achieved sample #**	**Businesses that agreed to follow-up research # (%)**	**BOS population[1] # (%)**
Low intensity	A Agriculture, Forestry and Fishing (ex A02)	2	93 (7.7%)	3,516 (8.4%)
	B Mining		13 (1.1%)	105 (0.3%)
	E Construction	3	107 (8.8%)	5,070 (12.1%)
	G Retail Trade	1	65 (5.4%)	4,599 (11.0%)
	H Accommodation and Food Services		40 (3.3%)	5,694 (13.6%)
	I Transport, Postal and Warehousing	2	39 (3.2%)	1,554 (3.7%)
	N Administrative and Support Services	1	71 (5.9%)	1,650 (3.9%)
Medium intensity	A02 Aquaculture		1 (0.1%)	24 (0.1%)
	C13 Textile, Leather, Clothing and Footwear Manufacturing, C14 Wood Product Manufacturing, C15 Pulp, Paper and Converted Paper Product Manufacturing, C21 Primary Metal and Metal Product Manufacturing, C22 Fabricated Metal Product Manufacturing	7	74 (6.1%)	1,746 (4.2%)
	D Electricity, Gas, Water and Waste Services		18 (1.5%)	138 (0.3%)
	K Financial and Insurance Services	2	54 (4.5%)	576 (1.4%)
	L Rental, Hiring and Real Estate Services	1	28 (2.3%)	927 (2.2%)
High intensity	C Manufacturing (ex C13, C14, C15, C21 and C22)	3	161 (13.3%)	3,420 (8.2%)
	F Wholesale Trade	2	72 (6.0%)	3,195 (7.6%)
	J Information Media and Telecommunications	2	17 (1.4%)	360 (0.9%)
	M Professional, Scientific and Technical Services	4	187 (15.5%)	4,200 (10.0%)
Total		30	1,210 (100.0%)	41,889 (100.0)
Note: 1) Observations in the full BOS sample are weighted so that they match the observed industry and firm size distribution of the BOS population.				

TABLE 5: INVESTMENT IN INNOVATION BREAKDOWN			
Investment in innovation category	**Achieved sample #**	**Businesses that agreed to follow-up research # (%)**	**BOS population[1] # (%)**
Low investment	10	481 (39.8%)	20,955 (50.0%)
High investment	20	729 (60.2%)	20,937 (50.0%)
Total	30	1,210 (100.0)	41,889 (100.0%)
Note: 1) Observations in the full BOS sample are weighted so that they match the observed industry and firm size distribution of the BOS population.			

Interviews

We interviewed the person within each business who had completed BOS 2017 (where available). This person tended to be the owner, chief executive officer, managing director, general manager, chief financial officer or similar. At the same time, we interviewed (where applicable) the senior person responsible for innovation and R&D – the R&D manager, director of innovation, chief technical officer, chief information officer or similar.

Each interview lasted around one hour.

Most of the interviews were conducted face-to-face in the interviewees' workplaces. This was the case for businesses in Auckland, Christchurch and Wellington. In other locations throughout New Zealand (five businesses) the interviews were conducted by phone.

The interviews were conducted by two MBIE researchers experienced in qualitative research.

The interviews involved us asking the questions in the 'Topic guide' below. For the questions about the BOS, we had available a mock-up of the business' actual responses to BOS 2017.

The fieldwork period was June to July 2018. This timing reflected that firstly, we had to wait until BOS 2017 was in the LBD (May 2018), and secondly, we wanted to complete the fieldwork before BOS 2018 was in field (August 2018). The reason for the latter was that we didn't want interviewees to be confused about to which survey (BOS 2017 or BOS 2018) we were referring.

Analysis and reporting

We recorded and took detailed notes during the interviews. We didn't transcribe the recordings, but instead referred back to the recordings for any points that needed clarifying from our detailed notes and for the verbatim comments.

We undertook a thematic analysis of the data, using NVivo software.

When reporting the findings, we used terms like 'a few', 'many' and 'most' to provide a sense of how prevalent themes were among the sample businesses. Note, however, that as with all qualitative research, no inferences can be drawn about the prevalence of phenomena observed beyond the sample. In other words, the findings cannot be generalised.

Limitations

Some of the main limitations of the method for this study are that:

- the sampling frame (BOS 2017) does not include firms with less than six employees; very small firms' views and experiences of innovation may differ from those of larger firms

- the interviews were conducted almost a year after the interviewees had completed BOS 2017; recall of responses to the survey may be limited
- we only spoke to a small number of firms that never or rarely innovated; the findings in this area should therefore be considered indicative.

