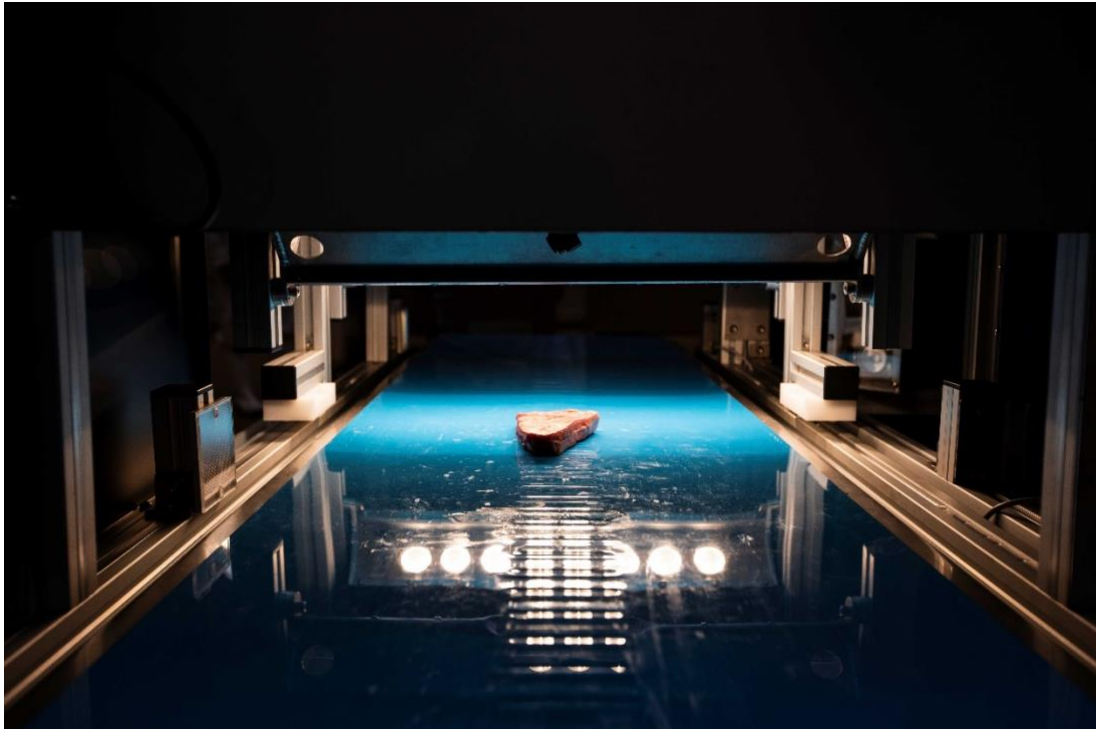




KELLOGG

RURAL LEADERSHIP
PROGRAMME



Research from the inside out

Pathways to market for investigator-led research

Kellogg Rural Leadership Programme

Course 48 2022

Cameron Craigie

I wish to thank the Kellogg Programme Investing Partners for their continued support

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1 EXECUTIVE SUMMARY

The pathway to impact for research outputs is often ambiguous. Commercialisation of research outputs is the exception to the norm in a system incentivising public research institutes to produce academic outputs primarily. Despite this, there is a thriving commercialisation community in New Zealand, who are passionate about seeing research through to impacts. Members of this community include entrepreneurial researchers, aspiring founders, technology transfer offices in public institutions, KiwiNet, investors and those that have been there and done that and are keen to give something back.

The aim of this report is to create a resource to inform and inspire entrepreneurial researchers interested in commercialisation and aspiring founders of investigator-led research to give it a go. This report addresses two research questions:

1. How does an aspiring founder navigate their way to becoming a founder?
2. How can the chances of successful commercialisation be increased?

The methodology comprises a literature review to provide some theoretical basis for thematic analysis and interpretation of fourteen anonymous semi structured interviews of four founders, three aspiring founders, (entrepreneurial scientists actively seeking commercialisation of their research in 2022), three technology transfer managers representing organisational perspectives and four investor perspectives. Responses were categorised into the following high-level themes:

- **Why:** Motivation with dimensions of Culture and Engagement
- **How:** Execution with dimensions of Focus, Confidence and Success
- **What:** Problem definition/Relevance and Key messages

Critical analysis of these themes considering the literature yielded two high-level discussion areas: the importance of **contextual awareness** and **relationships**. As well as focusing on the technology development, aspiring founders, entrepreneurial researchers, and research organisations must prioritise understanding the context and developing relationships.

Recommendations for entrepreneurial researchers and aspiring founders:

1. Engage early with Technology Transfer office and undertake due diligence before designing the research to ensure more targeted use of resources
2. Be relevant. Strive to be more aware of the operating context and drivers for the research organisation and the potential end users of your research outputs.
3. Work on your ability to communicate and work with a multi or transdisciplinary team
4. Get a business mentor to help you focus on what is most important and why from both the demand and supply perspectives.

2 ACKNOWLEDGEMENTS

I wish to acknowledge the support if the Rural Leaders Trust and the rural leaders programme team: Chris Parsons, Scott Champion, Patrick Aldwell, Lisa Rogers, and Annie Chant. Thank you for your commitment and dedication to creating a great experience that stretched my thinking and expanded my intellectual and social capital resources! Growth comes from uncomfortable.

I wish to acknowledge the founders, aspiring founders, technology transfer managers from public research organisations and investors who gave up their time to be interviewed for this study. Interview responses are anonymous, so respondents are not named here. The interview process is like a facilitated reflection session – thank you for engaging in free and frank discussions - your lived experiences around the commercialisation of investigator-led research is both inspiring and invaluable to those looking to move from academia to industry.

Thanks to Prof. Hamish Gow (Lincoln University), Prof. Sally Davenport (Science for Technological Innovation National Science Challenge), John McKenzie (PGG Wrightson Seeds) Seumas McCroskery and Glen Beattie (KiwiNet) for helping me develop the thinking behind this report.

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4 INTRODUCTION

In New Zealand, like most countries, the public, through collective government channels are the largest single investor in research and development initiatives. A document called the national statement of science investment 2015 - 2025 outlines the way the New Zealand government currently invests in science (MBIE, 2015). The key purpose of investment is to deliver public-good benefits to New Zealanders through outcomes and impacts which result in changes to the economy, society, or the environment (See figure 1). For a detailed overview and analysis of the New Zealand Science and Innovation system with a focus on the agricultural sector see Foley (2022).

According to New Zealand government figures, budgeted research, science and Innovation investments totalled \$2 billion of government investment in 2021/22, compared with \$2.4 billion of business R&D expenditure over the same period (MBIE, 2020). Given the magnitude of public investment in New Zealand's research sector which government policies and priorities are of key importance driving the behaviours of research providers and other actors along the various stage of innovation which can be thought of as an innovation pipeline (KiwiNet, 2021). Figure 2. Shows the typical stages of the innovation pipeline seen in a New Zealand context. The innovation pipeline is widely referred to, but arguably less well understood and implemented by those conducting research in public institutions.

