Investing for Deep Purpose with Deep Tech? An Exploratory Study of the Organisational Reality of New Zealand Deep Tech Investors.

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Abstract

Recent years have seen the rapid growth of the deep tech ecosystem both in New Zealand and abroad. Deep tech is characterised by long development timelines that are resource-intensive and are highly risky, often requiring multidisciplinary teams to commercialise them. Despite these challenges, deep technologies are capable of addressing complex societal and environmental challenges, bringing fundamental technological advancements across diverse sectors such as quantum computing, future materials, synthetic biology, and artificial intelligence. The twin goals of deep tech investors, to solve global challenges and make outstanding returns, are highly similar to those of impact investors. Indeed many impact investors operate in this field, and over 97% of deep tech ventures target at least one of the UN Sustainable development goals. Academic literature has yet to agree on a fixed set of terminologies to describe deep tech, and little is known about the organisational environment of deep tech investors.

By drawing on neo-institutional theory, this thesis explored the organisational and institutional environment of deep tech investors. Specifically, this thesis investigated the nature and existence of institutional hybridity at the organisational and field level. A qualitative research strategy using abductive reasoning was employed to accomplish these exploratory aims. Among the findings of this research was that the deep tech organisational field displayed similar hybridity levels to impact investing. Looking at the behaviours and practices of deep tech investors, the existence of a group of non-impact deep tech investors that utilised many impact investor practices was highly surprising. The study also discusses the many pressures that deep tech investors experience to incorporate sustainability and impact practices and how these investors responded to these pressures.

This thesis generated valuable insights for other deep tech investors and founders of deep tech ventures. By shedding light on this under-researched topic, this research contributes analysis, insights, and hypotheses to assist future research efforts in developing further generalisable and explanatory theory.

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Chapter 1: Introduction

1.1 Background

Recent years have seen the rapid growth of the deep tech ecosystem both in New Zealand and abroad. Deep technologies – technologies based on fundamental scientific discoveries and engineering innovations – are characterised by long development timelines and capital-intensive nature, and often require multidisciplinary teams to commercialise them (De la Tour et al., 2019, 2021). These qualities of deep tech present barriers for investment and funding across the entire ecosystem, resulting in calls from different stakeholders to rethink how deep tech ventures are financed (Behrens, 2020; Gigler et al., 2018; Nanda, 2020; Nedayvoda et al., 2021; Portincaso et al., 2021). Despite this, some hail deep tech as the next great industrial revolution, bringing fundamental technological advancements across diverse sectors such as quantum computing, future materials, synthetic biology, and artificial intelligence (Nedayvoda et al., 2021; Portincaso et al., 2021). The global amount of private investment into deep tech grew from $15B in 2016 to over $60 billion USD in 2020, a 20% year-on-year increase (De la Tour et al., 2021). In New Zealand, the growth of the deep tech sector has become particularly pronounced as the start-up sector has begun to mature. The first half of 2021 saw a record amount of venture capital (VC) early-stage start-up funding, with deep tech receiving 42% of total funds compared to 24.6% for the same period the prior year (Reddy et al., 2021b). However, despite this massive growth in the global deep tech industry and a near pervasive use of the term by governments and industry (Romasanta et al., 2021), academic literature has yet to agree on a fixed set of terminologies to describe deep tech, with little known about its properties and boundaries (Siegel & Krishnan, 2020), or what theoretical lenses are best suited to study deep tech organisations and their organisational environment.

While multiple factors and megatrends have contributed to the recent growth and interest in the deep tech sector, both academic and practitioner literature, suggest that one aspect of deep tech to be responsible for its continued development despite its challenges: deep tech's potential to achieve disproportionately positive impact. In fact, a survey of 1277 deep tech ventures by Boston Consulting Group and Hello Tomorrow found that 97% targeted at least one of the United Nations Sustainable Development Goals (UN SDGs) (De la Tour et al., 2021). The fact that deep tech companies aim to solve complex social and environmental issues while enabling strong economic growth has made the growth of deep tech ecosystems of strategic importance for governments and sustainable development organisations worldwide

(Nedayvoda et al., 2021). Deep tech ventures' dual aims to solve complex issues and create outsized returns for their investors are highly comparable to another global investment trend, Impact Investing. The International Finance Corporation defines impact investments as "investments made in companies or organizations with the intent to contribute measurable positive social or environmental impact, alongside a financial return" (IFC, 2020). Impact investing has seen rapid growth and diversification, with an estimated $714 billion USD invested in impact investments globally (GIIN, 2020). At the intersection of deep tech and impact, Europe in particular has been a centre for new deep tech impact VC firms, and 108 European explicitly impact deep tech start-ups achieved over $2.5B USD in VC funding in 2020, an eightfold increase over 2015 (Renoldi, 2022). The overlap between impact investing and deep tech investing is tangible within practitioner literature (Different Funds, 2020; Portincaso et al., 2021). However, the phenomenon has only just begun to be studied in academic literature (Gidron et al., 2021; Granath, 2021).

Both impact ventures and deep tech ventures have the same dual aims of marrying purpose with profit, and the goals of the deep tech sector at large appear to be seated at some level within altruistic motivations. Logically it is plausible that the investing strategies and organisational practices of deep tech investors and impact investors would overlap. However, as previously alluded to, general academic literature on deep tech is scant. A search on the Web of Science (WoS) for the term "deep tech" would return just nine articles, while expanding into "deep technology" would return 29 articles. The academic landscape investigating the field level focuses primarily on the issues of funding and undercapitalisation. How and if deep tech investors interact with and manage the seemingly competing goals of profit and purpose similarly to impact investors is academically open territory. Looking to the extant literature on impact investing does provide theoretical avenues to use as a foundation to study this space. Compared to deep tech, impact investing has a wealth of published literature at the organisational and field level (Agrawal & Hockerts, 2021). Particularly the institutional logics and hybrid logics theories have been used to study the decision-making process and competing social and commercial goals of impact investors (Birkholz & Santos, 2015; Castellas et al., 2018; Quinn & Munir, 2017). Using this theoretical lens, impact investing is a hybrid organisational field, where a social logic and commercial logic each make competing or contradictory prescriptions on what behaviour is considered legitimate. Moreover, one of the central studies of organisational hybridity is how organisations within hybrid fields experience these challenges (known as institutional complexity) and respond to them.

In a similar vein, we can conceive of the deep tech sector as a hybrid organisational field using the institutional logics perspective. The goals of deep tech and impact investing are nearly identical, and we can infer that both are under the influence of the same competing social and commercial logics. This assumption provides the theoretical foundation for the research conducted in this thesis and provides a focus for the research purpose and aims.

1.2 Research Purpose and Aims

As highlighted above, deep tech academic research is scarce. In particular, the organisational environment of deep tech investing is unknown, though this thesis's premise is that there is hybridity within the field. In the geographical context of this research, New Zealand has seen tremendous growth in its start-up ecosystem over the past 15 years and more recently, has experienced rapid growth in its deep tech sector (Reddy et al., 2020, 2021a). However, New Zealand's investment ecosystem is relatively small compared to overseas, in terms of the number of investors, fund size, and typical 'cheque size' (The Treasury, 2019).

For the purposes of this research, the New Zealand deep tech ecosystem has many different types of relevant investors. There are non-impact investors (henceforth referred as traditional investors) and impact investors. These investors can either be specialised deep tech investors or generalists who make individual investments into deep tech ventures. Several deep tech investors do not appear to be impact investors but do use impact language such as "purpose-driven" or "mission-led" investors. Although all these investors operate within the same organisational field, the discourse around the positive impacts of deep tech has been occurring mostly within more mature global markets. It remains to be seen if New Zealand deep tech investors have different norms and expectations of themselves and their investments than their overseas counterparts.

By drawing on neo-institutional theory, this thesis aims to explore the organisational and institutional environment of deep tech investors. Specifically, this thesis intends to explore the nature and existence of hybridity at the organisation and field level and investigate how New Zealand deep tech investors experience and react to possible tensions between logics. To accomplish this, the research conducted in this thesis aims to understand the views and behaviours of deep tech investors regarding how they interact with and account for the non-financial outcomes of their investments. By shedding light on this unresearched topic, this research intends to contribute analysis, insights, and hypotheses to assist future research efforts in developing generalisable and explanatory theory.

1.3 Research Questions

To pursue the above research aims, the research was framed by the following research questions, which sit within an overarching investigation of the hybridity or institutional complexity within the organisational field of deep tech investing:

1. How do New Zealand deep tech investors experience and respond to possible tensions between institutional logics?
2. What are the views of New Zealand deep tech investors regarding the non-financial outcomes of their investment, and does this influence their investment decision-making behaviour?

1.4 Methodology

To best achieve the exploratory research aims of this study, a qualitative research strategy utilising semi-structured interviews was employed. Twelve interviews of thirteen participants across the deep tech investment ecosystem were conducted, totalling over 10 hours of audio records. Seven were investment managers or partners at deep tech venture capital firms, four were categorised as impact investors who made investments in deep tech ventures, two were associates in a deep tech venture capital firm, and one was an executive director of a university investment fund. These participants were selected using a mix of purposive and snowball sampling techniques to best uncover their perspectives and views on how they approach the non-financial outcomes of their investment. In line with the exploratory aims of the study, analysis of the interview data followed an abductive approach moving iteratively between institutional and hybridity literature and the empirical data (Timmermans & Tavory, 2012).

1.5 Thesis Structure

This thesis consists of six chapters. Chapter 1 has covered the Introduction, providing the research context, purpose, and aims. Chapter 2 reviews the literature, with an overview of what deep tech and impact investing are, an outline of venture capital investing, and a detailed review of neo-institutional theory. Chapter 3 describes the research methodology, including the research strategy, research procedure, and data analysis methods. Chapters 4 and 5 present the study's findings and discusses them in the context of neo-institutional literature and theory. The final chapter 6 summarises the overall conclusions of this thesis, outlining the implications of this study, the limitations of the research. The chapter concludes with recommendations of avenues for future research.

Chapter 2: Literature review

2.1 What is Deep tech?

The term deep tech originated from (Chaturvedi, 2014) to describe companies "founded on a scientific discovery or true technological innovation". The definition was intentionally vague, as to allow future technologies to fit within the definition. Sometimes known as either as Key Enabling Technologies (KET) in the European Union (EU) or Tough Tech in the USA (Gigler et al., 2018; Nanda, 2020). Deep technologies often take years of research and development before being able to be deployed outside the lab, increasing the timeframes, the risk of failure and increases the capital expenditure required. However, the R&D intensive nature make deep technologies difficult to reproduce and create strong barriers to entry (De la Tour et al., 2019). Today, examples of the technology sectors underneath the 'Deep Tech' umbrella include artificial intelligence and machine learning, robotics, advanced materials, biotechnology, nanotechnology, photonics, cleantech, space tech, and life sciences (Nedayvoda et al., 2021).

Despite the prevalence of deep tech in industry, academic literature has yet to agree on a set definition for how to describe deep tech's properties, boundaries, and theoretical frameworks (Siegel & Krishnan, 2020). For the purposes of this thesis, we will use the following definition of deep tech:

> *Deep tech is technology based on fundamental scientific discoveries and engineering innovations that offer significant advances over those currently in use and typically have long development times, require substantive amounts of capital, and aim to solve large global issues.*

Deep tech has not been extensively researched academically and covers a range of topics. Siegel & Krishnan (2020) provide an industry definition of deep tech and highlight the gap between current academic research current developments. Siegel & Krishnan frame deep technologies as causing the next wave of Schumpeterian creative destruction - targeting existing successful solutions in order to create long term sustainable value (Schumpeter, 1942). Other authors use the lens of creative destruction to investigate deep tech's influence; downstream of venture capital investment in Europe (Edström & Klinger, 2020);

More research has been focused on the financing of deep technologies and technology ventures. Some of these focus on a lack of funding for deep tech ventures to cross the 'valley of death' - the post-start-up phase in which most new technology ventures falter or fail - highlighting

possible market failures. Granath (2021) investigated the deep tech valley of death by interviewing Swedish deep tech equity (private equity (PE) and venture capital (VC)) financers, finding that high credit risk, knowledge gaps, information asymmetries, and a of lacking financing alternatives prove a major barrier for deep tech funding. These barriers to obtaining funding were also found to be problematic in a 2018 study by the European Investment Bank looking at deep tech financing tech (Gigler et al., 2018). For funding of later stage ventures, long development times and high expertise requirements impaired traditional financial tools for larger institutions to assess opportunities, causing a general market failure in the funding of deep tech. The holes in funding come from a lack of funding before venture capital steps in, an underdeveloped equity capital market, and low levels of available venture debt (Alperovych et al., 2020; Gigler et al., 2018; Wilson et al., 2018).

The investing strategies of venture capital investors in relation to deep tech has been a topic of particular academic interest. Nanda (2020) showcases the proportional change in what sectors VCs have been funding favouring predominantly IT software and services, consumer products and services, B2B products and services, and financial services. The challenges involved with deep tech companies in comparison to these sectors is one possible explanation for why deep tech has been largely neglected by VC financers over the past ten years (Nanda, 2020). Ewens and collegues (2018) provide another explanation by studying the role of technology in reducing the cost to de-risk initial venture capital investments. This lowered cost to de-risk has caused a shift in investment strategy towards what is colloquially called a "spray and pray" approach, increasing the amount of funding towards sectors where the cost of experimentation is low. This makes it harder for deep tech as the costs of experimentation is lower and the value of the technology is revealed slowly (Ewens et al., 2018). Behrens (2020) provides a view for how more patient VCs might approach deep tech investing. Looking at data on biotech and deep tech investing, Behrens found a market failure in the funding of 'scrappy' biotech ventures, referring to those that are …. Instead, VCs are now more commonly founding biotech ventures in house, importing knowhow and entrepreneurial expertise. This highlights the role that further organisational experimentation might have in increasing the funding of deep tech ventures.

Nearly all of the literature reviewed above emphasise the role other players, such as governments, universities, patient capital investors, and new organisational investment forms have to play in assisting deep tech companies successfully cross the valley of death

(Alperovych et al., 2020; Behrens, 2020; Gigler et al., 2018; Granath, 2021; Nanda, 2020; Wilson et al., 2018).

In his research of Swedish deep tech financers, Granath (2021) suggested a positive link between increasing accessibility of private capital and the rising trend of impact investing. As deep tech and impact investing often target societal or environmental issues, the increased interest and acceptance in impact investing as a category legitimates deep tech as a conventional investing strategy (Granath, 2021). Garnath highlighted the overlap between deep tech strategies and impact investing strategies as a topic for future research. Torres Ventura (2020) also found analogies between deep tech investing and impact investing in that investors experience similar liquidity issues due to long development phases and there are few opportunities for suitable exits for both types of investing. (explanation for this is that investors are more 'invested' or less willing to accept failure due to potential negative impacts / other suggestions are alternate fund structures, blended finance, longer fund performance)

Institutional logics have not been a common theoretical framework to analyse deep tech. (Clarysse & Thiel, 2019) used institutional logics to analyse how different actors throughout the growth of a deep tech venture use their professional logics to aid the further development of the venture. (Korber et al., 2022) focused on how misaligned institutional logics between entrepreneurs and venture capital/angel investors stimulate the maturation of entrepreneurial ecosystems (life science & female led entrepreneurship (including deep tech) context).

2.2 Institutional theory

Thornton & Ocasio (2008) characterise neo-institutional theory as originating from Meyer and Rowan (1977) and Zucker (1977). In their seminal work, Meyer and Rowan (1977) utilised a macro-level perspective to describe the role taken-for-granted rules had in creating isomorphic pressures on organisations. Zucker (1997) focused on the micro-level, also described the taken-for-granted nature of institutions but emphasised the pervasiveness of institutions as a key characteristic. Tolbert and Zucker (1983) emphasised that it is an organisations' legitimacy, rather than economic efficiency, that is the main factor explaining the success and survival of organisations. In contrast to 'old' institutionalism, early neo-institutional scholarship was primarily interested in macro-level sociological structures that exert pressure upon organisations, rather than the intra-organisational structures that lead to individual action (Hirsch & Lounsbury, 1997).