Topic guide

Introduction (3 mins)

Thank you for agreeing to participate in this interview. We are researchers at MBIE.

The interview is one of a number being conducted with businesses throughout New Zealand – **both those that innovate and those that don't**. Your responses will be combined with those from other people we are interviewing, so that you and your **business will not be identifiable** in the report that we prepare.

The main topic we will discuss is **business innovation and R&D**. We have the information from the **Business Operations Survey** completed last year. We will ask for a bit more information about your responses to certain questions. There **aren't any right or wrong answers** – we're just keen to better understand what innovation means for your business. If you **can't remember**, that's fine.

Here is a **CONSENT FORM** asking for your formal consent to participate in the interview. Please can you read and sign. Just to help me with my notes, is it ok to record our conversation?

The interview should take **up to one hour**. We will be **keeping time** throughout the interview.

Do you have **any questions** before we start?

Background/context (10 mins)

1. What are your business' **main activities**? [Probe about products and markets]

2. Roughly **how many staff** does your business employ?

3. What is **your role** in the business?

4. What are the main changes in the **operating environment** that affect your business?

5. How would you describe your organisation's **broad business strategy** or business model? By 'business strategy' we mean the broad approach used to reach your business' goals.

Innovation (5 mins)

6. What does **'innovation' mean in practice** in your business? [Probe for what immediately comes to mind in the context of their business/their type of business, and for examples that are in scope and out of scope]

7. And **research and development**? [Probe for what immediately comes to mind in the context of their business/their type of business, for examples that are in scope and out of scope]

Business Operations Survey responses (20 mins)

8. Please can you tell me about **how your business completes** the Business Operations Survey?

   a) **Who** completes it? [Probe whether interviewee/his or her predecessor]

   b) **What** information is used to complete it?

9. Turning to your business' **interpretation of some of the questions** in the survey. What do the following mean in the context of your business? [Probe for why they answered BOS in the way they did, and for specific examples that are in/out of scope]

   a) **Research and development** (Section A, Q9)

   b) **$$$ spent on R&D** (Section A, Q10)

   c) **Innovation** (Section A, Q22)

   d) **Technology change** (Section A, Q24) [Probe for minor v major v complete technology change]

   e) **New or significantly improved goods or services** (Section B, Q3)? [Probe for new v significantly improved]

   f) **New to New Zealand v new to world good or service** (Section B, Q5)? [Probe for how assessed]

   g) **New or significantly improved operational process** (Section B, Q7)? [Probe for new v significantly improved]

   h) **New or significantly improved organisational or managerial process** (Section B, Q10)? [Probe for new v significantly improved]

i) **New or significantly improved sales or marketing methods** (Section B, Q12)? [Probe for new v significantly improved]

10. How does the **definition of innovation used in the survey compare** with what you said earlier about innovation in your business (see Section B, para 2 on page 10 for definition)? And **R&D** (see section A, Q9 on page 4 for definition)?

Business strategy and innovation (10 mins)

11. Picking up our earlier discussion about your business' strategy – what is the **role of innovation** within that strategy, if any? [If innovated – probe for the main triggers for innovation, the main benefits sought, and whether these benefits have been realised. If not innovated – probe for if the business has ever innovated previously and what the results were]

12. And what is the **role of R&D** in your business' strategy, if any? [If undertaken R&D – probe for the main triggers for R&D, the main benefits sought, and whether these benefits have been realised. If not undertaken R&D – probe for if the business has ever undertaken R&D previously and what the results were]

13. What are the **approximate timelines** for conducting R&D or innovation and seeing the results in your business?

Overcoming constraints (10 mins)

14. What are the **main constraints**, if any, to innovation for your business? And for R&D? [Cross-refer to Q27 in the BOS]

15. How do you think these **constraints might be overcome**? [Probe for examples of failure, and how these have been overcome]

16. Do you think the **government should have a role** in supporting innovation and R&D?

17. Are you aware of anything the **government is doing** to support innovation and R&D?

18. What **more could the government do**?

Wrap up (2 mins)

Is there **anything else** you would like to say in connection with what we've been talking about?

Appendix B – Government's support for business innovation and R&D

Government targets a number of policies to increase innovation and R&D to lower the gap between private and social benefits. Businesses that innovate and undertake R&D do not capture all the benefits from these activities, and so the benefits to society as a whole are much greater than those to innovating businesses.