New Zealand research Institutions incentivise researchers to produce academic outputs over commercial outputs. Therefore, the pathway to impact is severely restricted. There are some exceptions – the researchers with an entrepreneurial spirit developing intellectual property within a research institute who want to be part of the impact story. Unfortunately, the part of the pathway from academia to industry is very ambiguous and can be difficult for aspiring founders to navigate.

The vision for this study is to help aspiring founders, as well as research organisations and investors convert research outcomes into ventures with potential to change the world.

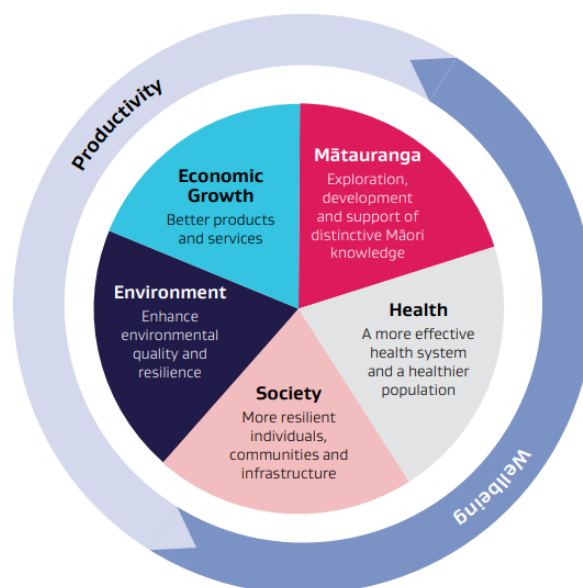


Figure 1: Desired outcomes from investing in Science for New Zealand (MBIE, 2015)

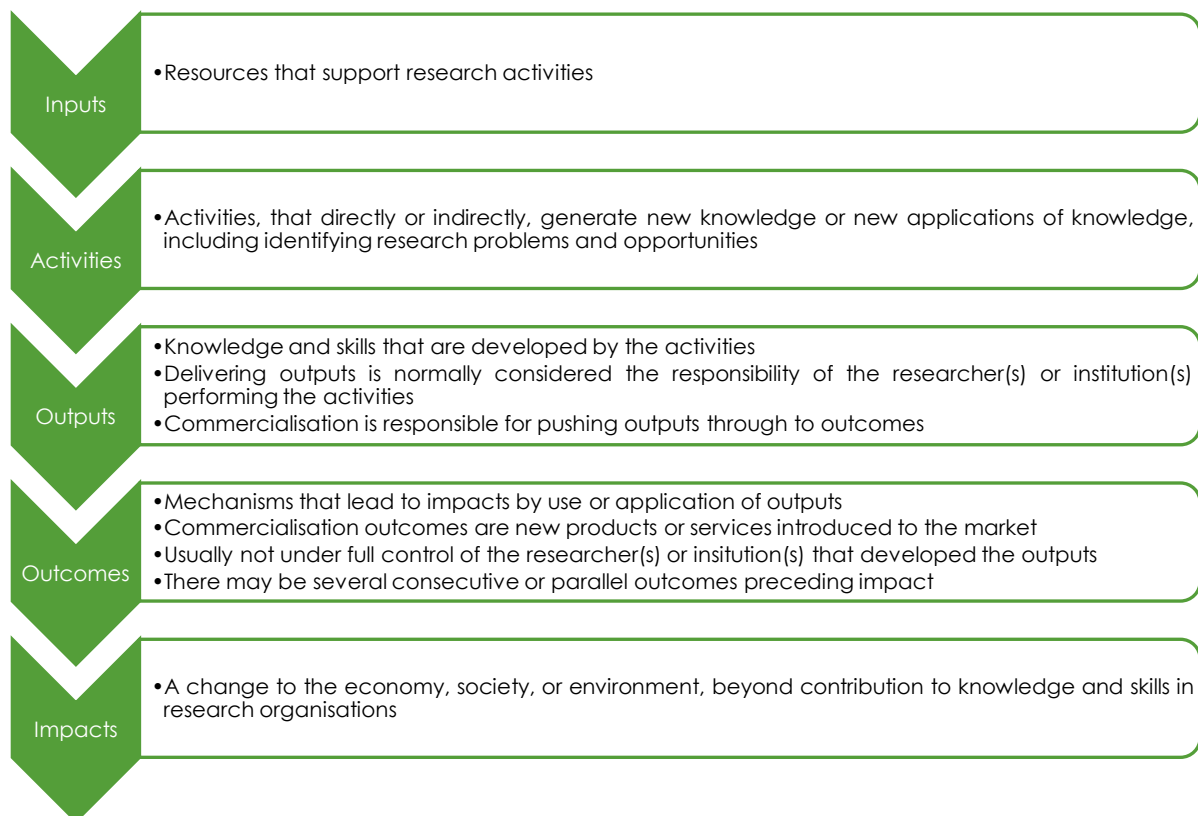


Figure 2: The innovation pipeline. From the perspective of research for impact, commercialisation (turning outputs into outcomes leading to impacts) can be viewed as one activity within an innovation pipeline. Source: KiwiNet (2021).

5 RESEARCH AIM

The aim of this report is to create a resource to inform and inspire entrepreneurial researchers interested in commercialisation and aspiring founders of investigator-led research to give it a go.

5.1 RESEARCH QUESTIONS

3. How does an aspiring founder navigate their way to becoming a founder?
4. How can the chances of successful commercialisation be increased?

6 METHODOLOGY

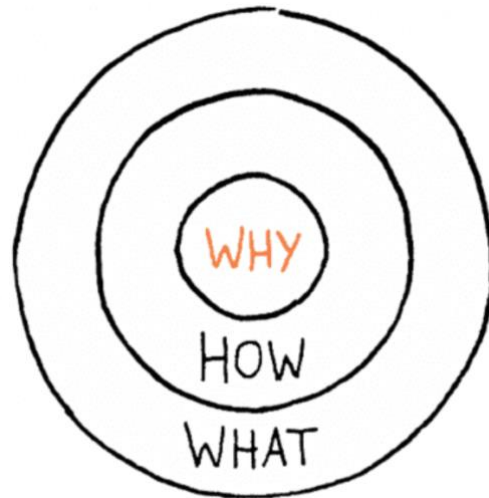
Three main approaches are used to address the research questions:

1. The Literature review, undertaken to provide foundations, comprises of definitions and some theoretical context for key aspects underpinning the research theme "Research from the inside out." The reason for this is that those seeking to commercialise their big idea are often so enthusiastic in their pursuit that the wider perspective is often missed. This also provides some theoretical basis to explore concepts of intellectual and social capital and the importance of teams and culture in the commercialisation of research outcomes and the knowledge economy. These concepts are particularly relevant in the world of "Deep-Tech" which has enormous potential but requires large research

investment both in time and funding – typical of that found in public research institutions where good things take time, and cost money!