That organisations primarily seek legitimacy is the one of the critical concepts underlying neo-institutional theory (Deephouse & Suchman, 2008; Suchman, 1995). Suchman, (1995: p 574) defines organizational legitimacy as "a generalized perception of appropriateness and desirability which fits in the values and norms of a given socially constructed system". Pfeffer & Salancik (1978) assert that legitimacy provides organisations a right to exist that can be revoked when legitimacy is brought into question, stating that "Legitimacy is known more readily when it is absent than when it is present. When activities of an organization are illegitimate, comments and attacks will occur" (p 194). Legitimacy increases the chance of an organisation surviving its early years (Hannan & Carroll, 1992), and positively impact an organisation's financial performance (Heugens & Lander, 2009). Within the context of early neoinstitutional work, organisations gain legitimacy when they conform to institutional pressures and adopt 'legitimate' norms and structures. Ultimately organisations become homogenous as these 'isomorphic pressures' cause organisational norms, values, and structures to diffuse throughout the field (Meyer & Rowan, 1977).

DiMaggio and Powell (1983) built on Meyer & Rowan's (1977) description of isomorphism by concentrating on an organisational level, arguing that there are three different types of isomorphic pressures: mimetic, normative, and coercive. Mimetic isomorphism arises in the face of uncertainty, organisations may copy the norms or structures of other organisations that are seen to be more legitimate or successful. Normative isomorphism is closer to gradual propagating norms among professionals and individuals across organisations. Coercive isomorphism takes place when external pressures, such as government regulation or consumer pressure, force organisations to adapt to new, more legitimate practices. While this understanding of isomorphic pressures assumes that legitimacy is the driving force, Kraatz & Block (2008) note that the effect of these pressures do can happen without any legitimacy seeking behaviour.

In summary, neoinstitutionalism focuses on the macro level societal structures that are responsible for the isomorphism seen in organisations within an institutional field. Within this context, organisational behaviour is explained by seeking out and maintaining legitimacy, which is the prime factor to attract resources needed for the success and survival of the organisation. However, we need to understand what defines legitimate behaviour, and so we need to discuss institutional logics.

2.2.1 Institutional logics perspective

The institutional logics perspective originates in the seminal work by Friedland and Alford (1991) where they conceived of society as a multi-institutional system operating across the different levels of individuals, organisations, and society. Friedland and Alford (1991) laid out the capitalist market, bureaucratic state, democracy, nuclear family, and Christian religion as the core institutional orders that made up society. Thornton et al., (2012) refined these core orders to: family, community, religion, state, market, profession, and corporation. Each of these ideal-type institutional orders has its own central logic – a set of symbolic constructions and material practices (Friedland & Alford, 1991) that "constrains both the means and ends of individual behaviour" (Thornton & Ocasio, 2008 p. 101) contains their own sources of legitimacy, authority, norms and identity. Overall, the institutional logics perspective contains a meta-theoretical framework to understand human behaviour by analysing the interrelationships among individuals, organisations, and institutions in social systems (Thornton et al., 2012).

Building on Friedland and Alford's (1991), Thornton and Ocasio (1999, p. 804), define institutional logics as the: "the socially constructed, historical patterns of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality." Kraatz and Block (2008) describe logics are the "rules of the game" (p 243) that both enable and constrict action. In the context of legitimacy, institutional logics are the "socially constructed system" that acts a source of values and norms by which action is deemed legitimate (Suchman, 1995).

While the ideal-type logics operate mainly on a societal level, institutional logics an emerge at multiple different societal levels of analysis, including "organizations, markets, industries, inter-organizational networks, geographic communities, and organizational fields." (p 106) (Thornton & Ocasio, 2008). These logics at multiple levels have enabled institutional logics to be used as a method of analysis for many different research contexts. It is proving to be an increasingly fertile perspective for business research because organisations and organisational fields can be subjected to influence from multiple institutional logics (Thornton & Ocasio, 1999; Thornton 2004; Thornton & Ocasio 2008). This helps to us to explicate the challenges for businesses responding to sustainability imperatives or aligning to society's so called 'grand

challenges' as it requires them to blend logics that traditionally were outside the business domain.

2.2.2 Institutional pluralism and institutional complexity

It has been established that organisations and organisational fields can be subject to the influence of multiple institutional logics (Nigam & Ocasio, 2010; Scott, 2008; Thornton, 2004; Thornton & Ocasio, 1999, 2008), a phenomena known as institutional pluralism. These multiple logics may or may not be mutually incompatible (Friedland & Alford, 1991; Kraatz & Block, 2008). Kraatz and Block (2008) note that in a pluralistic environment, organisations face legitimacy pressures to conform to the institutional logics that operate in the field level (DiMaggio & Powell, 1983) but the combinations and tensions between these logics cause "variations, unintended consequences, and myriad opportunities for organizational action and continuous change" (p 245). Early scholarship of institutional pluralism portrayed organisational fields as an arena for different competing logics until a single dominant logic emerged victorious (Greenwood et al., 2011; Reay & Hinings, 2009). Under this schema organisational fields would have a period of stability under one dominant logic, needing an external "jolt" (Meyer, 1982) to cause a new dominant logic to attain prominence (Greenwood et al., 2011). It is now more commonly accepted that multiple logics can coexist for longer periods of time, though these logics can be conflicting, contesting or incompatible when they make contradictory prescriptions on what defines legitimate action (Kraatz & Block, 2008). Though what happens when organisations face these enduring competing prescriptions from multiple logics?

Greenwood and colleagues (2011) (318) state that "organizations face institutional complexity whenever they confront incompatible prescriptions from multiple institutional logics". Institutional complexity has been studied at individual level (McPherson & Sauder, 2013), the organisational level (Battilana & Dorado, 2010; Pache & Santos, 2013), and at the field level (Purdy & Gray, 2009). Early research on this complexity focused on the dangers that organisations experiencing institutional complexity must overcome if the tensions remain unresolved (Pache & Santos, 2010; Reay & Hinings, 2009). These include internal challenges in maintaining the unity of identity of organisational members (Battilana & Lee, 2014; Kraatz & Block, 2008), and external challenges over managing organisational legitimacy between external stakeholders each with their own notions of legitimate action (Deephouse & Suchman, 2008). However, Meyer & Höllerer (2010, p. 1251) note that "logics may peacefully coexist,

compete, supersede each other, blend or hybridise, or reach a temporary 'truce'". Scholarship has since further explored how organisations survive under, or strategically embrace institutional complexity (Besharov & Smith, 2014; Jay, 2013; Pache & Santos, 2010; Smets et al., 2015; Smith et al., 2013). For example, Kraatz & Block (2008, p. 261) posits that an organisation that can embody the values from the perspective of multiple different institutional logics and achieve success from each logic's prescription results in an "especially legitimate" outcome. How these organisations incorporate different parts of institutional logics in response to institutional legitimacy is the subject of research on hybrid organising and shall be discussed further in the next section.

Both (Greenwood et al., 2011) and (Raynard, 2016) argue that the structure of the organisational field and the configuration and nature of the institutional complexity within the field determine how organisations experience institutional complexity. Building on prior work (Raynard & Greenwood, 2014), Raynard (2016) conceptualised that the configuration of institutional complexity depends on the interactions of three factors: the level of incompatibility between the prescriptions of the logics; whether the field has a settled prioritisation of logics; and the extent that the prescriptive demands of logics lay claim over overlapping jurisdictional spaces. These factors lead to four different configurations of complexity: 1) segregated complexity, where each logic only holds influence over a set domain of actors and activities; 2) restrained complexity, where hybridity and conflicting demands exist, but one logic holds priority over the other at the field level; 3) aligned complexity, with compatible and reinforcing logics but competition exists as to where and how they can be applied; 4) volatile complexity, the most unstable and hardest to navigate as there is no agreed upon relationship between competing logics. An analytical model of how these interact can be found at Figure 1.

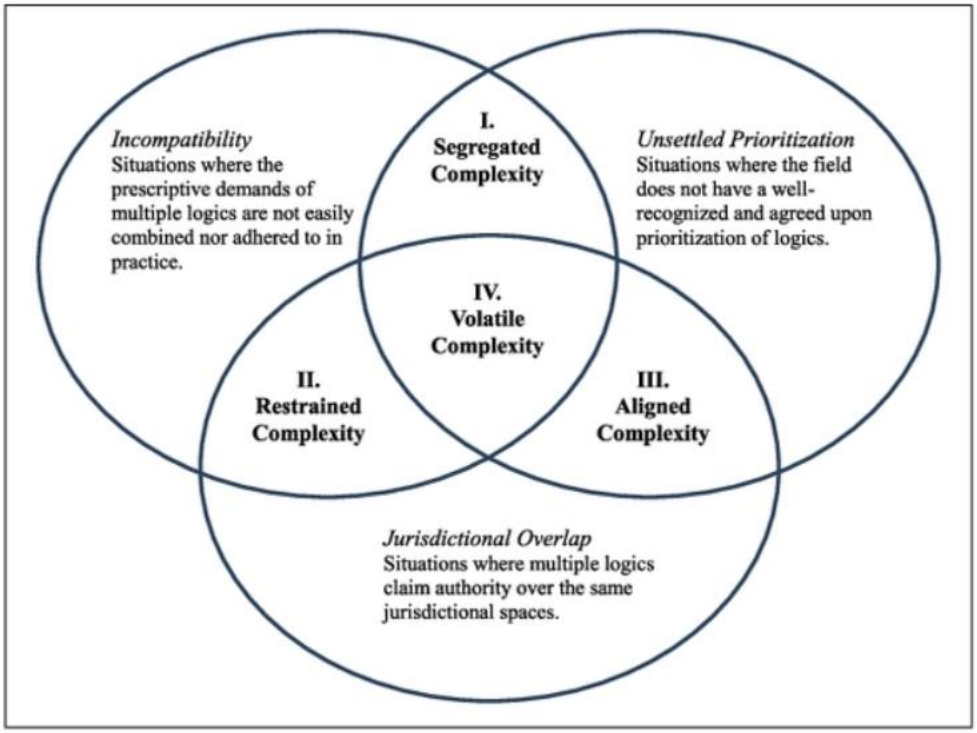

Figure 1. Analytical model of the components and configurations of institutional complexity. Adapted from Raynard 2016.

The positioning of agents and organisations in relationship to their organisational field also impacts the kind of institutional complexity experienced (Greenwood et al., 2011). In their study of the institutional complexity within emerging hybrid fields, Birkholz and Santos (2015) theorised that which type of institutional complexity hybrid organisations face is influenced by their proximity to other mature fields (Greenwood & Suddaby, 2006; Raynard & Greenwood, 2014). Looking specifically at the emerging field of impact investing, Birkholz and Santos (2015) theorise that there are three categories of impact investors depending on how close they are each competing logic. Either experiencing volatile complexity (even combination of logics) or restrained complexity (combined with a preference for one logic) (Figure 2.2).

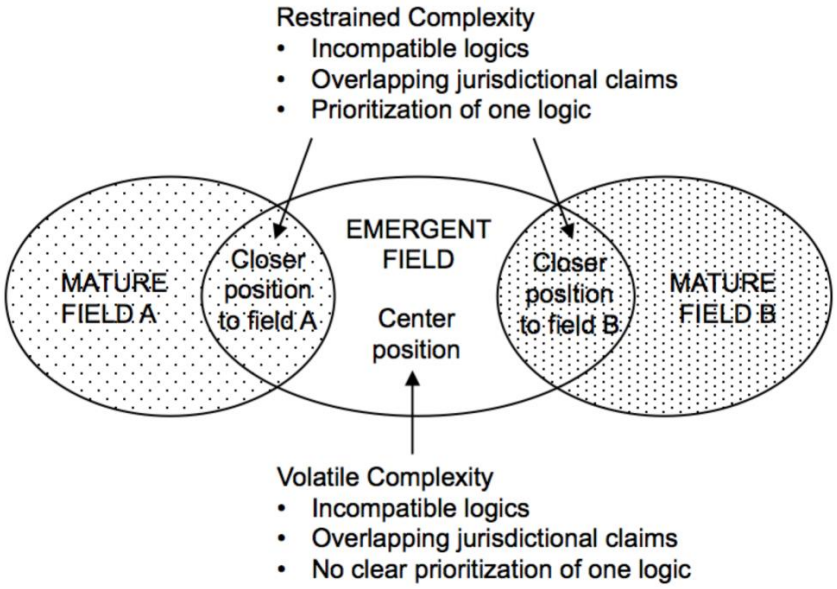

Figure 2. Volatile and restrained complexity in relation to field position. From Birkholz & Santos 2015

As we have covered the different configurations and dimensions of competing logics at the field level, how do organisations respond to organisational complexity?

2.2.3 Organisational Hybridity

From an institutional logics perspective, organisational hybridity occurs when multiple institutional logics and identities that would not conventionally complement each other, are combined in an organisational setting (Battilana et al., 2017; Battilana & Dorado, 2010). Hybrid organisations defy the maxims of early neo-institutional theory that organisations must conform to organisational structures in order to gain legitimacy (Battilana et al., 2017). While attaining legitimacy is still a key concern for hybrids (Kraatz & Block, 2008), hybrids are commonly the site of creativity and innovation (Dalpiaz et al., 2016), and use this creativity to enhance legitimacy and gain access to resources (Wry et al., 2014). Literature on hybrids have researched many different organisational settings, for example, private-public partnerships combining state, market, and civil logics (Jay, 2013), or combining a market-based business-like health care logic with a medical profession logic in heathcare settings (Reay & Hinings, 2009). Particularly, academic focus on hybridity has been placed within the study of social enterprises, conceiving them as the ideal-type hybrid (Battilana & Lee, 2014). Social enterprises aim to use market solutions to address social problems (Mair & Martí, 2006) and include organisations such as microfinance organisations, non-profits, and impact investing. Impact investing will be covered in more detail in the following section. The fact that social enterprises combine both a social logic (solving a social problem) and a market logic (maximise

profit) means that these logics are typically make incompatible prescriptions about legitimate action but both logics are essential to the core activities of the business (Besharov & Smith, 2014; Kraatz & Block, 2008). Therefore, social enterprises more likely to be loci of competition and contestation as these organisations negotiate what is the best strategy or direction (Battilana & Dorado, 2010; Besharov & Smith, 2014). Failing to manage the thin line between their social and economic goals, social enterprises experience "mission drift" (Battilana et al., 2012). So how do hybrid organisations respond to these competing logics – how do they navigate institutional complexity?

Kraatz and Block (2008) identify four basic strategies which organisations enact to manage competing institutional demands. The first is to try and eliminate institutional pluralism by marginalising or deleting logics. The second is to compartmentalise the competing logics in different parts of the organisation. The third strategy aims to manage competing logics by integrating them into an organisation. The final is that organisations merge competing logics to forge a new identity of their own to "emerge as intuitions in their own right" (Kraatz & Block, 2008, p. 251). Greenwood and colleagues (2011) drawing on prior research, make the distinction between "blended" and "structurally differentiated" hybrids. Blended hybrids, similar to Kraatz and Block's (2008) strategy of integration, mix organisational practices taken from different logics into the same part of the organisation. Structurally differentiated hybrids compartmentalise logics into separate units within an organisation. This bears similarities to selective coupling strategies where discrete elements of competing logics are strategically incorporated to satisfy multiple intuitional demands (Pache & Santos, 2013). As part of their conceptualisation of different configurations of institutional complexity, Raynard (2016) provides examples of organisational responses for each type of complexity.