In New Zealand, MBIE is responsible for policies in relation to innovation and R&D. Callaghan Innovation implements these policies. One of the main policies used to boost R&D is R&D grants. Callaghan Innovation manages the R&D grants scheme on behalf of government. At the time the interviews for this study were undertaken, three main grants were available – see Table 2.

TABLE 2: R&D GRANTS

Grant	Key features
Growth Grant (phased out from April 2019)	To assist businesses that are experienced R&D performers, to grow their R&D spend. To be eligible, companies must have had a minimum of $300,000 in eligible R&D expenditure sourced from non-government funds in each of the last two financial years, and have had eligible R&D expenditure of at least 1.5% of their revenue in the last two financial years. Businesses are paid 20% of their total eligible R&D spend up to $25m per year to a maximum annual payment of $5m. Businesses must provide an R&D plan when they apply. However they have the flexibility to change plans throughout the duration. The initial term of the Growth Grant is three years, and the applicant may be eligible for a two year extension.
Project Grant	To assist businesses to grow their R&D spend over time and become eligible for a Growth Grant. For businesses who cannot receive a Growth Grant and are: undertaking their first R&D, or expanding their activities. Companies can have multiple Project Grants, each for a distinct R&D project. Funding is typically 40%; reducing to 20% for larger grants with higher total project funding.
Student Grant	To support undergraduate and postgraduate students to gain and develop their scientific/technical skills in a business that has an on-going R&D programme. Support is limited to: wages, salary or a tax-free stipend, in some cases a travel allowance may be paid when the business is a significant distance from the university. Tax-free stipends are paid through the student's university and the university receives an administration fee.

Source: Callaghan Innovation 2015

Most OECD countries have a tax credit as part of their support for R&D (Appelt et al 2016). In 2008, New Zealand introduced a tax credit but then subsequently withdrew it. A new R&D tax Incentive came into effect from April 2019. Key features of the new regime were proposed in the Government's discussion paper (see New Zealand Government 2018) and subsequently changed in response to the consultation process.[15] The final design features (with the original proposed features indicated in brackets) are that:

- businesses receive a 15% (originally 12.5%) tax credit on eligible expenditure

[15] https://www.mbie.govt.nz/info-services/science-innovation/funding-info-opportunities/rd-tax-incentive

- firms need to spend a minimum of $50,000 (originally $100,000) on eligible expenditure per year, and the maximum annual payment is $18 million (i.e., cap on eligible expenditure is $120 million)
- companies in tax loss receive limited refunds in the first year, with a full policy to be in place by 1 April 2020
- the definition of R&D aims to incentivise activities that create new knowledge through use of a systematic approach
- Growth Grants will be phased out, but Project Grants and Student Grants will continue.

The definition of R&D used for the R&D Tax Incentive is:[16]

> - *A core activity is: conducted using a systematic approach; and has a material purpose of creating new knowledge or new or improved processes, services, or goods and of resolving scientific or technological uncertainty.*
> - *An activity is not a core activity if knowledge required to resolve the uncertainty is: publicly available; or deducible by a competent professional working in the relevant scientific or technological field.*
> - *A support activity: has the only or main purpose of, is required for, and integral to, conducting a core activity.*

Note that a narrower definition of R&D was originally proposed in the consultation document for the R&D Tax Incentive (see New Zealand Government 2018). This narrower definition was the one being considered at the time the fieldwork for this present study was conducted and was:

> *(a) Core activities: those conducted using scientific methods that are performed for the purposes of acquiring new knowledge or creating new or improved materials, products, devices, processes, or services; and that are intended to advance science or technology through the resolution of scientific or technological uncertainty.*
>
> *OR*
>
> *(b) Support activities: those that are wholly or mainly for the purpose of, required for, and integral to, the performing of the activities referred to in paragraph (a).*

In addition to R&D grants and the R&D Tax Incentive, Callaghan Innovation supports business innovation in a number of other ways as it:[17]

- provides research capabilities, programmes, links, and support for firms to innovate
- administers government-funded innovation support including accelerators, incubators and repayable grants for start-ups
- makes available access to pilot plant facilities (e.g. FoodBowl), and also provides pathways to connect businesses with research expertise across the innovation system.

[16] https://www.mbie.govt.nz/info-services/science-innovation/funding-info-opportunities/rd-tax-incentive.

[17] See https://www.callaghaninnovation.govt.nz/?gclid=EAIaIQobChMIkeyGwK7S3gIVxRaPCh1_CQpmEAAYASAAEgJmjfD_BwE