2. Lived experiences is another way to gain insights into the commercialisation world. A total of fourteen semi-structured interviews were conducted covering different actors involved with the commercialisation of investigator-led research outcomes in a New Zealand context. Interviewees comprised of four founders, three aspiring founders, (entrepreneurial scientists actively seeking commercialisation of their research in 2022), three technology transfer managers representing organisational perspectives (i.e., publicly funded institutions that employ entrepreneurial researchers and own intellectual property arising from research) and four investor perspectives. Semi-structured interview questions can be found in the appendix.
3. Thematic analysis was then applied to identify themes relating to the research questions followed by critical analysis and evaluation. For full details of the thematic analysis see the six steps outlined by Braun and Clarke (2006).
4. High level themes were mapped to Simon Sinek's golden circle model (Sinek, 2009). The purpose of considering the themes and detailed insights from the interviews in this way because according to Sinek's theory, the information first appeals to the Limbic brain which controls behaviour and decision making, and then to the more rational part of the brain - the neocortex. The intent here is to ensure the data are presented in a way that is engaging, relevant and applicable. The golden circle model is about aligning strategy to goals, and the concept that inspiring leaders and organisation communicate with stakeholders from the inside out (starting with Why).

Simon Sinek's Golden Circle (Sinek, 2009)



WHAT

Every organisation on the planet knows WHAT they do. These are the products they sell or the services.

HOW

Some organisations know HOW they do it. These are the things that make them special or set them apart from their competition.

WHY

Very few organisations know WHY they do what they do. WHY is not about making money, cause, or belief. It's the very reason your organisation exists.

7 LITERATURE REVIEW

In the broadest sense, commercialisation is the process of introducing a new product or service to market. When considering commercialisation of research outputs from publicly funded institutions, like universities or crown research institutes (CRIs) there are many different options to consider each with trade-offs. Across the world, entrepreneurial researchers strive to make an impact through their research, this may be achieved through partnering with firms to take the technology to market or through a spin-out or start-up (the difference being that a spin-out has a parent institution that transfers some of its assets, often intellectual property, into a new company in exchange for a minority shareholding).

This review will consider social dimensions of the spin-out/start-up route, firstly by describing “Deep Tech” to set the scene for exploring the concepts of the knowledge economy, social and intellectual capital, the public good as well as innovation culture by touching on aspects of team structures along the innovation pipeline, because they are important aspects to understand for those seeking to close, or at least narrow the gap between academia and industry.

7.1 WHAT IS DEEP TECH?

Deep tech ventures are defined by their combination of visionary ambition, fundamental research, and commercial pragmatism (Gourévitch, Portincaso, Legris, et al., 2021). This is especially evident in the deep technology or “deep-tech” start-up world. Deep tech is a multidisciplinary convergence of advanced scientific research, along with the fields of engineering and design (Figure 3).

Deep-tech start-ups have several defining features: Firstly, they require substantial R&D to develop practical business or consumer applications and bring them from the lab to the market. Secondly, technologies are often aimed at addressing big societal and environmental challenges and thirdly, deep technologies have the power to create their own markets or disrupt existing industries and will likely shape the way we solve some of the most pressing global problems. Finally, the underlying IP is either hard to reproduce or well protected, so they often have a valuable competitive advantage or barrier to entry. In summary, Deep tech ventures can have a significant impact, take a long time to reach market-ready maturity, and require a significant amount of capital. Given the focus on large societal problems, the need for multidisciplinary approaches, the linkages to research institutes are to be expected because they foster collaboration amongst people with different skills and lived experiences.

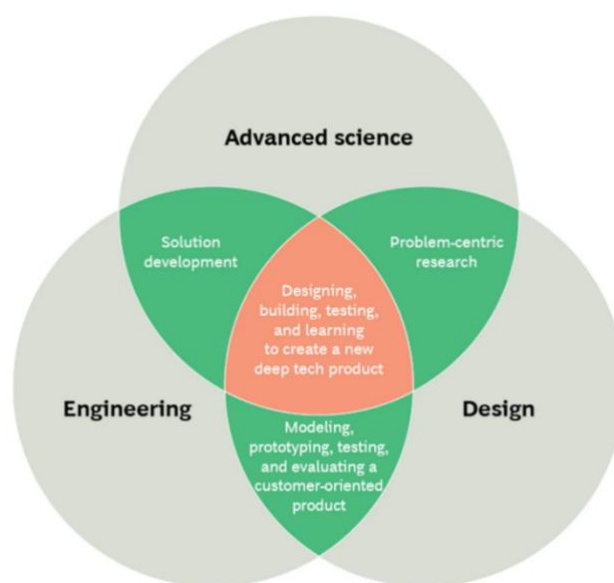


Figure 3: Deep tech ventures live at the convergence of Advanced Science, Engineering and Design. Source: Boston Consulting Group & Hello Tomorrow 2021

7.2 THE KNOWLEDGE ECONOMY

In a knowledge-based economy, knowledge and its adroit management are deemed essential for value creation, the knowledge owner is of key importance and capital may plausibly expand. (Dean & Kretschmer, 2007; Nahapiet & Ghoshal, 1998). Firms belonging to technology and knowledge-based industries recognise intellectual capital as the key knowledge base that contributes to the creation of a competitive advantage for the firm (Appuhami, 2007). For intellectual capital to be conceived as capital in an economic sense ideas (knowledge) must fulfil the same function in the production process (so-called "factors of production") as other forms of capital (Dean & Kretschmer, 2007). Intellectual capital has been defined numerous times by scholars from "collective brainpower" (Stewart, 1997) or "the stored knowledge possessed within an institution" (Erickson & Rothberg, 2000) to Intangible assets: knowledge, competence, intellectual property, brands, reputations, customer relationships (Teece, 2002).

7.3 SOCIAL CAPITAL

The term "social capital" can be used to help explain and understand entrepreneurship in the knowledge economy. It relies on the assumption of social networks "the presence of more or less structuralized networks between people or groups of people [...] that facilitate certain actions for different actors within the structures" (Porta, 2014). The premise is that networks and the associated norms of reciprocity have value, both for the people in them as well as public and private externalities (Putnam, 2001).

There are three types of social capital; bonding, bridging and linking (Porta, 2014). Bonding social capital refers to relations between members of a network that perceive themselves as being similar in terms of their shared social identity (Slack & Pierazzo, 2021). Bridging social capital, by contrast, comprise relations of respect and mutuality between people who know that they are not alike in some socio-demographic (or social identity) sense (differing by age, ethnic group, class, etc.). Linking social capital introduces hierarchical or unequal relations, stemming from differences in power, resources, or status (Szreter & Woolcock, 2004; Woolcock & Narayan, 2000).

Social capital plays an important role in how individuals can access useful information and knowledge and make decisions in response to a given set of alternatives based on acquired information and (formal and/or tacit) knowledge (Doh & Zolnik, 2011). Social capital facilitates both the acquisition and exchange of knowledge in research, education and commercial R&D processes (Westlund, 2006). Or simply put by Woolcock and Narayan (2000) "It's not what you, it's who you know", or "wisdom born of experience".