2.2.4 Impact investing

Technically classified as a form of social entrepreneurship, impact investing is a growing class of investing strategies that aims to both generate positive social and environmental impacts while also generating a return for the investor (Nicholls & Daggers, 2016). The term as well as the philosophy behind it, came out a desire from the worlds of institutional finance and philanthropy to ensure that investment decisions should positively impact the world beyond simply generating financial returns (Bugg-Levine & Emerson, 2011; Quinn & Munir, 2017). The terminology for what specifically defines impact investing or impact investments has developed over time and is often the subject of discussion and debate (Agrawal & Hockerts,

2021). For the purposes of this thesis the impact investments defined as "investments made in companies or organizations with the intent to contribute measurable positive social or environmental impact, alongside a financial return" (IFC, 2020). How impact investors ensure that their investments achieve both financial returns as well as a measurable impact, a 'blended value' (Emerson, 2003) or 'double bottom line' (Wilburn & Wilburn, 2014), has been the focus of multiple studies (Agrawal & Hockerts, 2021; Nicholls & Daggers, 2016). There is some literature on the decision making process of impact investors (Lee et al., 2020), and of the ex-ante impact assessment models that could be used by impact investors during portfolio management (Corvo et al., 2021; Johnson & Lee, 2013). One topic of discussion with the field is whether true impact investments should aim to accept a lower financial return in order to maximise impact (Brest & Born, 2013).

As impact investing had its origins in the financial investment sector and the philanthropic sector, it incorporated the institutional logics from each of those sectors. Impact investing is a prime application of organisational hybridity and institutional complexity as it is an emerging hybrid field with competing commercial and social logics (Battilana & Dorado, 2010). A breakdown of the characteristics of each institutional logic can be found in Table 1 below.

Table 1. Properties of the institutional logics found in impact investing. From Birkholz and Santos 2015.

Levels of Differences/Institutional Logics	Commercial Logic	Social Logic
Ownership	Group/Individual owns the enterprise through investment or equity (Pache & Santos, 2011)	Group/Individual protects and spreads the social mission (Pache & Santos, 2011)
Sources of legitimacy	Return on investment, performance, effectiveness, efficiency (Nicholls, 2010)	Hero entrepreneur, beneficiaries, social change, disruptive change (Zahra, Gedajlovic, Neubaum, & Shulman, 2009)
Mission	Efficient allocation of resources; earned income while serving the society (Ruebottom, 2013)	Socially relevant and innovative solutions to serve the society (Neubaum, & Shulman, 2009)
Central values	Self-interest, consumer rather than the beneficiary, earned income, growth (Tracey & Jarvis, 2007)	Social value creation, equality, social justice (Zahra, Gedajlovic, Neubaum, & Shulman, 2009)
Model of governance	Governance towards defined objectives and performance, linear and rational (Ruebottom, 2013)	A democratic form of governance, high importance on the interest of beneficiaries (Ruebottom, 2013; Defourny & Nyssenes, 2012)
Logic behind decision	Profit maximization and fulfilling fiduciary duty (Battilana & Dorado, 2010)	Social value creation, welfare (Battilana & Dorado, 2010)

In their framework of institutional complexity within the impact investing field, Birkholz and Santos (2015) outline different organisational configurations of impact investors under either restrained or volatile complexity. Impact investors experiencing restrained complexity (conflicting logics with one prioritised) can either enact a symbolic coupling strategy or a

hierarchically structured configuration. Symbolic coupling is when organisations are able to appear externally as hybrids but do not actually integrate the unprioritised logic into their organisational practices. A hierarchal structured configured hybrid incorporates elements of the unprioritized logic however they retain a clear preference to the dominant logic. For impact investors experiencing volatile complexity, there are three types of responses to manage the uncertainty and conflicting demands inherent in this type of complexity: a federated, network-modular, and generative hybrid. Federated hybrid impact investor organisations place each logic in its own unit that all work in concert to achieve the organisation's hybrid goals. Network-modular hybrids employ a decentralised organisational structure focused on co-ordinating individuals each embodying different logics in a task-by-task manner. Generative hybrids integrate both different logics within the same team, with the intention to generate novel organisational practices and norms.

2.3 Summary of theoretical framework

Neoinstitutional theory focuses on the macro level societal structures that are responsible for how institutions proliferate, change, and compete at the level of individuals, organisations, and society at large. In this theory organisational behaviour is explained by the need for legitimacy, which is the main currency to attract resources needed for the success and survival of the organisation. Organisations experience isomorphic pressures to conform to the set structures and ways of organising of each institution. In exchange for conforming, organisations become legitimate in the eyes of that institution. Each institution contains within it an institutional logic, a series of assumptions, values, beliefs, and norms, that both enables and constrains action, and determine what actions are considered legitimate. Institutional logics operate at all societal levels and can overlap with each other. This quality, that multiple logics can exist in the same context, enables for individual actors (be they individuals or organisations) to choose between the sometimes contradictory prescriptions of those logics.

When organisations experience multiple conflicting logics the term institutional complexity is used. While earlier research in the field thought that tensions between competing logics would result in one logic achieving dominance over the other, academia has found many examples where tensions remain within organisations and organisational field for near indefinite periods of time. Organisations can experience different types of institutional complexity depending on a variety of factors, such as the maturity of the field, the compatibility of the competing logics, the jurisdiction of the logics within the organisation, and the position of the organisation in comparison to other mature fields. Organisations can respond to this complexity by either

resisting the influence of one of the competing logics, managing the tensions by incorporating elements of one or more logics, or by embracing complexity and attempting to merge logics into a new organisational identity and form.

Organisations that incorporate elements of different logics that would not usually go together are called hybrid organisations. Hybrid organisations experience greater challenges in managing their legitimacy as they often have to satisfy multiple stakeholders with multiple different logics. However, hybrids can take advantage of the institutional complexity to come up with creative and innovative ways of organising that may increase legitimacy and their access to resources.

One of the more studied types of organisational hybrids are social enterprises, which combine a social logic which prioritises creating social value, with a commercial logic which aims to generate financial value. Impact investing is one form of social enterprise. Impact investors invest with the intention to generate a measurable positive social or environmental impact, alongside a financial return on their investment. Impact investors, like other organisational hybrids, experience different types of institutional complexity. Restrained complexity is when one of the competing logics is prioritised over the other, and volatile complexity, is when both logics compete with no agreed-upon priority over the other. Impact investors can respond to these different types of complexity in multiple ways, from making symbolic efforts to appear more hybrid, to trying to generate novel ways of organising and investing.

Chapter 3: Methodology

This section will cover the methodology adhered to by this thesis, outlining the research procedure, and data analysis methods, before outlining some of the limitations and considerations associated with this methodology.

The research itself is an exploratory study of New Zealand deep tech investors' organisational environment, specifically focused on identifying possible hybridity at the field and organisational level and how this hybridity is managed and experienced at the individual and organisational level. The institutional and organisational environment of deep tech investing is not well studied. Looking at the deep tech investment field, different types of investor populations exist. Impact investors make up a significant portion of this population. Academic research on this investment strategy is more established; however, this branch of scholarship has not looked at deep tech impact investors. Given this lack of extant literature, an exploratory research design is appropriate to build on the links to established fields with data collected from leading actors in the field.

A qualitative research strategy using abductive reasoning was employed in this study to best conduct the exploratory research. Data was collected through 12 semi-structured interviews of 13 participants. Of these; seven subjects were investment managers or partners at deep tech venture capital firms, four subjects were categorised as impact investors who have made investments into deep tech ventures, two were associates in a deep tech venture capital firm, and one was an executive director of a university technology transfer office investment fund. Each of these participants provided a unique individual perspective on the research phenomena (Robinson, 2014).

The geographical context of the research and the small sample size of the participant population limit the generalisability of the findings of this study. However, the intention of this research project is that the analysis, insights, and possible hypotheses generated in this study can assist further research efforts in developing explanatory theory or generating more generalisable findings.

3.1 Qualitative Research Strategy

In order to achieve the aims of this study, a qualitative research strategy using abductive reasoning was employed. Qualitative research creates well-grounded, rich descriptions that can lead to new findings and generate and refine conceptual frameworks (Miles & Huberman,

1994: p 1). Abductive reasoning uses inductive and deductive reasoning elements to combine existing theoretical knowledge with new phenomena to best either extend or generate theory (Timmermans & Tavory, 2012). This approach is well suited to exploring how deep tech investors experience and respond to field level hybridity, and the exploratory nature of this research justifies its application.

Following this exploratory qualitative approach, this thesis sought to interview a range of New Zealand deep tech investors. The aim of conducting interviews was to explore institutional phenomena at the field and organisational level in-depth. These phenomena can be seen within each interview and in aggregate by comparing interviews. A multiple case study approach has been recommended as a suitable methodology to study institutional and organisation level phenomena (Beckmann & Padmanabhan, 2009; Ghauri & Grønhaug, 2010; Skarbek, 2020). Multiple case studies allow for in-depth empirical descriptions and can describe the development and change of research phenomena over time (Saunders et al., 2016). However, due to the time and resource constraints of a master's thesis, it was decided that performing semi-structured interviews across a range of deep tech investors was the most practical method for exploring and achieving the research aims.

3.2 Instrument

3.2.1 Semi-Structured Interviews

To achieve the research aims of this exploratory study, the research instrument used for primary data collection was semi-structured interviews. Semi-structured interviews utilise an interview schedule though there is flexibility in the sequence of questions and provide freedom in asking follow-up questions based on the initial responses of interviewees (Bryman & Bell, 2011). This flexibility allows the researcher to direct the flow of the interview in new directions to their discretion, allowing for further investigation of new or unexpected ideas raised by the interviewee. This approach lends itself to thoroughly investigating the research aims while allowing interview participants to provide complete and detailed responses on their own terms. The result is data that is rich and in-depth, uncovering ideas and perspectives that would have been missed if a more structured and strict interview approach was taken.

The interview schedule employed included a mix of different types of questions, including open-ended questions designed to allow for a complete illustration of the discussed topic. Typically, these were followed by a series of follow-up questions that directed the interview closer to the research topic or probing questions where interviewees were asked to elaborate

further upon a particular point they had stated. Before carrying out any interviews, the interview schedule was reviewed by the researcher's academic supervisor to see if the questions were appropriate to meet the research aims. The interview schedule was refined during the first three interviews in consultation with the supervisor.

The interview questions were grouped into four topics: history and background of the investor and fund, investment process and consideration for non-financial outcomes, the personal and professional motivations of the investor, and their perspectives on the deep tech ecosystem itself. The interview schedule is outlined in Appendix A. The first section focused on the history and background of the investor; this was essential in gaining an understanding of the investor's history and understanding their initial approach toward non-financial outcomes in their investment process. The following section delved deeper into their investment process, covering topics around their criteria for deal selection, factors for investment decisions, and the role of the technology and its potential impact in their investment process. The final sections inquired about the participant's personal motivations for being in the sector. These allowed for a deep investigation of the participant's perception of their work and their perceptions of the potential of the deep tech and impact investing ecosystem. The participants in this study were allocated by whether they made impact claims (including impact investors) and those who did not. Thus, it was appropriate to replace specific questions in several sections to uncover information relevant to the research aims. For the investors without impact claims, these questions investigated their relationship and interactions with other impact investors in the ecosystem or their experience investing in mission or impact-driven companies.

3.3 Procedure

As this study is interested in the institutional environment and organisational field of deep tech investing, it is crucial to recognise that there are different groups of investors within this field. Due to the specialised nature of deep tech investing, typically, investment funds specialise in thematically investing solely in deep tech ventures. These specialised investors have both: traditional deep tech investors that invest purely for financial outcomes; and impact deep tech investors who apply impact investing strategies and whose goal is to generate both a financial return and an impact return on their investments. Overseas, there are many impact deep tech investors; however, New Zealand has a significantly smaller proportion of these funds (Newth & Warner, 2019). Many traditional deep tech funds make public claims of creating impact, either through thematically making 'purposeful investments' or investing to achieve the UN SDGs. Among generalist investors (those investing across sectors), there are both traditional

and impact investors who invest in deep tech. In a global context, the New Zealand deep tech ecosystem is relatively small, so achieving a large enough number of participants to glean phenomena at the field and institutional level is a significant concern. These factors need to be accounted for when deciding which investors this study aimed to research.

With the above in mind, the inclusion and exclusion criteria are as follows: The participants had to be specialised deep tech investors or have made investments into deep tech ventures, The participants had to be either traditional investors or have made impact claims about their investments or investment strategy (this includes both impact investors and 'purposeful investors'), and finally, the participants had to be investors themselves or heavily involved in the investment process. These criteria allow the researcher to capture data across the breadth of the New Zealand deep tech investment ecosystem.

Participants were recruited using two methods, non-random purposive and snowball sampling techniques. Non-random purposive sampling is when the researcher makes the deliberate choice of the participants based on the qualities of the participants (Etikan et al., 2016). This allows for the strategic selection of possible participants that were most relevant to the study's aims. However, the non-random nature of this sampling method limits the generalisability of the findings beyond the sample taken (Bryman & Bell, 2011). The use of snowball sampling was highly complementary, allowing for participants to recommend and introduce prospective participants that may have been missed using purposive sampling alone (Ishak & Abu Bakar, 2014).

In this study, a total of 12 semi-structured interviews were conducted with 13 participants. Of these participants, seven were investment managers or partners at deep tech venture capital firms, four participants were categorised as impact investors who have made investments into deep tech ventures or were specialist deep tech investors, two participants were associates in a deep tech venture capital firm, and one participant was an executive director of a university investment fund. Further participant information is displayed in Table 2 below. The total length of time across all interviews was 10 hours and 7 minutes, with the average interview lasting approximately 50 minutes.

Table 2. Overview of the participant sample

#	Name	Job Title	Stage of investment	Investment Focus
1	SA1	Senior Associate	Early Stage	Deep Tech
	A1	Associate	Early Stage	Deep Tech
2	ED	Executive Director	Preseed and Seed Stage	Deep Tech
3	IM1	Investment Manager	Early to Growth Stage	Deep Tech
4	IM2	Investment Manager	Early Stage	Agriculture & Food Tech
5	IM3	Investment Manager	Early Stage	Impact Investment
6	IM4	Senior Investment Manager	Early to Growth Stage	Biotechnology
7	P1	Partner	Early Stage	Impact Investment
8	P2	Partner	Early Stage	Deep Tech
9	P3	Partner	Early Stage	Climate Tech Impact Investment
10	P4	Managing Partner	Early Stage	Impact Investment
11	P5	Venture Partner	Early Stage	Deep Tech
13	P6	Founding Partner	Early Stage	Life Science Impact Investment
12	PM1	Programme Manager	Early Stage	Deep Tech

For recruitment, participants were initially introduced to the researcher via email by the researcher's academic supervisor. After the introductory email, the researcher followed up with a standardised email containing information on the research and an invitation to participate in the study. Once the participant agreed to participate, the researcher emailed the participant information sheet and consent forms while addressing any specific questions held by the participant. The date and time of the interview would be arranged, with digitally signed consent forms sent to the researcher before the interview. Snowball sampling was highly valuable as it allowed participants to recommend further participants who had expertise relevant to the research topic. Here participants would introduce new people via an email introduction to the researcher.

Due to the barriers caused by a Covid-19 lockdown, 11 interviews were conducted over Zoom, and with the consent of the participants, the interview was recorded for later transcribing. One interview was in person. In that case, an audio recording was taken. All audio recordings were

immediately transcribed using the automatic transcription software Otter (otter.ai). Each transcript had two separate processes of review. Firstly, the researcher reviewed the transcript to correct mistakes as close to the time of the interview as possible. Then the transcripts were reviewed using the intelligent verbatim method, where edits were made to the transcripts to remove excessive repetition and verbal fillers. This method results in a more readable transcript without altering the meaning of the dialogue (McMullin, 2021). Then a copy of the transcript was sent to the participant, providing them with the opportunity to check and make any edits within 14 days.

3.4 Data Analysis

After the interviews were transcribed and reviewed, the transcripts were analysed using the qualitative software package NVivo Release 1.0 (QSR International). As previously stated, this study employed an abductive reasoning approach which involves iteratively moving between data and theory (Timmermans & Tavory, 2012). The analysis method for the transcript data consisted of three rounds of coding, namely open, axial, and selective coding (Strauss & Corbin, 1990; Strauss & Corbin, 1998).

The first stage of analysis was a round of open coding, where the researcher examined the data to identify initial concepts and group them into first-order categories. This was essentially a purely inductive process, coding any piece of relevant or interesting information. The researcher aimed to keep an open mind and let this first round of codes be representative and grounded in the data. The next stage of analysis employing axial coding was preceded by an investigation and review of institutional literature. This stage searched for the relationships between and within codes and grouped and refined the first-order categories into second-order themes. This process was not linear, rather the researcher moved iteratively between emerging concepts within the data and extant literature until the second-order themes crystallised to a satisfactory standard (Eisenhardt, 1989). This allowed the findings to be anchored in both the empirical data and the literature. Finally, selective coding was then conducted, identifying two core themes under which the second-order themes fell. Each of these themes, Hybridity and Legitimacy, consisted of an aggregate theoretical dimension of institutional theory. These two theoretical dimensions formed the basis for the framing of the discussion of this study.

Figure 3 below displays the data structure, showing the categories, themes, and dimensions that make up the model

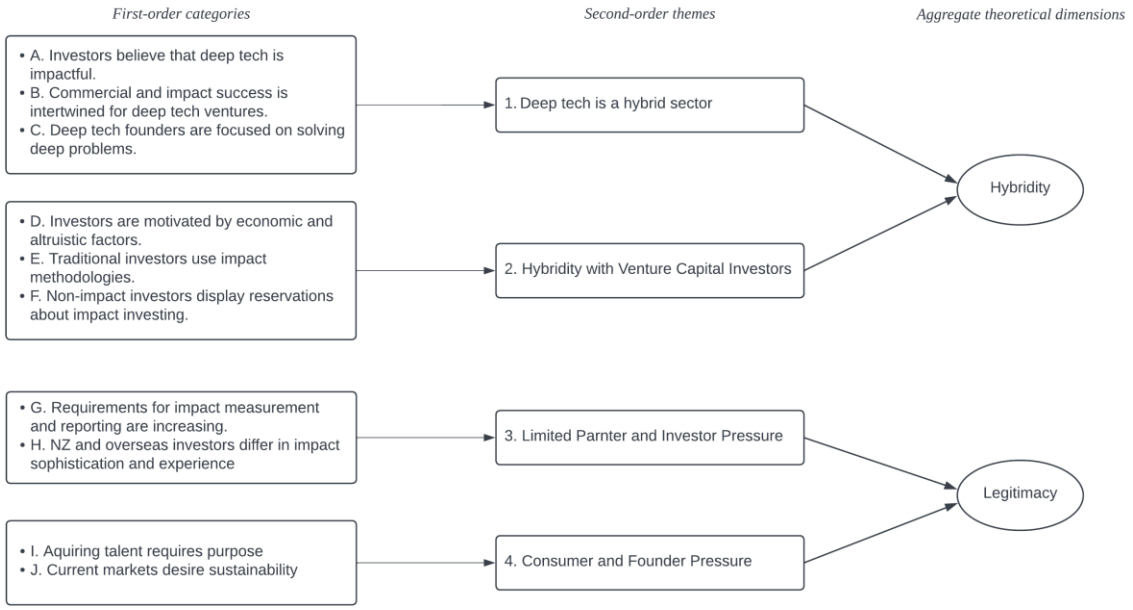

Figure 3. Data and analysis structure. Figure adapted from Tracey et al., (2011).

3.5 Ethical Considerations

This study ethics procedure was approved by The University of Auckland Human Participants Ethics Committee (UAHPEC) on the 11th of September 2018 for three years (revised 9th April 2019) (Protocol No: 022768). As per these regulations, a participant information sheet and consent form that contained a detailed overview of the study was provided to each participant prior to interviewing and ensured the participant gave informed consent. These documents contained information on the ethics regulation, data retention policies, and possible future publication.

Participants were informed of their right to withdraw and that all confidential or identifying would be removed and anonymised. Participants' transcripts were also de-identified, referring to them by a unique code known only to the researcher (e.g. Interview 1, Investment Manager IM1). Additionally, all information concerning this study has been held securely, and all data in the form of audio recordings and interview transcripts were permanently deleted at the conclusion of the study. Finally, any remaining information will be stored on the University of Auckland secure network and will be deleted after six years.

3.6 Reliability and Validity

In the context of qualitative research, reliability and validity are concepts to measure and evaluate if the research is of sufficient trustworthiness, rigour, and quality (Golafshani, 2015). Reliability refers to how reproducible the research is in replicating processes and results, while validity refers to the ability of the research approach to find results congruent with reality (Leung, 2015; Shenton, 2004). These essential qualities of research are highly intertwined, highlighted by Lincoln & Guba (1985) as "Since there can be no validity without reliability, a demonstration of the former [validity] is sufficient to establish the latter [reliability]" (p 316). The following paragraphs describe the efforts made to ensure a high quality of research and improve its reliability and validity.

To best improve this study's reliability, the researcher made efforts to report in detail the processes and methods utilised in this study to enable future researchers to repeat the study and, given the same research context, possibly find the same results (Shenton, 2004). Reliability within the study was also improved by standardising the email invitation sent to potential participants and utilising a semi-standardised interview structure across all conducted interviews.

Concerning validity, when developing the interview schedule, the researcher initially made a pilot schedule that their academic supervisor reviewed. After each of the first three interviews, the researcher wrote critiques on the interview schedule and subsequently edited it to improve effectiveness. After these three iterations, the schedule was deemed sufficiently compelling to carry out the rest of the interviews. Member checks, where participants are allowed to review the transcript of their interviews to see if their intent matched what they said, were also used in this study to improve validity (Shenton, 2004). In transcribing interviews, as an automated transcribing tool was utilised, each of the audio recordings was checked multiple times to ensure the final transcript had no transcribing mistakes. In addition, during data analysis, the interview transcripts and audio were repeatedly reviewed, employing a constant comparative approach to ensure that the findings arose from and were grounded in the data (Strauss & Corbin, 1990). Finally, throughout the research process, frequent debriefing sessions occurred between the researcher and their academic supervisor (Shenton, 2004). These sessions were a forum to discuss preliminary findings and develop ideas and interpretations of the data. Probing in these sessions allowed the researcher to recognise their biases and personal preferences to mitigate their influence on the research.

Chapter 4: Findings

4.1 Deep Tech as a Hybrid Sector

4.1.1 Investors Believe that Deep Tech is Impactful.

Deep tech investors identified deep technologies and deep tech ventures aimed to address significant global challenges. Deep technologies, in their view, are uniquely able to use novel innovations in science and engineering to address issues such as global warming, food insecurity, clean energy, and human health. One key rationale for why investments in deep technologies were attractive was the size of the problems the ventures addressed. A global problem presents a global market, and any investment that successfully scales to meet the need would constitute an attractive and lucrative commercial opportunity. The participants singled out investments that address climate change as particularly emblematic of this principle.

> *"If you are solving the world's problems, if you're looking at things like climate change, and you're looking at energy, and you're looking at equity for people, it's usually a science-based solution that makes that possible, or a deep tech solution that makes that possible." – P2*

> *"It's trying to chart a path for VC in New Zealand in a way that's more fit for the 21st century. Taking into account climate as an existential threat, but also as the biggest transition of our economy that we can see coming over the horizon. You know, there's such huge opportunities there, that would be mad not to take them up." – P3*

> *"Deep tech opportunities are often solving big social, environmental problems, if they commercialise and go to scale. It'll be interesting to see if you are investing in technologies which have a big market because they solve problems, or if your expertise is just in the technology for big markets, or whether you consider how you don't let it be about the market opportunity, but instead opportunity problem solving which is beyond just exploiting a commercial opportunity." – P1*

As deep technologies aim to provide solutions for global problems, all participants reported that they thought that deep tech investments had greater potential to generate a positive impact than other types of technology investments. In addition to this, most participants thought that deep tech was attractive to all different types of investors as if the investment was successful, it would generate a strong positive impact and a high financial return. The reasoning was that as deep tech innovations tend to be at the fundamental level of science and engineering, these technologies were naturally more disruptive. In line with this view, it was the experience of many traditional deep tech investors that they had worked alongside impact investors during

due diligence and had made co-investments with impact investors, and vice versa. The first quote below highlights the attractiveness of deep tech to impact investors. The following quote links the nature of disruptive technologies with creating positive change.

> *"In that we work with a lot of impact investors who are interested in deep tech, and I think it firmly comes under most impact investors mandate to use your word. It's pretty obvious that deep tech is impactful." – SA1*

> *"As a general observation, deep tech opportunities tend to lead to larger changes in markets rather than smaller changes in markets, right? So they tend to be more disruptive rather than incremental improvement, generally not universal, where you've got disruption, then you tend to be able to tell more of an impact story. Because you're, you know, presumably, you're making a significant change in a positive direction. Otherwise, why would people buy your stuff?" – P5*

Investors recognised that the development pathway for deep tech was not easy to traverse due to the high risks that define the field. Of these risks, investors identified long development timelines, lack of product-market fit, high technical risks, and few opportunities for appropriate exits as common issues they commonly had to manage in the running of their fund. The most prohibitive barrier reported was how long it took to achieve returns.

> *"The deep tech concept itself, you almost have to be philanthropic because you go put in your money and forget about it because it takes so long. I mean, to be honest, right? It's the patient capital concept." – P4*

Despite these risks, the overall sentiment of the investors was that the potential payoff was worth it. Investors found that this payoff's value was grounded in generating a sizeable financial return and contributing to solving problems. To achieve both ends was a common motivation for all types of investors in this study. Investors indicated that the global market had an increased desire for technologies that address global challenges and that this represented only a recent shift toward this kind of thinking. The quote below illustrates that the last few years have shown that deep tech is a viable investment class with substantial positive impacts, causing this change in investor mindsets.

> *"So deep tech has gone from this kind of niche area, where actually it was at a huge disadvantage, because the typical and I think outdated, venture capitalist view of our area was that the products are too expensive to develop, and the timelines are too long. So the risk is not worth the return. That's in comparison to something like a software product where you've got a low to zero marginal cost in selling the product. You compare that to some of our [deep tech] hardware companies where just because it's a physical product you're gonna have to spend a lot*

of money to make it before you sell it. That's completely flipped on its head in the last couple of years. Partially it's to do with ESG and impact, people can see that you can have outsized returns with deep tech, and that the problems that deep tech is solving are big, and companies are willing to pay for the solving of those problems." – SA1

Investors noted that as deep tech itself is highly risky, whether or not an investment will produce a substantial financial return or a significant impact is binary. These investors believed that deep tech ventures either become successful in achieving both aims or will fail to deliver either.

"It isn't like, you know, do you have an impact of 1000, or an impact of 5000? These are deep tech, they're binary, you're either going to be hugely successful, or we're not going to get anywhere. There's no chance for a scale of this." – P2

"I just honestly think that impact and financial return, are in the long term, synonymous." – PM1

The above point implies that deep tech was inherently impactful. This was a contentious point among investors. There was a broad split between those who thought that it is how the business is structured and commercialised that determines the impact and those investors who thought the product itself had embedded impact. Surprisingly this split did not fall evenly between the lines of traditional and impact investors. Illustrative of this, one impact investor quoted below thought that investing in specific sectors under the deep tech umbrella automatically created a positive impact.

"I think we're lucky in some way because of the sectors we're focused on. Being in healthcare, you're bringing benefits to health outcomes. Being in food or agri [tech], there is some innovation that's improving quality of food, or access of food. Being in green or climate, you're looking at carbon." – P6

However, other impact investors distinguished between the research that underlies deep tech and the ventures themselves. For example, one impact investor pointed out that research activities had embedded impact but that deep tech ventures themselves do not automatically have impact embedded outside the development of the technology itself. This view holds that which applications deep tech ventures prioritise determine the degree of impact. The distinction lies in the motivations of each group; the motivation of the scientist working on developing a technology is considered to be a lot more impact-focused, while the activities of the business could entirely be focused on commercial imperatives, potentially limiting its positive impact.

"What I do see is that there's a number of fields where impact is inherent. And the science or research space is absolutely one of them. I think generally, what the scientists and their like are working on is often an innovation that can significantly improve someone's life, they [the scientists] may not be doing it for the purpose of creating an impact business, for example, but absolutely, they're there because they think this will help the world." – IM3

"There's a number of deep tech initiatives, that are primarily driven by revenue generation. That driver can lead to decisions compromising impact, because the ultimate goal is revenue. Because of that, we don't have kind of a general flat rule that, you know, all deep tech is impact, we would still need to go through the process and understand whether impact is the primary driver of their business, and if they have the ability to deliver strong financial returns, as opposed to primarily being driven by the financial returns." – IM3

Other investors emphasised that even though deep tech ventures could create a significant positive impact, the general growth of the sectors deep tech operates means that the financial incentives are already high enough to motivate investment. This fact can relegate the potential good that deep tech ventures can do to a 'nice-to-have', entirely incidental in the eyes of traditional investors. Most investors believed that more capital flowing into the sector was highly positive, despite the investment strategy used to allocate that investment.

"There's a clear financial benefit, and you'd kind of be silly not to, to invest into these businesses that are delivering environmental impacts in particular. And so for a strictly financial perspective, fund manager X thinks it sees it as more beneficial to support this impact-focused environmental business, than a strictly financially focused business because environmental [focused investments] will make more money in the long term." – IM3

One question that traditional investors were asked was about their experience of co-investing with impact investors and vice versa. Generally, all investors reported complementary capabilities when co-investing. Already specialised in impact, impact investors in New Zealand were said to be similar to generalist funds that lacked the deep domain-specific expertise needed to assess the core science of deep tech companies. Traditional deep tech investors were reported to have little experience assisting their portfolio companies to identify and maximise their impacts. By working together, the impact funds accessed extensive technical capability to assist the due diligence process, and the deep tech funds accessed more complete support for their ventures to achieve their impact. The first quote illustrated the perspective of this collaboration from a traditional investor's point of view; the following quote highlights that of an impact investor.

"We have had a number of people who have defined themselves as impact investors invest alongside of us. The practical challenge has been that we've structured ourselves to have a lot of our team with strong scientific and engineering backgrounds, and real expertise in understanding the technical aspects of these companies. And I think a more generalist impact investor doesn't necessarily have the internal capability to review a deep tech company." – SA1

"The impact and the business model are deeply intertwined and the more impact you'll deliver, often the more money that can be made. But by with these investors not having the deep impact expertise, and not intentionally managing and maximising the impact, which is what an impact investor should be doing, you're not getting the full advantage of that business, you're not maximising their impact as much as you're trying to maximise the financial returns." – IM3

4.1.2 Commercial and Impact Success in Deep Tech Ventures

In this study, investors were asked if the impact of an investment factored into their investment process. While many traditional investors did not use impact measurement or metrics during their due diligence, investors of all stripes thought non-financial measurements and reporting made good business sense for their portfolio companies and their fund as a whole.

"It's archaic thinking to think that going through the policies and procedures is a kind of tax on a company in relation to ESG. My view, it's just good business in the modern world. If you're not having impacts and not thinking through things like ESG, well beyond the policy in place, you're not going to have a good chance of being a successful business." – SA1

"As I said before, you just put a sexy word call it impact, but actually we do it anyway. It's just good business sense. That's why I'm like this should be natural, but you shouldn't put it on a pedestal one way or the other, you don't overstate it or understate, it's just something you do." – P4

Expanding on what ways the pursuit of positive social and environmental impact provided 'good business sense', deep tech investors felt that there were numerous advantages to requiring businesses to have an impact lens. One set of these relates to how the business is viewed externally. Most investors talked about the benefits of having an 'impact story'. An impact story is a complete narrative of how a company currently or plans to achieve impact. These are analogous to a logic of change method (Ebrahim & Rangan, 2014) of identifying impact. Ventures that had an impact story could attract key talent members, form partnerships easier, and gain advantages in raising capital. The quotes below support these points; the first quote illustrates the abovementioned advantages. The second quote highlights how having an impact framework (including an impact story) increases the chance of getting funding.

Interestingly the quote suggests that having a clear idea about impact is more necessary when dealing with overseas investors.