Social capital (and its collective intellectual capital) necessary for knowledge-based action has been described as having three dimensions, structural, relational and cognitive (Nahapiet & Ghoshal, 1998) (Figure 4).

Structural social capital: Tangible, it relies on the properties of a social system and how a person can interact with others with whom they have built connections with inside the system.

Relational social capital: Intangible, it involves the nature and quality of relationships and how individuals think and feel. Assets such as trust, norms, obligations, expectations, and identities that are created and leveraged through relationships create relational social capital.

Cognitive social capital: both tangible and intangible. The social setting or culture, shared understanding through language, narratives, goals, values, beliefs and clarity in group interpretations or meanings comprise the cognitive dimension.

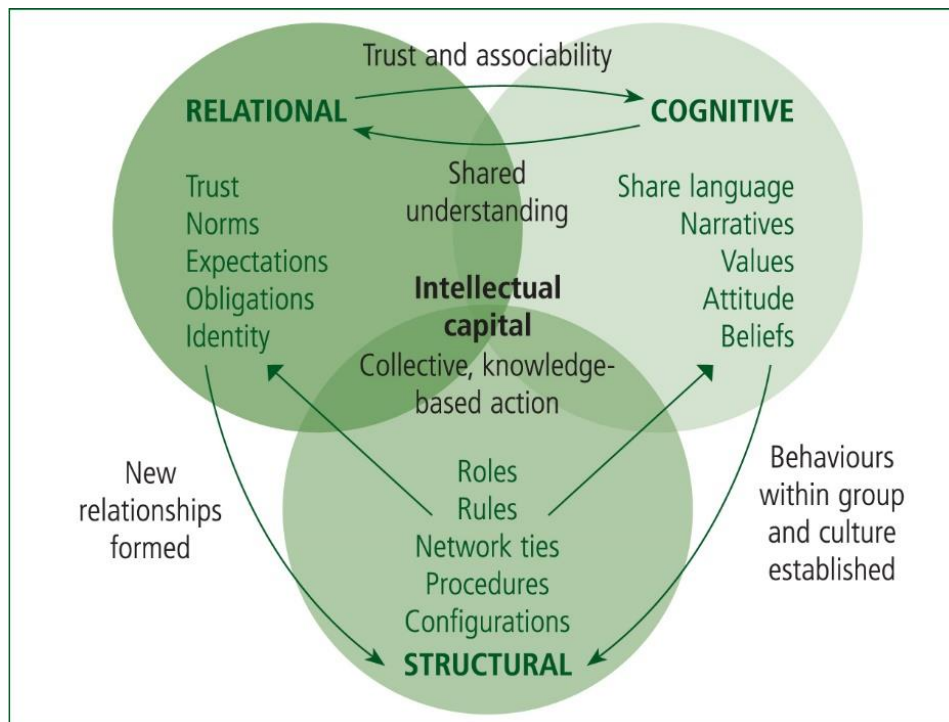


Figure 4: The three dimensions of social capital reproduced from Slack and Pierazzo (2021). These combined contribute collective intellectual capital necessary for knowledge-based action

7.4 INTELLECTUAL CAPITAL

Economic wealth is generally recognised as being derived from knowledge assets and intellectual capital and their applications, replacing or perhaps supplementing land, labour, and capital (Dean & Kretschmer, 2007). The same authors quote: "Experience of the past is preserved in the knowledge of the present; just as past labour is preserved in capital. In this way, ideas (knowledge) can be conceptualised as capital." But this concept is flawed - ideas and knowledge continue to be refined with use, and the intellectual capital concept fails to account for the individual and organisational learning processes (Dean & Kretschmer, 2007). Furthermore, the concept of intellectual capital treats ideas as separable and capable of being valued independently of the individuals and groups that created them. In other words, ideas are not a durable asset, they deplete over time.

7.5 PUBLIC AND PRIVATE GOODS

The use of an idea by one party does not prevent use by another party which means ideas are actually “public goods” because ideas are non-rivalrous and non-excludable (Varian, 1992). However, the boundaries between private and public good are porous - the physical characteristics of a good, together with the context of its consumption, values, tastes, legal, moral and social norms as well as technological possibilities determine the proper categorisation of a good as a private, public or other derivatives such as common pool or club goods (Reiss, 2021).

Nowhere else is the porosity of the public good more relevant than in the commercialisation of new knowledge produced by individuals (human intellectual capital) working within a publicly owned institution (structural intellectual capital) undertaking publicly funded research and development. The research projects undertaken by such institutions carry significant technical risk, while market risk is often much lower due to the potential value of the solution to society (Gourévitch, Portincaso, Legris, et al., 2021), thus institutional research endeavour lends itself to “deep” technologies, which are disruptive solutions built around unique or hard to reproduce technological or scientific advances.

7.6 TEAMS AND CULTURE

It is well understood that cultural differences exist between people from different walks of life, and the same applies to different professions and disciplines, although this is a relatively unexplored field compared to other forms of cultural research (Hofstede, 2007). The innovation pipeline from fundamental to applied research and development through to deep tech commercialisation is a multi-cultural, multigenerational and multidisciplinary team effort (Tomek, 2011). Teams can be conceptualised as either intact (Salas et al., 2008) or ad-hoc (Sharma et al., 2011). Ad hoc teams differ from intact teams in that members come together to achieve a common goal with time constraints and inconsistent planning (White et al., 2018). Ad hoc teams are common in healthcare, including in emergency departments, trauma care, surgery etc. (Slack & Pierazzo, 2021). Ad-hoc teams are also common in academic research projects, where members come together to deliver a research output and then disband once the project is complete. It is important to consider the differences between intact and ad-hoc teams because we often default our thinking towards intact teams. For example, training and team building are largely pitched towards intact teams (Slack & Pierazzo, 2021). Compared to intact teams, ad-hoc teams face some hurdles because they lack an opportunity to develop a team identity, shared mental models of how the team operates, approaches and solves problems, and responds to crises (Tomek, 2011; White et al., 2018). The impact is a reduced ability to develop adaptive behaviours and anticipate each other’s needs (Leach et al., 2009). Feitosa and Fonseca (2020) question whether ad-hoc teams actually teams because they lack collective identity and unity or just subgroups working together on a task. Furthermore, ad hoc- teams are at high risk of poor teamwork and communication, which are largely attributed to social barriers, differences in training and the environments in which they work (Roberts et al., 2014; White et al., 2018). Members of intact teams and ad-hoc teams can either be assigned or selected based on knowledge, skills and attitudes, they also go through the same stages of forming, storming, norming and performing (Tomek, 2011).

Considering the research underpinning deep tech, the development stages from conceptualisation to commercialisation are usually split into several stages (projects) because unforeseen technical and or market risks and challenges arise. To reach the objective, challenges must be either overcome or avoided by “pivoting” in a new direction. Whatever the innovation, it is likely that the team composition will change accordingly to secure the necessary knowledge, skills, and attitudes to meet the team objectives.

8 INTERVIEWS

A rich dataset full of insights into the different dimensions of investigator-led research was obtained from the semi-structured interviews. In total fourteen interviews were conducted, comprising three aspiring founders, four established founders, three commercialisation managers from research organisations and four investors.

Following the thematic analysis process outlined by Braun and Clarke (2006), a mind-map was developed to outline the distillation of interview insights into high-level themes (Figure 5).

Keeping to the context of the research aim and questions, a critical analysis and evaluation of the interview responses across the four groups of respondents produced three key themes which can be mapped to Simon Sinek's golden circle framework (Why, How, What) (Chaffey, 2022; Sinek, 2009) These themes were:

- **Why:** Motivation with dimensions of culture and engagement
- **How:** Execution with dimensions of Focus, Confidence and Success
- **What:** Problem definition/Relevance and Key messages

The golden circle model is about aligning strategy to goals, and the concept that inspiring leaders and organisation communicate with stakeholders from the inside out (starting with Why). The purpose of considering the themes and detailed insights from the interviews in this way because according to Sinek's theory, the information first appeals to the Limbic brain which controls behaviour and decision making, and then to the more rational part of the brain - the neocortex. The intent here is to ensure the data are presented in a way that is engaging, relevant and applicable.

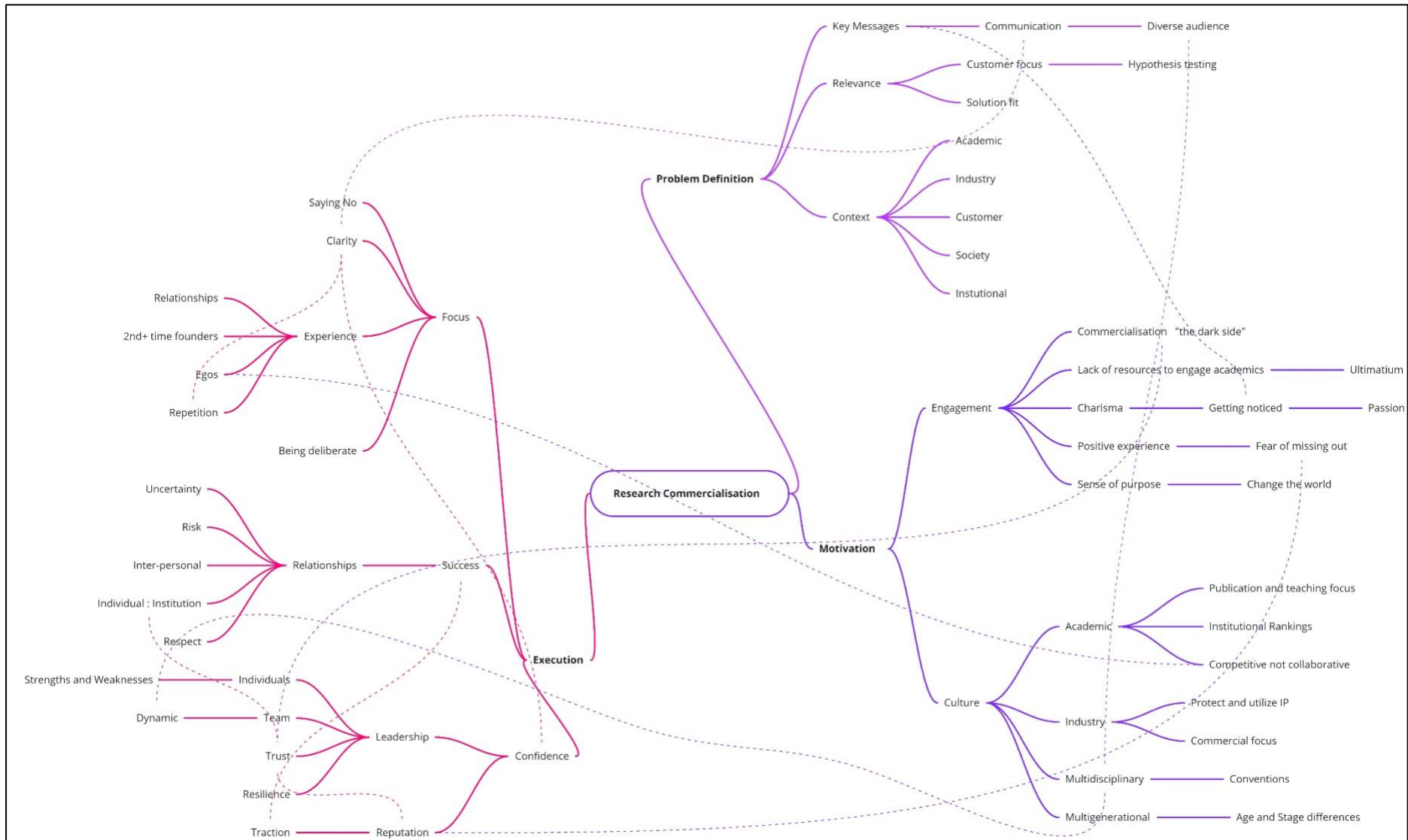


Figure 5: A mind map showing the distillation of interview responses into high-level themes with the thematic analysis processes as described by Braun and Clarke (2006). The dashed lines represent links between sub-themes.

Motivation (and de-motivation) as a high-level theme was very prominent, both in a positive and negative sense and therefore an additional thematic analysis was undertaken to delve deeper (Figure 6). This analysis revealed the aspects of the institutional environment that inhibit commercialisation of research outcomes as well as the drivers for those who see themselves as part of the commercialisation community.