> *"But you can still say that this investment could potentially have impact, right? So if you highlight those [impact] stories, then I can tell a better story for the company, which can help achieve more success. In my mind, you have to actually achieve it as well." – P5*

> *"When they [start-ups] go to raise capital from another investor, they've already got that framework in place. When we invest in our companies, we're trying to build them for the future. We help them establish frameworks and systems that make them more investable. So if they are trying to raise a series B round in the US, and we're looking to give the best shot of them raising capital and attracting blue chip investors, then they have to have this stuff in place. Or the risk is if they don't have it in place, then it will be harder to raise money. And it's hard enough anyway." – IM4*

Other advantages of having an impact lens were more internally focused, such as improving how the ventures grow and maximising their market and long-term returns. Investors thought that a clear idea of the impacts of prospective investments increased their understanding of the investment's potential. Regarding due diligence, engaging with stakeholders or end-users was found to give the investor early and reliable indications of whether the venture would address the problem it aimed to solve and positively impact the users.

> *"When we're evaluating the TAM [Total Addressable Market], effectively is when we're starting to think about impact. And usually that's a combination of, the higher the impact that it's going to have, most likely, the higher the return that we're going to get from it." – IM2*

> *"For example, if you make an investment and you don't talk to the beneficiaries, whether it's the doctors or the practitioners, or if you don't talk to the users. Which in our model, it lends for impact… So really, when we go and do those things, as part of our assessment, it makes good business sense. Why make something that doctors can't use because they can't integrate it into their practice, their workflow, or how they get paid? Or why create something that doesn't work for the patients? So for us, it's actually good business sense to do that measurement. It's not an inconvenience," – P4*

Among impact investors, implementing impact measurement and reporting in their portfolio companies was seen as something that aids in the growth of their start-ups. Investors emphasised the benefits of placing metrics and reporting practices early in the start-up's life cycle. These metrics provide goals that can help identify what areas of the business may be weak and push the business towards the next stage of growth.

It's also the kind of thing that is not always urgent, so the company can put that on the to do list. Whereas if we can push them into doing it, we think that's going to make them a stronger company for the next stage of their growth. One of the things that we do is to always push people to use recognised metrics. – P3

Investors had contrasting views on whether it was necessary or beneficial to themselves or their portfolio companies to measure impact at all. A repeated sentiment was that if positive impact is embedded into deep tech ventures, then the business's financial success is indicative of achieving positive impact. The first quote below is of a non-impact investor who used the tight relationship between financial and impact returns to justify not measuring non-financial outcomes. Some investors took the notion of financial and impact success being tied one step further. The second quote is from a deep tech impact investor who explicitly stated that all non-financial outcomes are financial outcomes.

"The nice thing is that, at the end of the day, impact and financial returns for us, are completely tied. So if we make a big return on a drug, our investment thesis would have been that that drug has the potential to change people's lives." – IM4

"We're working with the hypothesis that all outcomes are, ultimately financial outcomes. We're moving in the general direction that everyone cares about impact, whether that's the company, their suppliers, their customers, their investors, regulators, all of them. So, what we're seeing right now is this sort of sharp split between financial returns and impact returns. But I think that's rapidly eroding, and I think that will go away." – P3

4.1.3 Deep Tech Founders Focused on Solving Deep Problems

Early-stage investing has a strong focus on the founding team's quality, which holds true in the deep tech context. The investors studied all ranked founders and their qualities highly on what constituted a good investment. Some of the most important things that investors reported looking out for were the founders' motivations and level of dedication. Understanding what motivates the founding team was an essential part of due diligence for many investors interviewed. All investors had a preference for founders whose primary motivation was solving a particular problem over making a profit for themselves. This preference is rooted in a belief that the more dedicated a founder is towards solving a problem, the more de-risked the investment is perceived to be. These founders are more likely to navigate shifts in product and market and finish with a company that still achieves its' broader mission. Both traditional investors and impact investors held this view.

"But one of the ways we mitigate that risk is we're also looking really closely at the founders that we invest in. And absolutely, we only invest in founders who fundamentally care about improving the world as well." – IM3

"It's also pretty telling about what drives them. You know, there's going to be times where they are driven just by solving the problem, not getting out of bed and going, "well, if I do this, do I get a little bit more money?" You know, they're quite different mindsets and you can tell which one we would back and which one we wouldn't." – IM4

"It's early stage VC, so it's really about the founders, and them having a deep understanding of the problem they're looking to solve. Ideally, a systemic understanding… because they will change the business to change an idea to be what it needs to be."– P1

"But for us, as soon as any kind of serious money goes in, there needs to be almost a maniacal individual leading the company and that's been our experience as to the companies we've been involved on that have been most successful. It's actually the sheer power of will of some individual to make it happen. I think it's something you need in the modern world just to create something" – SA1

One common characteristic among deep tech founders are scientific and research backgrounds. Investors thought that science-based founders had different motivations compared to their pure business-based counterparts, namely, a predilection for targeting big global problems. Science-based founders wanted their technology to reach the world and achieve its impact, which influenced where these founders ended up in their company. If they lacked the commercial acumen, investors needed to work with these founders early in the process to make the startup investment-ready. As the quotes below highlight, investors know that many scientific founders are motivated by getting their science out of the lab, whether they end up running their start-up or not.

"The technical founders don't necessarily have the three C's [Capability, Connection, Capital]. Because these are PhD students, and you know they've got a different profile from [typical] startup founders. Some of them just want to do the science. and they don't necessarily want to be CEO of a startup, or make lots of money on listed companies, or do whatever, they just want to good." – P4

"I can't think of many more stimulating places or ways to work as a scientist than to actually see your research to go beyond journals to actually become products that are being used around the world and making a difference." – IM2

As founders are deeply motivated to solve problems they passionately about, they naturally look for investors who reflect their values. This fact is not unknown to investors. By marketing themselves as impact, or purpose-led investors, these funds attract founders that naturally have more impact-focused ventures. The first quote below is from an impact investor confirming this view. The logic of mission-driven VCs attracting mission-driven founders was reported by other non-impact investors, such as in the second quote below.

> *"That's one of the reasons why people want our capital over others is that we focus on this [impact] stuff and they know we will support them on it. It will be aligned, the intent of our capital aligned with the impact of they want to achieve." – P1*

> *"I think there's a flow-on effect. And the impact funds that truly believe that "we are investing in founders that want to change the world". Those funds will attract those founders. And those founders won't be doing dodgy stuff. Hopefully." – IM4*

That same non-impact VC (IM4) in the quote above said they had recently started recording and reporting several impact metrics. One benefit the investor emphasised was the showing their founders these impact reports further motivated these founders with a scientific background.

> *"You know, the other thing too, it [having impact metrics] resonates with our founders. The reason most of our research and science-driven founders do what they do is because they want to make a difference. I don't think any of them are doing this and saying, "Oh the reason I bought you this opportunity was because I think we can make a crap tonne of money out of it". You know, they're all coming [to us] because, "Hey, I think I've got a solution to this big issue. It's really early, but I think there's an opportunity here to create a product or a treatment for, whatever the disease or health issue it might be." – IM4*

4.2 Hybridity within Venture Capital Investors

4.2.1 Investors Motivated by Economic and Altruistic factors.

This study asked investors what motivated them to work as a deep tech VC. At the level of specifics, there was a wide range of responses. However, two separate categories of motivations emerged. Primarily non-impact investors held the first category of motivations where they stated that they were motivated by financial and non-financial reasons. For example, a common sentiment here was that they want to make a difference in both their field and the world and get paid for doing so. The quotes below highlight this dual rationale:

"Ask anyone in the team including me. It's if we get our job right, maybe we can cure cancer. It's hard to have any other reasons for doing it and don't get me wrong, I'm not doing it for free. But it's pretty nice to be able to go: Hey, we're going to invest this money, and we're going to work our butts off to try and make it a success. And if we are successful, this could lead to a treatment that means a kid with glioblastoma actually spends some time with her family." – IM4

"[A primary motivator is] being part of something that has an impact and does something that's going to be beneficial to the world and to industry, it's being part of it and cheering them on to that success. You know, financially, we're not investors just there for the fun of it. We are trying to make a good economic return." – IM2

Aligned with these dual financial and impact motives, other investors talked about the meaning and fulfilment that working on projects that align with their personal values gave to them. In the quote below, one investor talks about why working on health and climate tech is important to them. Before talking about this, the investor stated that they do not actively seek investment opportunities of this kind but instead find them enjoyable and meaningful when investments in these sectors come across their table.

"If you can create certain value and can see the company's success when it aligns with your personal interest and vision, I think that's really enjoyable process. To me, both health tech and climate tech means so much me. Health tech is about people's health. Without health, no amount of money means anything. For climate tech, the Earth is in danger, yes you've got a lot of wealthy businesses and prosperous countries, but the planet is deteriorating.... if I can through my job, get investors to help invest in those areas I think that's very meaningful." – IM1

The other category of investor motivations for being in deep tech was defined by a lack of outward financial gain and a focus on altruistic goals and motivations. Nearly all of the impact investors in this study displayed this motivation. However, a significant number of traditional investors shared these same altruistic motivations.

One common altruistic motivation held by both kinds of investors was a desire to help build the New Zealand science and innovation sector. This motivation was common among Investors with a scientific background. These investors believed in science and technology's power in improving people's lives. Thus, growing the innovation sector in New Zealand increases the impact that high quality New Zealand science can create on a global scale. The first quote below exemplifies this. The motivation in the following quote is more focused on the positive

economic consequences of a thriving deep tech sector. The last quote shows a more general altruistic outlook.

> *"I would like to be doing work that makes a difference to people's lives. I would like to be achieving impact. I know that it's very hard to quantify and so I'm not going to try and do that. But I guess the realisation that I had around a year ago was that I didn't get into this role to help make rich people richer. I got into this role because there's lots of really great science and technology that exists in New Zealand that just never makes it out." – P5*

> *"I think that the recovery from the COVID economy is going to be through the licencing and spinouts of deep tech. So I'm really interested to be part of that journey. I want to improve New Zealand for the future." – P2*

> *"I've identified that helping people makes me far happier than my paycheck or anything like that. So for a long time, I've been trying to do work that benefits people or the planet in some way. I also really appreciate the power of business. I always have and think it's a really effective vehicle for change." – IM3*

Other investors' altruistic motivations were more extensive in their scope and focused on addressing global challenges such as climate change or food insecurity. A common theme was to utilise their skills as investors to help identify and support possible solutions to what they saw as existential challenges. The first quote below emphasises the belief that deep tech as a sector holds more promise to solve said global challenges. The following quotations highlight this overall theme of needing to solve intractable challenges.

> *"We need to be in deep tech because that's where the real solutions are. So is it personal because science really interests us… This is about if you want to make an impact in the future and change the world for future generations, you need tech to do that. And we believe you need deep tech to do that." – P2*

> *"I'm an engineer, and I like to make things happen. The things that have to happen are so vast and fascinating, so I want to be a part of that. Okay, that's the positive side of it. The negative side of it is, oh, God, we're all doomed. And I think we all have a moral duty at this point, to contribute to the best of our expertise." – P3*

> *"The role we wanted was to agitate the ecosystem and make it more sustainable and inclusive, to provide that aligned kind of form of capital. I think the values and goals aren't really any different from the people that are protesting at COP 26, or the people who are founding ventures and doing the stuff." – P1*

One investor displayed frustration at the lack of deep tech specialised funds, as deep tech takes so long to develop and commercialise, but the solutions are needed urgently. This fact motivated this investor to take a catalytic and patient approach to their investments, motivated to begin the development process as soon as possible even if their contributions (and thus returns) are not so outstanding compared to later entrants.

> *"Some of the investments we're looking at; it's deep tech, it's something that works on a lab bench, it's got to scale up. Let's say some are chemical engineering stuff, the plant size will be a billion-dollar investment and will be 15 years down the track. We'd only be a tiny part of the capital inputs to get it there. But if that whole market sector is heading in that direction, then to be there in 15 years' time, you've got to start now." – P3*

Many impact investors expressed dissatisfaction with the lack of innovation that traditional venture capital investors displayed. Their motivations were driven by wanting to improve how the VC sector operates by presenting an example of what can work or inspiring other investors to try to be more impact-focused. The following quote expresses these sentiments:

> *"Why are we even talking about impact investing? Because we're saying that we have an unequal society. And we've done a shit job with the environment. And now we've landed up in climate change, right?... To generate solutions of the future, we need a different way of doing business, which is impact investing or impact businesses and impact enterprises. Mainstream capitalism, just financially driven venture capital, is what has brought us to a lot of the current issues, right. So that's where we do need to include and think about things a little differently." – P6*

Another traditional investor reported that they were in the process of developing new ways of screening for and assessing the potential impacts of new investments. Like the quote above, their motivations for doing so come from wanting to create novel and modern ways of venture capital investing that are both sustainable and address current and future systemic challenges.

> *"This is sort of beyond ESG or impact assessment, this is trying to futuristically think about what really is going to impact humankind. I personally, feel so overwhelmed by the climate change, that's really at the front of my mind. But I know that what keeps [a colleague] up at night is, what is that AI future going to do to humanity?" – PM1*

4.2.2 Reservations about Impact Methodologies, Despite their Use

While investors thought that there were advantages for deep tech ventures that measured and reported their impacts in some form, investors had reservations about whether the use of impact language, metrics, and stories was necessary on the part of the investor to maximise and achieve

impact. These reservations presented scepticism about whether impact investing strategies were substantially different from traditional ones. The quote below indicates this view, believing that if impact and financial performance were tied in deep tech, the use of impact language was unnecessary.

> *"If you know, someone gets out of bed each day and says, "I want to use AI to diagnose patients more quickly, more effectively, and improve outcomes". That to me, is something that an impact investor would be interested in. But in reality, I think that's something that any investor would be interested in. Because of the purpose, nothing of the impact. They just look at them and go, "Hey, this person's got drive, they've identified the problem". It goes back to what's the unmet need? What's the problem? What's the solution? What's the market? You know, all that stuff. Some of this is just dressing it up with different language. That's my take on it." – IM4*

The investors in this study had varying understandings of what specifically impact investing was and how impact funds operated. Across all levels of knowledge, both non-impact investors and impact investors were wary that some funds overplayed the 'impact' side of their investing. In one example, an investor worked at a fund with no public claims around impact or purpose. However, this fund had an ESG policy, a basic impact framework that prospective investments filled out as part of their due diligence process, and workshops with their portfolio companies to help them identify their impact. In the quote below, this investor made clear that they are not an impact investor and casts doubt on the legitimacy of other impact investors.

> *"We don't try to pretend that we're an Impact Fund, because we're not. Whereas I suspect there are some of those who, if they didn't have an impact focus they would be investing in those same entities anyway. And then they are just trying to justify an impact story afterwards." – P5*

Other investors were more explicitly cynical in their view of more prominent institutional players within the impact investing movement. Small numbers of impact and non-impact investors thought that much of the momentum behind impact investing was being hijacked by other players to greenwash their activities.

> *"There's a tendency in some cases to, at the extreme, use the word impact investing as part of greenwashing strategy." – ED1*

> *"Hence, you do see a lot of the greenwashing in the very well presented programmes, which when you dig into them, the impact is actually minimal or inequitable or inefficient, or all of the other concerns that can be raised against them. So I've got this big concern about some impact investment, basically just reinventing what government should be doing, and doing it badly." – P3*

"But it's just some extent it's greenwashing. It's impact washing. They're not genuinely taking different risks in order to support more impact." – P5

Investors mentioned that many deep tech ventures and impact funds measure their activities against the United Nations Sustainable Development Goals (UN SDGs). In the quote below, an investor expressed concern that many businesses can argue they are working towards at least one or many of the SDGs. This low bar makes impact washing easier for both VC funds and start-ups.

"One of the reasons why some of these funds have started talking about being impact funds, as well as being financial financially led, is because they don't see it as being particularly difficult to measure impact metrics because they're just going against the SDGs. And you can make a pretty good case for almost any company to have some sort of impact against some of the SDGs." – P5

A separate topic of discussion that divided investors was if it was possible to invest for impact without making financial concessions. Compared to other issues, investors were cleanly split by their status as an impact or a traditional investor. Traditional investors' opinions relied heavily on their prior knowledge of impact investing. Those with more understanding of impact investing had the view that financial concessions were essential to investing for impact; otherwise, great impactful businesses that produced mild to moderate returns would be excluded from investment. These investors questioned the overall utility of impact funds if they did not go after investments with a high return on their impact but little to zero financial return.