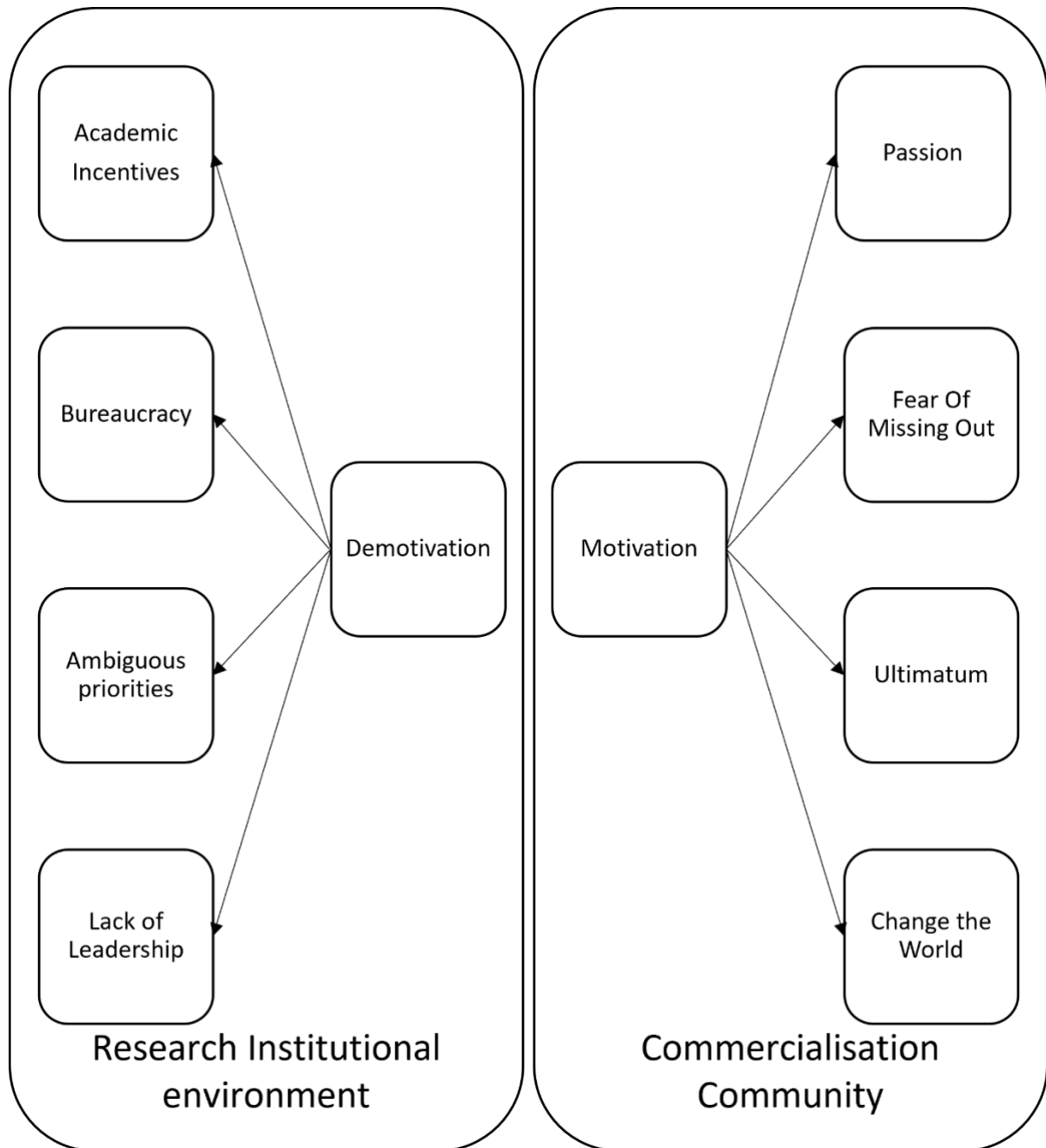


Figure 6: A deep-dive into the theme of motivation for commercialisation of research outputs following the thematic analysis process outlined by Braun and Clarke (2006). In this case motivation and demotivation are considered.

8.1 WHY: MOTIVATORS, CULTURE AND ENGAGEMENT

8.1.1 Motivations

There is a clear theme around purpose, motivations and why people do what they do, this was clear across the four groups of respondents.

Passion for what they do was a key motivator. As was the desire to help solve a problem or make a difference:

When asked about motivations two founder's responses were:

"See your research getting into the market. Publish is a limited audience. Benefit the public. Bigger mission."

"I always had that desire to make something useful to help people."

Other things matter too including fear:

"FOMO (fear of missing out) drives investors if you get a good lead investor, the rest will follow - Investors are not interested until you don't need them" Investor

Or career point:

"I was at a fork in the road careerwise, an ultimatum from the research organisation, go for it or re-start science career in a new area." Founder

De-motivators were also evident, comments around the fact that researchers are incentivised to publish research rather than protect it, and the observations that research organisations become *"obsessed with processes rather than outcomes."* Another interesting demotivator was confusion in exactly what the research organisation is trying to achieve through commercialisation. This was observed a lack of clarity in chief executive and board support for spinouts as a potential pathway to market.

8.1.2 Culture

Comments relating to culture were common, although interestingly, but perhaps unsurprisingly with some angst from the founders and aspiring founders. This is possibly because people in these groups are actively pushing boundaries, either within the research organisation or in industry. For example:

"...Culture. Not collaborative, its competitive." Aspiring Founder

From a research organisation technology transfer manager perspective

"We need people who can be flexible enough to improve the quality of their engagement in other (business) domains."

One founder recommended aspiring founders to

"Identify someone in the research organisation that understands what you are trying to do and who can work with the management."

The culture/reputation of the research organisation as experienced by investors through the commercialisation arm is also a point of interest:

"...culture or attitude in the commercial arm of the research organisation is highly variable across NZ. Some corporate partners won't touch things out of research organisations because of it."

This sentiment was echoed by another investor:

"If you can't deal with the simple stuff, the hard stuff is really hard - Reputation is important and the door swings both ways."

When asked about biggest fear:

"Fear of being seen as turning to the dark side - fear of being excluded or not liked." Where commercialisation was seen as being the "dark side" by researchers in general. "There are conflicting cultures and moral stances – it [commercialisation] is seen as a bad thing."

Investors saw this differently, for example:

"[Researchers] need to be asking WHY questions. It usually all boils down to some human making some changes to their behaviour... this can often be neglected as thought of it as the dark side. Many researchers are missing the intellectual curiosity for root cause analysis."

This sentiment is echoed by comments like:

"Patch protection [in research organisations] is rife. Innovation people seem more selfless, they are happy to let go and share load" Aspiring Founder

The concept that culture varies or evolves along the innovation pipeline also came through:

"Hard to move scientists on from the fundamental" Research organisation technology transfer manager

"Public sector not a good foundation for commercialisation. Can go a long way without commercial discipline. Can sometime lead to substantial rework!" Investor

"Despite seeing themselves as innovators, research organisations always have a fallback line on innovation... an excuse not to do it, e.g., "we are a science institute" Aspiring Founder

8.1.3 Engagement

The theme of engagement emerged most predominantly when speaking to the commercialisation managers of research organisations. When asked; What would you like to see more of:

"More engagement [with commercial managers], earlier. People that are open minded. Dialogue of possibilities, it's a cultural thing."

Founders also mentioned that they struggled to get the engagement and support they needed from the research organisation being discounted as "just a scientist" by other business functions. In this business managers taken aback by the fact that an entrepreneurial researcher is engaging in commercialisation discussions with stakeholders etc. The problem is exacerbated by changes in personnel at the

research organisation and needing to build relationships and trust with new managers.

A big problem for aspiring founders was the “need to get endorsement within [the research organisation] ... but if you go external, people will question that” this makes it difficult and unappealing for researchers with genuinely great ideas to progress them within the research organisation environment.

8.2 HOW: EXECUTION, FOCUS, CONFIDENCE AND SUCCESS

8.2.1 Focus

Execution is crucially important irrespective of whether you are a researcher, founder, research organisation or investor.