"So for me, the definition of impact on should be that if you are an Impact Fund, you should be having those impact metrics, you should be monitoring them, you should be requesting them from your portfolio companies, and you should be quantifying your overall level of impact. ***And you should be prepared to take a lower financial return in exchange for more positive impact*** *[emphasis added]. I know that there are impacts funds that call themselves impact funds that don't meet that definition." – P5*

On the other hand, the notion that impact investors had no desire to produce financial returns was more common among investors with less knowledge on the topic. The quote below shows an investor who believed that impact funds are not financially driven. Interestingly this particular investor contrasts this idea with their fund, which is a purpose-driven fund.

"Whereas a lot of impact funds go well, we want the impact, but we don't care about a financial return. That's not us. We're not an Impact Fund. We're a purpose-driven fund." – P2

All impact investors in this study believed that financial concessions were unnecessary to invest for impact. A common belief encountered in this group was that by investing in businesses that fundamentally were trying to do good, then the financial success of that business is tied to achieving the impact. Impact investors showed an awareness of how traditional investors perceived financial concessions as an essential element of impact investing. Of those interviewed, most impact investors believed that their New Zealand colleagues had not had the exposure to successful impact investing examples needed to change their minds. Impact investors highlighted that these perceptions were less prevalent in overseas investors.

> *"At the very very top end of the capital markets, we're talking about investors, institutions and stuff like that. There is still this thinking in New Zealand, that impact means you don't make money, that there are financial concessions to its impact. It [impact investing] is evolving in New Zealand, but it's still in its infancy." – P4*

Despite how traditional deep tech investors thought about impact investing, there were some traditional investors whose attitudes and behaviours displayed many similarities to impact investing. While most investors believed that their investing created a positive impact, one traditional investor stated that their fund was an impact investment fund as they made investments into deep tech.

> *"We think we've been investing in areas that create impact over the last 17 years, quite naturally, we've not ever described ourselves as an Impact Fund, or a fund that focuses on that necessarily. In fact we think it comes quite naturally from our activities, rather than being something we need to mandate. Talking legal structure, it is a key reason that a lot of our own investors have chose to support us. But it's not something that's legally sewn up in any way. Or mandated in any way. We think it just happens quite naturally, really… I think we are an impact investor. We just don't really brand ourselves that way. But we invest in impact and we do put our own frameworks on the companies." – SA1*

In a different example with another traditional investor, the explicit goal of their fund was to find possible solutions to global problems. When asked how the fund identifies impactful investment opportunities, the response was that they identified and evaluated using heuristics. This investor believed the only difference between them and other impact investors was a more formalised process for investment decision-making.

> *"It's heuristics. It's more of a collaborative assessment with the Investment Committee on if it will create a meaningful improvement, and is it likely something that people would see value in?... it could probably do with being put into a framework… I just think it's because we lack a*

framework probably, we're not impact investors. But if we put a framework in place, we will probably show that we are essentially, by definition, an impact investor." – PM1

4.3 Limited Partner and Investor Pressure

4.3.1 Increasing Requirements for Impact Measurement and Reporting

Regardless of their status as impact investors, many participants stated that they were required to report ESGs or other non-financial metrics by their Limited Partners (LP). Below are quotes highlighting different reporting levels investors gave to their LPs. The first two quotes show formal mandated reporting requirements, while the last quote shows reporting as part of managing a positive relationship with LPs.

"We've been talking to other global players as potential LPs. We've been pitching to them. They get it. In fact, we're talking to a fund in Hong Kong, a big family office, very organised family office, probably billions of dollars. And they said, "Do you have IMM [Impact Multiple of Money]? Do you meet UN SDG?" And we said, yes, we do… This woman that only invests in PE and VC around the world was saying, "I want to see your impact framework. Do you meet SDG? How are you going to overlay? A what kind of reports am I going to get?" – P4

"We do an ESG assessment on every company that we invest in. One of our LPs mandates that we do that. But no, we're not measuring their outcomes. I mean, the whole company is purposeful. So if they're successful, then the purpose is met." – P2

"It's a big part of why they continue to put their money with us, and why they are always interested in our impact stories. So as part of our reporting, we don't just send them a spreadsheet to say look, here's the valuation. We capture a heap of metrics. So even just things as simple as how many people are employed, is really important. A lot of our investors are superannuation funds." – IM4

As to why these LPs were placing these requirements, investors believed that many LPs invest as part of a long-term strategy to improve the world's economic and societal conditions. The quotes below highlight this perspective.

"Many of our LPs have family offices. And the reason they invested in us is partly because of who [other fund Parnter] and I are, and partly because we are purpose-driven. They like that it fits with an intergenerational plan to invest in a fund that is improving the world for future generations... they want the long-term outcomes." – P2

"They're investing for broad economic outcomes for New Zealand, because they see that investing in deep tech is good for New Zealand overall, as opposed to the specific products that deep tech companies produce being good for their customers." – P5

Sometimes the LPs' views would cause them to pressure investors to be more impactful directly. The quotes below illustrate this narrative where one traditional fund's LP fund owner purported that his motivation for running the fund was entirely non-financial. These motivations to make a difference manifested itself in a different example, where the participant was pressured by an LP to increase the number of impactful ventures and to increase those targeting environmental issues specifically.

"[The LP Fund owner], who is quite an inspirational speaker, was like, "you know people say to me, you've got enough to retire, why you still working? But that's not why I work, it's inconsequential. Why I work is because every day I'm making a difference, and I feel really excited to be part of people who are changing things"." – PM1

"For example, [an LP] recently sent out an email to me to put a bit of "where are all the ESG? Where's all the environmental ones? We're just not seeing any cleantech [PM1], I want to see more cleantech." – PM1

Outside of receiving direct pressure, other investors stated that they were putting non-financial measurement and reporting frameworks in place *in anticipation* of LP pressure and regulatory requirements increasing. This reflected a view that while impact reporting was not necessary currently, changes in investment norms due to public demand meant that future increases in regulatory and industry requirements were only a matter of time.

"I guess the way that we see it, you know ESG is becoming quite an important thing moving forward and there's going to be requirements around reporting. I think it just makes sense for us as a business to be making a start earlier rather than later." – A1

"If I were to hypothesise about fundraising today, I would absolutely expect more pressure and questions and expectations from LPs around what our impacts should look like and how we should be managing and reporting them." – IM3

"So the pressure will come from consumers, investors, but also regulatory. Some countries, like the Scandinavian countries, will just lead reporting. I can see New Zealand jumping in at some point once reporting such as impact [weighted] accounts becomes mainstream. All these funds, in 10, 20 years, will just move from "we are a health fund", or" we are an agri fund" or "we are climate fund" to "we are an Impact Fund, because we have to do reporting on impact"." – P6

Some of those interviewed were sceptical about how VC funds were meeting this increasing demand for sustainable and impact investments. The first quote below is a more cynical view of how venture capital investors will try to differentiate themselves from other VCs to their LPs. The second quote highlights how investors will try and appeal to LPs without using the term impact investing.

> *"Like anything in the world, the market for investment is a competitive market. It's a competitive market for ideas, it's a competitive market to apply your capital. It's probably the most capitalistic. But a lot of people who say I'm an impact investor, is about differentiating why your fund is different and therefore might be appealing to a particular group of entrepreneurs. Over at another fund, they might do the same thing, but just haven't decided to differentiate itself using that model… And so everybody's hustling something, even if you're not. You're hustling to your LPs saying "Give it to me because I'm different. I'll make a bigger difference"." – ED1*

> *"But I think with the pandemic, investor sentiment has changed, they don't use the word impact, they use mission-led, purpose-driven, societal benefit, marrying purpose with profit, those sorts of phrases. It almost seems like impact is still a dirty word for the pure investors." – P4*

4.3.2 New Zealand vs Overseas Investors

One common theme in this study was the differences between New Zealand and overseas investors. A common critique of New Zealand investors was that they lacked sophistication in their impact measurement and reporting approach. This contrasts with overseas investors, where a pronounced shift towards more sustainable forms of investment has meant impact reporting and measurement practices have become especially developed. The first quote below highlights this gap in expertise and sophistication. The investor in the following quote remarks on how generally behind New Zealand investment practices are to the world in adopting ESG and impact investing.

> *"But you will not encounter that in New Zealand. I haven't encountered that in New Zealand, other than in philanthropic organisations. Of the family offices I have encountered in New Zealand, they want to do good, and don't get me wrong, they get it. But they're not organised in the way that these PE, VC investment managers in Hong Kong are." – P4*

> *"We work with quite a few people in Australia, where it seems that impact investing and responsible investing is somewhat more advanced. Because they have a lot more in the way of pension funds, long term capital, and they've been very much ahead of us on ESG. I feel like they're very much ahead of us. Globally, yeah I think it's fair to say were generally behind overall." – P3*

Investors offered different rationales as to why this may be the case. The first quote below suggests that NZ investors lack the experience needed to be sophisticated investors. However, this situation will improve overtime as more investments, and human capital flows through the pipeline. The second quote highlights how the mindsets of NZ investors are more conservative, leading to the lack of uptake of impact methodologies that overseas investors are adopting.

> *"The people who run the firm have to be really have their sophisticated themselves, have the domain knowledge, technical expertise, and commercial, everything to help them invest and support those companies [startups]. I guess in New Zealand, sophisticated investors are still needed, but we are not quite there yet, we are still on a learning journey." – IM1*

> *"I find the New Zealand private equity sector is a lot more conservative, we've seen that with impact investing, we are much more following what other people are doing. And it almost feels like how UK was 10, 20 years back or we are pushing for Silicon Valley model in Auckland. Silicon Valley is revamping the way they're thinking about sustainability and investing. So we're trying to catch up to how Silicon Valley was 10, 20 years ago. So I'm a little bit more sceptical about New Zealand VC funds and private investors." – P6*

Another possible explanation for the slow rate of investment innovation was the small market size of New Zealand. Here, any specialisation in investment practices reduces the possible deal flow towards unsustainable levels. Specialising in impact investing and deep tech limits potential investment opportunities to a fraction of the overall market, something possible in large markets but not in New Zealand. Without the option to specialise, investment funds rely on heuristics rather than sophisticated metrics due to the general nature of their investing. The quotation below supports this narrative.

> *"One of the key reasons for why we struggle to have impact investment in New Zealand is because we don't have the level of deal flow that you see in other jurisdictions like the United States. So in places like the US and Europe, you can afford to specialise into a particular sector or impact investing or whatever else. You've got funds that only invest in women, for example. Even when you do that, you're still get hundreds or 1000s of pitches and opportunities for you to invest every year. Whereas in New Zealand, if you start to narrow things down, suddenly, you've only got 15 opportunities that you've seen this year, and you didn't like any of them. Well, you didn't get to make any investments. You didn't actually get to do your job. So until we build up that level of input into the system, we're not going to be able to sustain the type of differentiation and specialisation that you might see overseas." – P5*

4.4 Consumer and Founder Pressure

4.4.1 Talent acquisition

One crucial factor that determines the success or failure of a start-up is the hiring of key talent. Investors frequently mentioned the importance of talent acquisition; however, investors reported that their ventures needed to have a purpose that was exciting enough to be passionate about to attract this talent. Employees want to work in companies that they feel positively impact the world. The first quote below supports this idea. The following quote states explicitly that the generational shift in the workforce to millennial or younger workers is the primary driver of this phenomenon.

> *"It's the sort of companies people want to work for. Because when we look at founders, or entrepreneurs, or employees, what sort of businesses do they want to work for? It is ones that have a positive social and environmental impact, right? That is where the future is." – P6*

> *"We want people who are passionate and who believe in what they're doing. And if it [the company] has purpose, people tend to fit better into that structure. And also, these founders today are hiring people who are millennials, and most millennials care. And because they care, if your company doesn't have purpose or doesn't have an overriding; "we will improve the world or the way people live", you're unlikely to be able to get the key employees." – P2*

A specific example of this is in the quote below, highlighting this new environment's carrot and stick nature. In this example, start-ups that have a clear and exciting purpose is able to attract top international talent. On the other hand, a lack of a clear purpose will result in the company struggling to survive in the current environment.

> *"We've seen in the companies that we've invested in, they are inundated with internationally highly qualified people looking to work for them. You know, one of them is a tiny little startup with four people, and they've got top C level team coming in from overseas going; "I want to work for you because of what you're doing, not because of the company" ... Because if you're not a purpose-based company, in five or 10 years, you won't be here." – P2*

There was a minority view among the investors in this study that while a company's purpose attracts talent, the business ecosystem's recent focus on purpose and impact is part of an insincere effort to attract said talent.

> *"Everything else [beyond financial returns] is just, you know, is just greenwashing to try and trick people to come and work for you. When the reality of what they will do on a day to day basis, will be quite hard." – ED1*

4.4.2 Current Markets Desire Sustainability

Investors remarked that local and global markets increasingly desire and value sustainability and impactful products when discussing the general business and social environment. As mentioned in prior sections, this directly impacted investors in managing their LPs and attracting key talent for their ventures. Investors perceived the role of consumer demand in influencing the business environment to be highly consequential. The quote below highlights how consumer demand has caused businesses to move more sustainably.

> *"Well the markets have changed. That's the thing because now markets are more conscious of impact. Even if you're not measuring it quantitatively. Think of the brands that you want to purchase? You are looking for sustainability, you're looking at are they circular, are they reusing things? Are they a good, positive brand? You can see it through the evolution of businesses. There's a lot of critique now on Apple's sustainability practices with its smartphones, or even Fonterra here in New Zealand."* – P6

As shown in previous quotes (PM1 4.3.1), there are examples of LPs who pressure fund managers to invest in more sustainable ventures. While this may signify a general shift in investment markets towards sustainability, many institutional investors and family offices prefer to maintain a more segmented approach, keeping impact and financial returns separate.

> *"I think the pandemic has changed a lot of things. People are starting to look for purpose, serving the community, sustainable businesses that are going to make a difference and not just make money… But at the end of the day, institutional investors, are paid to bring a [financial] return. And the way a lot of family offices are organised hasn't evolved. In terms of the spectrum, they put you in a buckets of if you make a financial return, talk to my investment managers. Or if you create impact, okay, go and talk to the philanthropic arm". – P4*

While institutional investors may be more conservative in their support for impactful ventures, the demand coming from founders for aligned capital is rising. In New Zealand, this mismatch between impact-driven technology ventures and the innovation sector leads these companies to move overseas for funding and support. As one investor described:

> *"We've still got all these great companies coming forward. It's so clear that demand is there. So I see this very much as a demand-driven thing. And then it just is incumbent upon the rest of the innovation community to actually step up and match that demand. Because if we don't, then all those companies can just go overseas for money. Which means we miss out to some degree and that's a little frustrating." – P3*

If the innovation community is yet to 'step up' and support impactful ventures, it was the view of one impact investor that it was ultimately up to consumers to generate demand for these types of ventures. The quote below illustrates how consumer demand for impact measurement and reporting creates top-down pressure through the investment ecosystem, from investment funds to portfolio companies.

> *"It's all a cycle when you think about it. You have some money in Kiwi saver. Now, if you choose Kiwi savers which have a strong ESG rating, that goes into the pension funds or the fund of funds, that has to deliver on ESG or impact metrics to you. That pension fund is putting money into LP groups, in NZ that pension fund is putting money into NZGCP. NZGCP is putting money into deep tech funds. It's all a cycle. If you see individual people as investors start demanding it [impact reporting], their pension funds then have to start reporting it so that it comes top down. There's quite a bit of ESG pressure that LPs are getting now, but the impact pressure hasn't come. – P6"*

Consumer demand not only impacts how LPs and VC fund managers invest, this demand carries implications for how deep tech ventures grow and commercialise their technology. Today's most recently founded deep tech ventures will take many years to arrive in the market. The opinion of one investor was that by focusing on being impact-driven and listening to where consumer demand is heading, deep tech ventures could utilise this demand to their advantage.

> *"Think 10 years down the line, if you just thought about growing a deep tech [company], you probably wouldn't think of maximizing the impact. You're just looking at scale. However, a deep tech business that is not cognizant of impact nowadays, is just not being conscious of where its markets are. People definitely care a lot more about impact, and they also look at if you measure it, because there's a lot of impact washing. So I don't think a lot of deep tech businesses are there yet. But it will, everything is pushed from consumers to markets." – P6*

Chapter 5: Discussion

5.1 Hybridity Within Deep Tech Investors

This study investigated the organisational and institutional environment of New Zealand deep tech investors to explore possible hybridity at the organisational and field level, and how these investors experienced and responded to institutional complexity. At the outset of this study, two different groups of investors were intentionally chosen to make up the sample: traditional investors who operated using a financial logic and impact investors using a hybrid of social and financial logics. Surprisingly, the interviews uncovered a separate group of investors. This third group of investors considered themselves to be traditional investors but appeared to be operating using a similar blend of social and financial logics analogous to impact investors. For the purposes of this study, this third group will hereafter be referred to as blended investors. Investors within these three different groups displayed similar views and perspectives as other investors within their group across many of the topics discussed in the interviews.

Looking specifically at the motivations of these groups of investors, as mentioned in the findings, there were investors whose motivations were both financial and non-financial, and other investors whose stated motivations were more altruistic. Traditional investor motivations were primarily both financial and non-financial. They found personal satisfaction arising from involvement in projects aligned with their values. However, they did not seek out those projects or value them more in their investment decision-making than other projects. Both impact and blended investors had predominantly altruistic motivations, such as aiming to inspire other impact investors or solving large societal challenges.

The relationship between impact and financial success was another topic discussed in the interviews. Most investors across all groups believed that impact and financial success had a strong interrelationship for deep tech ventures. This attitude appears to remain as a sentiment for traditional investors and does not translate into action. At the same time, both blended and impact investor groups had examples where investors actively pushed their ventures to be more impactful, believing it would increase the chance of financial success.

Regarding deep tech more widely, all the investors interviewed agreed that deep tech was highly impactful as a sector. The responses focused on how deep tech's highly disruptive, resource-intensive, and risky nature was balanced by the size of the problems being addressed and the near existential nature of the challenges that deep tech addressed. All investors agreed that this made deep tech attractive to investors of all kinds, as successfully providing solutions

to these grand challenges would satisfy both dual motivations of generating significant financial returns and significant positive impacts. Many impact investors used this notion to legitimise their pursuit of both measurable positive impacts and non-concessionary financial returns. Traditional investors and some impact investors used the intertwined nature of impact and financial success as a rationale for only valuing and investing to maximise financial return. However, some blended investors used the intertwined nature as justification for maximising and going after impact.

Looking specifically at blended investors, these investors displayed similar characteristics to impact investors, including what appears to be the same combination of institutional logics. However, there were differences in the degree of this similarity. Some blended investors believed there was little difference between how they operated and how impact investors operated. Others claimed to be impact investors despite not actively measuring the impact of their investments. One blended investor thought that their lack of impact measurement was the only difference between them and impact investors. In contrast, another blended investor claimed that while they aim to solve global challenges with their investments, their pursuit of a financial return meant that they were not an impact investor. The examples show that these blended investors had a range of understanding of impact investing, even though they displayed many similarities with impact investors in their goals, motivations, attitudes, and actions.

In summary, the investors in this study displayed different levels of organisational hybridity similar to what was expected going at the outset of this research; impact investors incorporating multiple logics, and traditional investors following a single dominant logic. The existence of a third group of investors – blended investors - was an unexpected finding. Blended investors display many similarities in values, norms, and motivations as impact investors. Doing so presents strong evidence that organisational hybridity is present within a portion of deep tech investors. This blended investor group's overall number and proportionate size among the wider deep tech field is currently unknown. However, there was heterogeneity among blended investors as to which practices, attitudes and norms of impact investors they had incorporated. The following sections will conceptualise this heterogeneity as different organisational responses to field level institutional complexity and other institutional pressures

5.2 Institutional Complexity within the Deep tech Investing field

Greenwood and colleagues (2011) state that “organizations face institutional complexity whenever they confront incompatible prescriptions from multiple institutional logics” (p, 318).

In the case of hybrid organisations, navigating and coping with this institutional complexity is an essential task that can determine success or failure due to issues of managing legitimacy (Kraatz & Block, 2008). In the case of this study, deep tech investors showed various levels of institutional pluralism depending on their classification as either impact, traditional, or blended investors. If the existence and degree of institutional complexity correlate with the presence of multiple institutional logics, we would expect institutional complexity among impact investors and blended investors.

The configuration of institutional complexity that organisations experience depends on the structural dynamics between competing logics (Raynard, 2016). By drawing on Birkholz and Santos' (2015) framework for investigating institutional complexity in an emerging field, depending on how close organisations are in relation to competing logics, they either experience volatile complexity (an even combination of logics) or restrained complexity (combined with a preference for one logic). We would expect impact investors to have volatile complexity as they aim to combine financial and social logics evenly, even when they may prioritise impact or financial return depending on the specific investment or structure of their fund's mandate. As blended investors sit between impact and traditional investors, we expect them to experience restrained complexity (Birkholz & Santos, 2015). While there were investors who met these expectations, there are examples within both groups where blended investors displayed evidence of volatile or even aligned complexity and impact investors that experienced restrained complexity (Raynard, 2016). The mapping of traditional, impact, and blended investors and what type of complexity they experience is shown in figure 3.

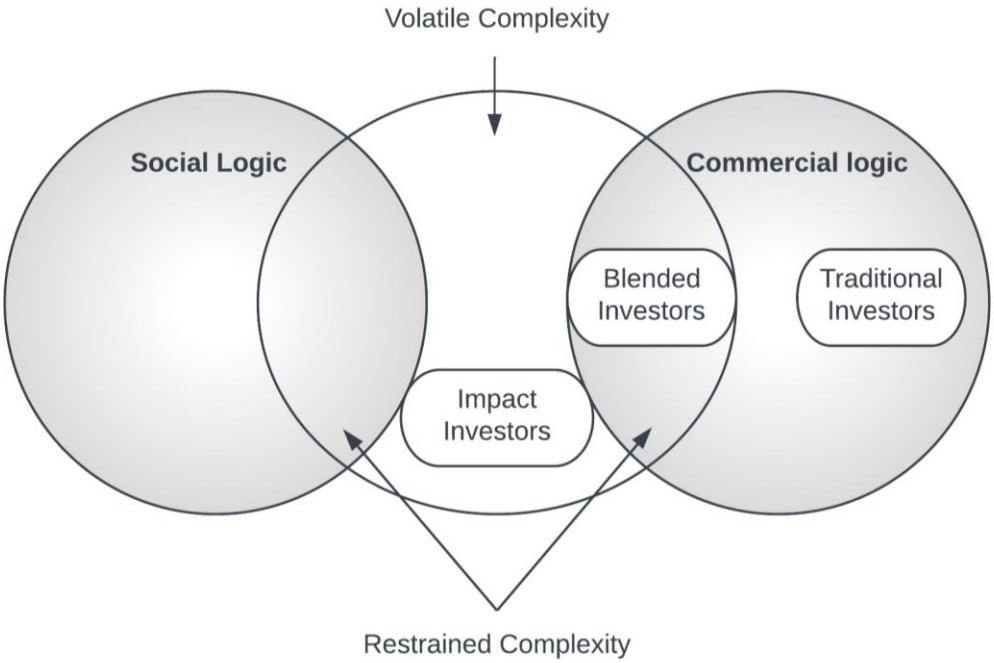

Figure 4: Position of traditional, impact, and blended investors in relation to their competing logics and expected configuration of institutional complexity. Adapted from Birkholz & Santos, 2015.

The impact investors in this study respond to this institutional complexity in many ways. In response to volatile complexity, several impact investors reported innovating novel impact investing frameworks and flexibility in their investing style, evidencing a generative hybrid impact investor configuration (Birkholz & Santos, 2015). One impact investor encountering restrained complexity had a clear preference for a market logic; integrating both logics but having a clear preference for one logic indicates that they enacted a hierarchically structured hybrid configuration to respond to restrained complexity (Birkholz & Santos, 2015). Other impact investors stressed the role of having a financial floor and being financial first organisations to gain legitimacy with the wider investment ecosystem. These funds were typically more thematic in their approach to impact investing. While they still went about impact measurement and reporting, these impact investors deployed each logic to achieve a set goal during their investment process. A social logic was utilised when initiating deal flow and the initial screening of investments. At the same time, financial logics played a more dominant role when making investment decisions. This separation of logics within these impact investors' organisational practices indicates a selective coupling strategy being employed (Pache & Santos, 2013).

Like impact investors, not all blended investors had the same organisational responses on how they resolved the tension between logics. One blended investor encountering restrained

complexity had public claims of having a unique strategy centred around purposeful investing. Still, there were no systems to quantify or ensure that investments had 'purpose' beyond 'knowing it when you see it':

> *"It's not hard to determine if it [an investment] has purpose or not. Basically, if you have to try and convince me that you have purpose, you probably don't." – P2*

Whether or not this is a simple example of symbolic coupling or a part of a selective coupling strategy is difficult to litigate in the context of this study (Birkholz & Santos, 2015; Pache & Santos, 2013). In contrast, another blended investor's firm made no such claims but had semi-formalised investing methods for impact situated within the culture. That investor reported discussions within their investment committee focused on quantifying and maximising potential impact. The approach of this venture capital organisation to innovate and generate novel ways of incorporating impact into their investment decision-making is highly interesting. While this firm falls outside the definition of impact investing as they do not measure impact, they are configured similarly to a generative hybrid impact investor (Birkholz & Santos, 2015).

Looking broadly at the findings of this study, the fact that there is evidence of varying levels of institutional complexity within the studied group of deep tech investors is surprising. Many in the deep tech sector argue that deep tech ventures are 'impact enterprises' and that there are a significant deep tech impact investors in the sector (De la Tour et al., 2019; Dealroom, 2021). Even still, we would expect only two different populations of investors, each with their respective degree of institutional pluralism. The existence of a third group of investors – blended investors – could be emblematic of a more significant shift within the industry to value and incorporate sustainability into VC practices. This shift would constitute an increasing field level complexity. A different explanation for the presence of blended investors stems from a higher proportion of this investor population coming from a research science or technical founder background – a background with documented multiple competing and cooperating logics (academic, social, and market logic) (Brantnell & Baraldi, 2020). The exact characteristics of the multiplicity of institutional logics as well as further stratification of organisational responses within blended investors are unknown,

There are many possible explanations for the emergence of blended investors within the deep tech sector. It is possible that the deep tech sector itself contains an inherent multiplicity of logics but has yet to create widely agreed-upon norms and practices to establish what hierarchy of logics is seen as legitimate (Raynard, 2016). Industry reports and published information

from VCs and start-ups suggest that those in the sector are motivated and believe that they are trying to create a considerable positive impact (De la Tour et al., 2019, 2021; Portincaso et al., 2021). This belief assumes that even though deep tech innovations are highly risky and expensive, those risks are worth it when looking at the potential good and high returns that these technologies can bring if successful. This culture is especially palpable when looking at media comparing deep tech with fin-tech or pure software-as-a-service (SaaS) start-ups. Peter Barrett, an investor at the California-based deep tech VC firm Playground Global, summed up this comparison; "We look at things between the improbable and the impossible. Why would I work on a social media app when I could be doing something worthwhile" (Metkino, 2021). The attitude of both doing something profitable and worthwhile highlights the existence of possible institutional pluralism within the sector at large. This is reflective in the growing numbers of deep tech impact start-ups or deep tech ventures targeting the UNSDGs (De la Tour et al., 2019). It is salient to highlight that the deep tech sector still has not reached its full maturity (Different Funds, 2020; Portincaso et al., 2021). This lack of settled norms and practices within the sector leaves much room for different organisations and actors to decide how they want to acknowledge, navigate, or take advantage of the deep tech sector's apparent hybridity and institutional complexity. In the context of NZ deep tech investing, the hybridity of the broader deep tech sectors may have trickled into investor mindsets, possibly explaining the existence and attitudes of the blended investors identified in this study. As many investors reported in the study, a different angle is that the small and interconnected nature of the New Zealand venture capital ecosystem means that co-investment with impact and traditional investors is commonplace. This interaction and collaboration at least suggest alignment of goals, but also could hint at information and cultural exchange. This could explain the similarities in organisational hybridity shared among blended and impact deep tech investors.

Both Greenwood and colleagues (2011) and Birkholz & Santos, (2015) suggest that hybrid organisations within an emerging hybrid field encounter institutional complexity as they navigate the tensions between contradictory institutional logics. Surprisingly, the hybrid organisations and actors in this study appear to face little tension between logics. One possible cause of low institutional tension could be the highly specialised nature of deep tech. As discussed in the social sector context by Agrawal and Hockerts (2019), specialisation reduces the tensions between logics by increasing the depth of knowledge in the social issues being addressed, allowing the commercial logic to assess risks and returns better. The high level of technical risk of deep tech affects the investment activities of investors as well. Many essential

activities, such as technical due diligence, do not require heavy involvement of either financial or social logics. The lack of central participation of institutional logics within deep tech investing compared to other sectors indicates that these plural logics have a low level of centrality, reducing the institutional complexity experienced by investors (Besharov & Smith, 2014).

The nature of deep tech investing itself contributes to the lack of tension and contradiction between logics. As highlighted above and in the transcripts, deep tech ventures are highly risky, and either will achieve massive success or fail completely. (Kraatz & Block, 2008) states that achieving success from the perspective of multiple different institutional logics results in an "especially legitimate" outcome. In the case of deep tech, as financial and impact success is intertwined, and the level of success of investments are highly binary, this results in investors in this space avoiding contradictory situations where only one of financial and impact success is achieved. This suggests that there is a level of high compatibility between these multiple logics in the deep tech context. High compatibility and low centrality are thought to produce low levels of conflict between logics (Besharov & Smith, 2014). This low tension between logics allows investors to innovatively mix these logics without endangering legitimacy. The unique environment this creates could prove fertile ground for traditional deep tech investors to incorporate more sustainable and impact investing elements than other investment sectors. This could explain the high number of impact investors and impact ventures in the deep tech space. That this environment is the cause of such trends, and how investors increase their hybridity over time will require further validation with subsequent research. The motivations for why investors may incorporate elements from other institutional logics will be a point of discussion for subsequent sections covering legitimacy pressures.

5.3 Institutional Pressures on Deep Tech Investors

The organisational field of Venture Capital investing is highly competitive. As mentioned by one investor, VCs compete with each other to attract the most promising new ventures, and VCs compete with each other to attract capital from Limited Partners. Especially in saturated markets, VCs are incentivised to differentiate themselves to gain a competitive edge on both fronts. This can be done by specialisation into a particular sector, bringing expertise, or having better value-added services. In the case of deep tech investing, several points of differentiation are available to VCs. Deep tech itself is a relatively new organisational field. Specialising in this field and having the capabilities to invest in deep tech ventures is a major point of differentiation when fund managers may stay away from the sector (Portincaso et al., 2021).

VCs also must differentiate themselves against the backdrop of a growing movement among the global investment sector to invest more 'sustainably' and a general shift towards stakeholder capitalism (Cohen, 2020). Some deep tech impact funds in this space ride the dual waves of deep tech and the desire of markets to address societal issues instead of purely driving a financial return. Within this shifting macro-level context, deep tech venture capital's competition for capital and deal flow exposes investors to a variety of institutional pressures. This section shall explore those pressures and, where appropriate, the responses to those pressures to gain legitimacy and increase the likelihood of success.

In common theme arising from interviews was the types of relationships and expectations that investors had with their Limited Partners. Investors noted a general trend that LPs were increasingly interested in reporting nonfinancial outcomes (ESG and impact measurement) and putting formal requirements for investors to report them. Interestingly, this trend was not distributed evenly across all investors studied. While the interviewees were all investors based and operating predominately within New Zealand, their VC fund's Limited Partners were reported to come from various countries, including New Zealand. Further investigation of whether or not VC investors had overseas LPs or not produced two emergent trends.