As one founder put it:

“You are selling the execution, creating intellectual capital. One idea can lead to several products. Execution is therefore more important than the idea.”

Limited Resources is the one thing all groups have in common, and that necessitates a sharp focus.

As other founders explained:

“I stay focused by literally by killing innovation every day. Start saying no.”

“Clarity of mission. Doing too many things is a problem. Within the research organisation I have noticed that individuals with a clear vision and stayed focus have developed successful things”

There is some conflict here in that research organisations incentivise researchers to focus on publishing rather than commercialising and when attempting to support commercialisation a lack of focus from the research organisation:

“It felt like the internal advisory was there to “manage us” rather than championing the concept - Unprepared people, of-topic, lack of shared interest for group purpose” Aspiring founder

On a more positive note, from a founder who left a research organisation:

“The act of founding a company is a statement to the world that you are serious about technology development...i.e., it's not just another research project. This opens doors to new interactions, new collaborations/partnerships, and new sources of funding which you just wouldn't get at the research organisation”

8.2.2 Confidence

Confidence was a theme that came through because it underpinned people's willingness to make tough decisions, push-back when they needed to and move forward.

“Don't get pressurised, stand your ground” Founder

“Experience talking to a wide range of people, practice builds confidence. We are confident and we bring success. We also ask hard questions” Founder

When thinking about personal risk assessment, one founder made a good point around the importance of mentors and confidence

Assessing the personal risk of becoming a founder was hard –

“I’m naturally risk adverse, mentors were a big help... it “feels right,” the clarity have me the confidence to go”

8.2.3 Success

The upside of commercialising research manifests in diverse ways. There is the obvious to make money, however that driver was rarely discussed in the interviews. The importance of celebrating success was noted several times, for example

“Positivity. Celebrate achievements, encourage people”

but also, the sentiment of founder wellbeing

“Put yourself first so you don’t burn -out”

Another interesting dynamic was different, almost polarising, views on what is more important for success: IP or execution. Delving into this deeper, from one investor’s point of view,

“... [research organisations] tend to over-value IP, the execution is key, execution (3), team (2), timing (1). Team is about experience and ability to pivot...”

The converse from another investor:

“There is not enough focus [from within the research organisation] on what IP is being created in terms of an asset. Invest in the people and the IP. People are the execution; IP is the potential. If execution is terrible, can fall back on IP. If execution is fantastic, leverage IP being acquired. The more value in the IP the more the zero-revenue condition will last”

A future state of success to a research organisation was:

“...that our scientists can see that commercialisation is celebrated and rewarded alongside other things. Making that part of the culture. Impact.”

8.3 WHAT: PROBLEM DEFINITION/RELEVANCE AND KEY MESSAGES

8.3.1 Problem definition and Relevance

The idea that researchers are great at solving problems came up often, but are they solving the “right” problem?

One founder said:

“Most commercialisation attempts by aspiring founders fail because they don’t understand the problem. Don’t understand the market. Try and fit solution to a problem.”

This was echoed by an Investor and a research organisation technology transfer manager.

"You need to be in love with a problem, scientists are inclined to be in love with a solution" Investor

"We need people who can be flexible enough to improve the quality of their engagement in other (business) domains." Research organisation technology transfer manager

Others recognised it too:

"Science plans and KPIs set expectations, E.g., innovations. But these require some desirability for people to use the outcomes. They need to be designed!" Aspiring founder

"More relevant = more success." Aspiring founder

"Pure scientists' micro-zone in on things whereas, as an entrepreneur or developer, you need to think wide, scale, application, design." Founder

"More commercial insight/ due diligence in the research phase." Investor

8.3.2 Communicating Key Messages

The idea of clarity in thinking and clarity in messaging arose several times during interviews.

In terms of aspiring founders and founders pitching to investors:

"Don't need a perfect pitch deck - rather, be memorable!" Founder

"Think: Who are you appealing to? A good compelling story gets us more interested in the product" Investor

Some founders and aspiring founders felt that there was a lack of clear messaging from research organisations about what success looked like, both in terms of promotion incentives for academic outputs, but also a lack of clear messaging about exactly what success looked like for the research organisation, or even what the options were for aspiring founders looking to lead commercialisation: When asked what research organisations could do better, one respondent explained:

"Better informing researchers that commercialisation is an option. How its managed etc. set expectations." Aspiring founder

Another suggested:

"...Ask [the research organisation] their purpose and early on in the journey what they have appetite for, what is the realistic target and what is the mandate we are working under, keeping consistent on the message and direction is essential." Aspiring founder

When positions are fluid, it was also acknowledged that technology transfer offices at research organisations may lack of clarity around the research organisation's appetite for spinouts from the senior leaders and board level support.

9 DISCUSSION

The discussion section of this report is about interpretation, making sense of the insights gained from the semi-structured interviews, considering both the literature review and the background/operating context. The innovation pipeline model (Figure 2) is a useful framework for explaining how research turns into impact, however what is missing is the need to zoom out further, to the fundamentals of why things entering the innovation pipeline are the way they are.

9.1 CONTEXTUAL AWARENESS

At an elevated level, it was clear that most respondents are broadly aware of their operating contexts and that the contexts were markedly different for each of the four groups interviewed. Aspiring founders and founders that have exited a research organisation had to work hard to understand the broader organisational context and navigate through it. These two groups were also aware of the context of the industry in which they were engaging, i.e., they understand the problem they were trying to solve and “know why the status quo is the status quo” as one investor highlighted.

The investors interviewed were also well well-versed in the context of the public institution, the tension between academic incentives and commercial opportunities, the lack of commercial acumen amongst some researchers and the stretched resources of the technology transfer offices.

Although not interviewed in this study it is clear from the feedback of the other groups interviewed that most Researchers (i.e., those naive with respect to commercialisation) may not necessarily actively consider the context, both within the research organisation or the potential outcomes and impacts of their research beyond the institution. A lack of incentives to pursue commercial avenues means that research is conducted with the intent to publish in academic literature rather than identify and protect intellectual property.

Amongst the research community (both individuals and organisations), contextual awareness of how and why an innovation pipeline functions and the roles of actors at each stage is also lacking. This problem is especially evident considering “deep tech” a term that is often used but not well understood by the research community who fail to recognise early on that so-called deep tech innovations are underpinned by long development times, diversity and multi-disciplinary collaboration (Gourévitch, Portincaso, de la Tour, et al., 2021). Most researchers fail to understand and acknowledge that to have impact, research outputs (particularly development of innovative technology) also need to be designed and engineered to be relevant and desirable to be able to move through an innovation pipeline.

Founders tended to be acutely contextually aware, particularly around their circle of control and circle of influence - “knowing when to move on” either when it was time to make the move from academia to industry, when/how to pivot or learning to accept unavoidable things imposed on them.