The first trend was that overseas LPs were more likely than their NZ counterparts to require funds to report ESG and impact metrics and more sophisticated metrics. This indicates a gap in either expertise or familiarity with impact investing, impact measurement and reporting between NZ and overseas LPs. Interviewees also reported that NZ investors were generally slower to adopt international trends. Investors posited that this was due to a lack of exposure, as there are few examples of impact fund and enterprise successes and deep tech impact fund success in NZ compared with overseas countries. The second trend was a seeming correlation between funds with overseas LPs and funds that made external claims of creating a positive impact with their investments. These claims to impact were either in the form of marketing themselves as impact investors, or the use of impact adjacent language such as 'purpose-driven investing' or 'saving the world with deep tech'. Both impact and blended investors were more likely to have overseas LPs than traditional investors. There were examples of LPs putting direct pressure on VCs to have more sustainable or ESG aligned investments in these groups.

As overseas investors are more likely to value sustainability and have had greater exposure to impact investing generally, they will be more likely to invest in VC firms that align with their values. This then flows on to VC's portfolio companies, as highlighted by one investor:

> *"So if they [one of our portfolio companies] are trying to raise a series B round in the US, we're looking to give them the best shot of raising capital and attracting blue chip investors. Then they have to have this stuff [impact measurement & reporting frameworks] in place. Or the risk is if they don't have it in place, then it will be harder for us to raise money." – IM4*

This top-down pressure for sustainability and reporting impact metrics can lead to adapt-or-die situations for NZ start-ups moving overseas. Looking at the global investment and innovation ecosystem, it is self-evident that addressing sustainability is now a prerequisite for legitimacy. The top-down selection pressure inferred in the above quote can be conceptualised as coercive isomorphic pressure – external pressures that force organisations to adopt more legitimate practices (DiMaggio & Powell, 1983). This coercive isomorphism can acts on both VC firms and their portfolio companies.

These findings are in line with a recent study of Nordic institutional investors. Linhart and Nyborg (2021) found that these investors had experienced various isomorphic pressures to incorporate sustainability into their strategies, in turn putting pressure on their holdings to 'adapt-or-die'. Changes in international investment norms as signified by UNPRI (United Nations Principles for Responsible Investment) and SDGs and copying sustainable strategies were cited as main sources for institutional pressure. While the environment studied is different from this study's context of NZ Deep tech investors, the overall findings align with this study's findings of overseas LPs putting pressure on VCs to be more impact-focused.

Generally, the market shift towards sustainability places a variety of institutional pressures on deep tech investors. In addition to the pressures that LPs place on investors, both founders and consumers are sources of institutional pressure. Consumers now search for and demand sustainable products, and many mission-driven start-up founders seek values-aligned capital. Agrawal and Hockerts (2019) suggest that impact investors and their investees have increased financial and impact performance when they are closely organisationally aligned. Most investors in this study thought that meeting these demands conferred advantages to themselves and their portfolio companies more than simply avoiding negative consequences. Notably, all investors felt that it was advantageous for their start-ups to have an impact story. Impact stories are narrativized versions of theory-of-change models. According to So and Staskevicius (2015), the advantages of theory-of-change models lie in their versatility and ease of use, providing a framework for impact investors useful for due diligence and aligning incentives.

Investors in this study thought that the benefits of an impact story were primarily external: hiring talent, marketing the startup to investors and business partners, and increasing the general chances of success through external factors. These external advantages reflect a selection pressure on businesses in the current environment. In an environment that values sustainability, appearing more impactful confers an edge over your peers. However, whether or not impact stories are used to either intentionally gain market favour, or due to a change in standard practice, or employed "genuinely" remains uncertain. The effect of the general shift towards sustainability (including the impact investing movement) among investment professionals and startup founders can be interpreted as a form of normative isomorphic pressure. As consumers demand more action in response to grand global challenges, industry professionals themselves are re-evaluating what norms and practices are conducive to solving these challenges, or at least not actively contributing to the problem. Some investors in this study were wary of how this market shift combined with consumer pressure could crystallise into regulatory or legal requirements. Regulatory requirements, a form of coercive isomorphic pressure (DiMaggio & Powell, 1983), have been passed in legislative bodies worldwide. In New Zealand, there is a growing interest in implementing broad sustainability reporting requirements (Meech & Bayliss, 2021). The investors studied believed that such regulation was coming in the near-to-short term, causing some to put impact frameworks in place in anticipation of such regulatory shifts.

Satisfying the demands of both LPs, consumers, and founders is ultimately one of gaining or maintaining legitimacy. Legitimacy is a challenge for emerging fields, and is exacerbated by the presence of hybridity (Casasnovas & Chliova, 2020). As deep tech is an emerging field with both field-level hybridity and organisations displaying different degrees of hybridity, this is most certainly the case. However, due to the low tensions between the multiple logics at play and the broader macro-level shifts toward sustainability, many investors in this study showed that they could leverage their hybridity to their advantage. Embracing hybridity can enhance legitimacy and increase access to resources (Wry et al., 2014). This phenomenon was seen in this study in investors exposed to overseas LPs who marketed themselves as being more aligned with impact and sustainable investing to gain legitimacy and access to overseas capital. Other investors leveraged their status as impact investors to gain legitimacy with mission-aligned founders and attract high-quality deal flow.

One response to legitimacy challenges that investors utilised was tactical mimicry. Tactical mimicry is the strategic decision to change the external appearance of organisations to align

with an external set of values and norms to obtain legitimacy and other benefits (Dey & Teasdale, 2016). As the market demands more sustainable products and investment instruments, an opportunity arises for VCs to move with the tide and appear more impact aligned. While this is a similar response to symbolic coupling (Raynard, 2016), tactical mimicry can be seen as a form of mimetic isomorphism. In this study, some investors decided to utilise ESG and impact language to provide strategic advantages to their operations and increase the likelihood of long-term success of their portfolio companies, even if the implementation was highly aesthetic to a large degree.

In summary, the overall investment environment has shifted towards valuing sustainable products and practices. Deep tech investors feel this shift in the form of impact pressure from LPs, increasing regulatory involvement around impact reporting standards, and impact-focused founders seeking aligned capital. These shifts present legitimacy challenges and isomorphic pressures that deep tech funds and their portfolio companies must navigate to ensure success and survival. The young age of the deep tech sector and hybridity at the field level both exacerbate these challenges and provide avenues to gain further resources, and provide a space for investors to create innovative solutions to these challenges.

Chapter 6: Conclusions and Implications

6.1 Overall Conclusions

This thesis explored the organisational and institutional environment of New Zealand deep tech investors by investigating the views and behaviours of deep tech investors regarding the non-financial outcomes of their investments and the deep tech sector more broadly. Twelve interviews with New Zealand traditional and impact deep tech investors were carried out to research these aims.

Industry bodies within the deep tech sector had indicated that the industry's goals were to solve complex social and environmental challenges. However, little academic research suggests that these goals translate into organisational or field-level hybridity within the deep tech context. The deep tech investors in this study all thought that the ultimate goal of deep tech was to achieve the goals of addressing grand societal challenges, such as climate change, food insecurity, and human health. These goals were seen by most investors as worth the high risks associated with deep tech investing. While most investors thought that the impact and financial success of deep tech ventures were closely interlinked, investors were split as to whether they should try and maximise the impacts of their investments to maximise their financial returns. Much of the rationale for behaviour and general motivations of both traditional investors and impact investors were closely related. Consequently, there were indications that there were multiple institutional logics within the deep tech organisational field. Moreover, the competing commercial and social logics identified in this study appear to mirror those of impact investing.

The investors recruited in this study belonged to two groups, impact investors and traditional investors. Exploring these investors' attitudes, beliefs and decision-making norms was expected to highlight two states of hybridity: impact investors incorporating multiple hybrid logics, and traditional investors following a single dominant logic. This study identified a third group of investors – blended investors – that were not impact investors but displayed many similar motivations, values and organisational practices of impact investors. Subsequent investigation of this investor group found that they mainly had a scientific and research background. They were also more likely to have international Limited Partners, and many of them had a limited understanding of what defined impact investment. There was heterogeneity within this blended investor group in which elements of impact investor’s practices they incorporated into their own.

The investors in this study experienced different configurations and degrees of institutional complexity. While the framework developed by Birkholz and Santos (2015) would suggest that impact investors would experience volatile complexity while blended investors would experience restrained complexity, investors in both groups appeared to experience a variety of complexities. This study also identified heterogeneity in the organisational responses to institutional complexity. These responses enabled investors to either mitigate the complexity's negative impacts or embrace complexity gaining further access to legitimacy and resources. The strategies identified include selective decoupling, symbolic coupling, hierarchical structuring, tactical mimicry, and a generative hybrid structure (Birkholz & Santos, 2015; Dey & Teasdale, 2016; Pache & Santos, 2013).

Investors reported that the general investment market had shifted to increasingly value and desired sustainability and positive impacts in recent years. The investors in this study felt this shift in increased impact pressure from LPs, increased regulatory involvement around impact and sustainability reporting standards, and impact-focused founders seeking capital aligned with their values. Within New Zealand deep tech investing context, institutional pressures arose due to overseas LPs placing coercive pressures on New Zealand investors to be more sustainable. The sector's small size meant that most early-stage investments were carried out with some level of collaboration between different VC firms, including impact investors. Where every investor can see every other investor’s process, this proves a fertile ground for normative isomorphic pressures to diffuse new ideas. This ease of cross-pollination of ideas creates additional mixing of institutional logics and organisational practices. Many deep tech investors report investigating implementing some form of impact measurement in response to either consumer demand or in anticipation of further regulatory involvement.

6.2 Research Implications

The organisational setting of deep tech investors has yet to receive much attention from researchers in the organisational hybridity and institutional complexity fields. This thesis makes theoretical contributions to institutional complexity theory and research on how organisations respond to complexity. Extending this theory to the context of deep tech investing has proven to uncover rich insights into organisational behaviour and how investors choose different organisational strategies to take advantage of the various pressures within a complex institutional environment. The uncovering and identification of a blended group of deep tech investors possibly indicate that as deep tech is an emerging hybrid field, some investors are

creatively managing and embracing the tensions between institutional logics to generate new organisational forms and practices.

This thesis provides empirical findings on how deep tech investors approach the non-financial impacts of their investments and highlight what impact practices that they find contribute most to the success of their portfolio companies. The benefits of impact stories outside of the investment process are also significant for deep tech ventures. The internal benefits of an impact lens for deep tech ventures were maximising the market size and long-term returns. Externally derived advantages of having an impact story were particularly emphasised, including helping to attract key talent members, form partnerships easier, and gaining advantages in raising capital. An insight for deep tech start-ups looking to raise money overseas is that overseas investors heavily care about and value making sustainable investments, and having impact or ESG measurements in place will be seen very favourably. New Zealand investors may benefit from putting in place impact or sustainability requirements of their own, as many investors in this study believe that following the example of other advanced economies, regulation in New Zealand is forthcoming.

6.3 Limitations

As highlighted in the Methodology, although this study took steps to protect the reliability and validity of the research, the research design has multiple limitations The first limitation of this study was the small sample size. Conducting only 13 interviews means that this study is highly susceptible to sampling errors and selection bias. The time and practical concerns of performing masters research were significant contributors to the small sample size. The research activities themselves were also conducted under a Covid-19 lockdown, limiting the availability of some investors to participate.

The interview method was also entirely carried out remotely using Zoom. This is a concern as the body language and other perceptions are harder to perceive, leading to misunderstandings or missing subtle meaning (Bryman & Bell, 2015). Video interviewing reduces these concerns somewhat. When the final interview of the study was carried out in person, this researcher found that in-person interviewing allowed for a more natural flow of questioning. A limitation implicit in this step is that deeper insights could have been gleaned if the interviews were all in person.

This study also relied only on one primary data source – semi-structured interviews. The lack of other data sources prevented triangulation of the findings, affecting their credibility.

The largest limitation of this study, like exploratory research generally, is the generalisability of the findings. The use of a small sample size and using a non-random sampling method reduces the ability of this study to generalise its finding to contexts outside the specific sample studied in this research. Further research corroborating this study's findings in other contexts is needed to make claims of generalisability.

6.4 Suggestions for Future Research

Finally, this thesis concludes with some interesting questions uncovered throughout this study and those questions that this thesis could not sufficiently answer. These are presented as suggestions for future research investigations.

This study was limited by its research design and constraints, resulting in a sample of individual New Zealand deep tech investment manager. To further investigate how institutional logics interact inside organisations and this shapes organisational level action, a multiple case study approach would be valuable to achieve deep insights best. Moreover, a longitudinal approach could observe how the organisational hybridity of deep tech investors changes over time in response to contextual influences such as stakeholder influence (such as limited partner investor attitudes and sustainability imperatives), changes in the technology landscape, or other global events or trends.

In this study's research of the institutional and organisational environment of New Zealand deep tech investors, evidence was found highlighting the presence of a field-level hybridity of logics as well as a group of non-impact investors that displayed organisational hybridity. As the field at large matures and develops agreed-upon solutions for navigating and resolving tensions between logics, we expect field level complexity to reduce. Indeed this process may be already happening. Investigating how these tensions are resolved into possibly novel deep tech-specific norms appears to be a fruitful line of research. This research would be similar to examining the institutionalisation of the deep tech sector.

This study added to the existing notion that the investment field is shifting to be more sustainability and impact-focused. The pace of this change and what factors are responsible would be an interesting topic for future research. This study found that organisational hybridity was more common in those investors that had exposure to international LPs. This suggests that hybridity is percolating from overseas to New Zealand investors generally. Further research on this topic could investigate whether other New Zealand investment sectors displayed a similar shift away from a purely financial logic to a hybrid one incorporating a social logic.

Identifying the blended investor group was one of the more exciting findings of this study. Investigations of this subsect of deep tech investors have many different possible research avenues. Firstly validating the existence of blended investors outside of the context of this research would be the first step. The prevalence of this group in different geographical contexts over time is also something worth researching. Other investigations could focus on capturing the specific institutional logics present in this group. This study suggests they are more likely to come from a science and research background which may bring their own logics. The initial findings in this thesis showed that blended investors displayed heterogeneous responses to institutional complexity. Future research could stratify blended investors by these responses.

Lastly, the study of deep tech investors' organisational and field-level practices remains a fascinating area of research. Deep tech investing is a critically understudied research context, operating at the intersection of many disciplines and investment approaches. Considering the sector's rapid growth and its global strategic importance in solving food insecurity and climate change issues, any research describing the phenomena within deep tech can only be a good thing.

Appendices

Appendix A: Semi-Structured Interview Schedule

Investors with Impact claims:

Topic 1: History and background of the Investor and the Fund

- How would you define the fund you work at?
- Tell me about your fund's mandate/investment thesis?
    - What stage of growth do you invest in?
- To what extent do non-financial outcomes play a role in the fund's investment thesis?

Topic 2: Investment process and accounting for non-financial outcomes

- Taking me through your investment process:
    - What do you look for in prospective companies?
    - At which stage are the impacts considered?
- During the investment process, to what extent do/can non-financial outcomes inform decision-making?
- What role does the type of technology play within the investment process/decision making process?
- What is the role of technology and its deepness and impact investing?
    - Does it change the type of co-investors or likelihood of co-investment?

Topic 3: Personal perspectives

- What are your motivations for being in this sector?
    - How does your work align with them?
- What potential do you see for the deep tech sector?
- What do you perceive your role to be in the wider deep tech ecosystem?
- What are your thoughts on impact investing?

Alternate questions for Investors without impact claims:

- During the investment process, to what extent do/can non-financial outcomes inform decision-making?
- Are any of your portfolio companies mission/purpose driven?
    - Did that factor into your investment decision-making process?

    - How do you support these ventures to achieve their mission?
- Have you co-invested alongside other Impact investors?
    - How did their investment process differ to yours?
    - Where there any advantages to the venture due to their process?
    - Where there any tensions?

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