The concept that ideas are “public goods” because they are non-rivalrous and non-excludable (Varian, 1992), but that they also arise from knowledge and are therefore a form of intellectual capital and possibly intellectual property is important. The act of commercialising research outputs (making outputs excludable and rivalrous) is effectively transitioning the porous boundary from public good/service to private good/service. This was referred to as the “dark side” in some of the interview

responses. Societal benefits (Figure 1) can be realised through appropriate commercialisation, but consumption of a good or service depends on context, values, tastes, legal, moral and social norms as well as technological possibilities determine the proper categorisation of a good as a private, public or otherwise (Reiss, 2021).

9.2 RELATIONSHIPS

The importance of relationships cannot be overstated. Structural, cognitive and relational social capital can be used to delve deeper into the nature of relationships (Slack & Pierazzo, 2021). Structural social capital relies on the properties of a social system and how a person can interact with others with whom they have built connections with inside the system. Research Organisations set the structural capital through roles, rules, processes etc. These structural aspects influence the way people behave (relational social capital), trust, norms expectations, identity as well as their attitudes, values, and beliefs (cognitive social capital).

Interviewees were unanimously clear in the fact that research organisations needed to better incentivise research commercialisation. Institutions need to provide the necessary structural social capital inventory to enable cultural change and acceptance of commercialisation as a desirable pathway to impact.

Issues relating to trust emerged several times from the interviews, this was most prominent in the aspiring founder and founder groups and relates to a lack of relational social capital among individuals and institutes. This is somewhat expected due to the ad-hoc team environment typical of research teams. Compared to intact teams, ad-hoc teams face some hurdles because they lack an opportunity to develop a team identity, shared mental models of how the team operates, approaches and solves problems, and responds to crises (Tomek, 2011; White et al., 2018). The impact is a reduced ability to develop adaptive behaviours and anticipate each other's needs (Leach et al., 2009).

This quandary may be at its most prominent for Aspiring innovators actively pursuing the commercialisation pathway because moving from certainty to uncertainty is uncomfortable and requires trust, confidence, and commitment. One aspiring founder noted that the "age and stage of team has a bearing on their willingness to join a start-up." Once the decision is made to form a commercial company, the team immediately becomes multidisciplinary with founders, investors, CTOs, CEO etc. This new team then needs to go through the four stages of forming, storming norming and performing (Tuckman, 1965). This effectively means the start-up team will have developed their own structural, cognitive and relational social capital through bonding, bridging and linking (Porta, 2014).

10 CONCLUSIONS

The purpose of this research was to help aspiring founders, as well as research organisations and investors convert research outcomes into ventures with potential to change the world. The aim of this report was to create a resource to inform and inspire entrepreneurial researchers interested in the commercialisation and aspiring founders of investigator-led research to give it a go.

Simon Sinek's Golden circle model was used to categorise the semi structured interview responses into Why, How and What dimensions. To ensure the insights were presented in a way that is engaging, relevant and applicable.

Know your Why...there is no doubt that motivation and a passion for the cause vitally important for founder success because it is what keeps founders going when the going gets tough. Notwithstanding that motivation is a deeply personal thing that aspiring founders and researchers need to intrinsically develop.

The How and the What dimensions of the semi structured interviews provided the most fertile ground for insights into how commercialisation of investigator-led research could be improved for entrepreneurial researchers, aspiring founders, research organisations and investors.

The discussion section focused on contextual awareness and relationships as two fundamental themes uniting the interview responses with the literature review. As well as focusing on the technology development, aspiring founders and entrepreneurial researchers must also spend time understanding the context and developing relationships.

10.1 KEY FINDINGS

- Most technological development in public institutions in NZ is aligned to "Deep Tech" which alongside science disciplines requires design and engineering components to be relevant and attractive for commercialisation.
- Working in silos is largely counterproductive to Deep Tech commercialisation, except in rare cases where the research team has accumulated deep commercial insights or domain knowledge.
- The research environment comprises ad-hoc teams, setting the scene for poor communication and lack of trust, both within the team and between the team and the research institute.
- Researchers operating in public institutes are broadly unaware and not incentivized to pursue commercialisation avenues over academic outputs.
- The importance of IP and its execution are undisputed when it comes to commercialisation, but there were polarising views from investors on which was more important, the IP or the execution.
- Risk factors into almost all dimensions of commercialisation but researchers are naturally risk adverse.

10.2 RECOMMENDATIONS

The following recommendations are made with reference to the two research questions this report sought to investigate:

1. How does an aspiring founder navigate their way to becoming a founder?
2. How can the chances of successful commercialisation be increased?

10.2.1 Researchers and Aspiring founders

1. Engage early with Technology Transfer office and undertake due diligence before designing the research to ensure more targeted use of resources
2. Be relevant. Strive to be more aware of the operating context and drivers for the research organisation and the end users of your research outputs

3. Work on your ability to communicate and work with a multi or transdisciplinary team
4. Get a business mentor to help you focus on what is most important and why from both demand and supply perspectives

10.2.2 Research Organisations

1. Support multi and trans-disciplinary research projects and ensure that people know why it is important to work in this way (not just a box ticking exercise)
2. Develop the necessary structural social capital functions to incentivise commercialisation of research outputs as a legitimate and celebrated career pathway
3. Be clear on what success looks like and communicate this widely and regularly with researchers and investors
4. Engage with investors earlier, there is an appetite for guiding the research to ensure it is more targeted and more investible

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12 APPENDIX

12.1 SEMI-STRUCTURED INTERVIEW QUESTIONS

Table 1: Semi structured interview questions

Established Founder/Researcher perspectives	Aspiring Founder/Researcher perspectives	Research Organisation perspectives	Investor perspectives
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What motivated you to commercialise your technology?	Why do you want to commercialise your tech?	Is investigator-led commercialisation something your organisation supports? Why/why not?	What are the possible advantages/disadvantages associated with investing in tech that has come from publicly funded research organisations?
Can you summarise your experience or formal training you had with respect to commercialisation?	What stage are you currently at and what are the next steps?	What are the advantages/disadvantages with investigator led research compared to other options?	What could research organisations do more of/better/different/less of to make them more attractive to investors?
What were the challenges you had when dealing with: The Research org Investors Others?	Do you have any relevant experience or formal training with respect to commercialisation? Strengths and weaknesses?	Process. How do you identify and back investors to lead commercialisation?	What could science teams do better in the research phase?
What were you most afraid of?	What steps have you taken to ensure organisational support of your endeavours?	What would you like to see more of from internal innovators?	What could founders do to improve chances of success?
How did you assess risk and factor that into your own decisions?	What could the Research Org do better?	Considering the commercialisation avenues and support available, are the current tools and infrastructure appropriate? Yes/No/ what is missing?	Other than return on investment, what else is important to you as an investor, what attributes are you looking for in the technology/team?
How did you eventually structure a deal with your organisation?	What expectations do you /they have and how are these being managed?	What does success look like for the organisation when it comes to investigator-led commercialisation?	
	What is your capital raising		

	strategy? (e.g., do you have an investor lined up?)		
	Have you identified market size and possible business models? What steps have you taken to validate these?		
	What is keeping you awake at night?		