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# Green Technology Innovation - the Perspectives of Venture Capital

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# Green Technology Innovation -the Perspectives of Venture Capital

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# Abstract

Technology has contributed greatly to our environmental problems, but also has a key role to play in solving those problems. While proper financing is an enabler for development, lack of financing is an important constraint. Innovations reach the so-called valley of death after demonstration of a commercially viable product - when capital demands are high but there is a low ability to obtain funding. Understanding investors' perspectives in this space enables more effective legislation to incentivize investment, addresses the disconnect between investor and innovator, and provides a framework for other investors who wish to engage. This research develops a grounded theory to describe the perceived risks and drivers of early stage venture capital investors. Theory was developed through a combination of literature review and semi-structured interviews. The findings reveal the complexity of the topic and that perspectives vary between investors. Common drivers include financial return and solving important issues. Quality entrepreneurs, policy, and defensibility can be either drivers or risks depending on the circumstances. Other perceived risks are technology risk, market risk, incumbent actors and capital intensity. Further research can serve to confirm and build upon these results.



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# Abbreviations

ESG: Environmental, Social, & Governance

EU: European Union

GTI: Green Tech Innovation

ROI: Return on Investment

SDG: Sustainable Development Goals

SEK: Svenska Kronor / Swedish Crowns

UN: United Nations

USD: United States Dollars

VC: Venture Capital

VOD: The Valley of Death

# 1 Introduction

This introductory chapter lays the foundation on which this report is built. It is broken into 6 sections. The chapter provides background and context in section 1, before stating the empirical problem in section 2. The aim and research questions are stated in section 3, and the limitations of the study are described in section 4 to explain what will be excluded from this paper. Section 5 explains how the knowledge created from this research contributes to the world. The chapter ends with a general overview of the remainder of the report.

## 1.1 Background

A transition to a sustainable economy is becoming increasingly urgent (IPCC, 2014). The anthropogenically enhanced greenhouse effect is causing and will continue to cause disruptions in the climate for decades, or even centuries, bringing with it many adverse effects including higher temperatures, severe weather patterns, sea level rise, and disruption to the ecological systems (Cook et al. 2016; NASA, 2019). Within the context of this scientific consensus, the global population is expected to hit 9 billion by 2050, putting higher demand and stress on finite resources (UN, 2017). As the problems continue to worsen, we come closer to the point where effects on even the global scale are irreversible (Steffen et al. 2015). The UN warns that at the current rate, there are approximately 11 years remaining to prevent irreparable damage to the climate and avert a catastrophe (UN, 2019b). A sustainable transition is imperative for mitigating and adapting to the effects.

Fagerberg (2017) affirms that innovation must play an important role in the transition towards a sustainable society. Schumpeter (1942) considers innovation as “a process of industrial mutation that incessantly revolutionizes the economic structure from within.” Put simply, innovation is “a new way of doing things” (Porter, 1990). The kind of innovation needed in a sustainable transition is eco-innovation. The EU commission (2019a) defines eco-innovation as

*“any innovation that makes progress towards the goal of sustainable development by reducing impacts on the environment, increasing resilience to environmental pressures or using natural resources more efficiently and responsibly”*

Eco-innovation is regarded not only as a catalyst for a sustainable transition, but also as a key element of EU policy for sustainable development (Sarkar, 2013). Eco-innovation is in fact vital for delivering strategic climate objectives (EU Commission, 2019b).

Modern technology has been a large contributor to our environmental problems; however, it also has a key role to play in solving those problems (Berkhout, 2002). A critical element of achieving a sustainable transition is the development and diffusion of clean technologies (IPCC 2014). If we consider Ehrlich & Holdren’s (1971) equation known as IPAT, we can describe in simple terms humanity’s effect on the environment:

$$I \text{ (Impact)} = P \text{ (Population)} * A \text{ (Affluence)} * T \text{ (Technology)}$$

Each of these three factors influence the overall impact on the environment, but they also influence each other. Advancements in Technology can reduce Affluence, thus compacting its influence on overall Impact (Chertow, 2000). Notably, Ehrlich and Holdren convey with conviction that ignoring any one of these will not comprehensively address impact (Chertow, 2000). With this in mind, green technologies, or green-tech (also known as clean-tech), is the focus of this paper.

The urgent need to drastically reduce burdens on the environment implies that adaptation within existing technologies is not enough (Rennings, 2000). Changing a technology as a whole, or changing the system in which it operates, has a far greater potential for sustainable development. (Mulder, Ferrer & Van Lente, 2011). For instance, energy storage has potential disrupt the energy market by acting as an enabling technology for renewables; carbon capture and storage is a technology that could provide significant aid in achieving Paris Climate Agreement goals; water desalination technologies increase the accessibility and abundance of fresh water (Evans, Evans & Strezov, 2012; UNFCCC, 2015; Miller, 2003). Radical innovations produce the market disruption necessary to displace the mainstream product (Christensen, 1997).

While green technology innovation (GTI) is recognized as an important aspect for transitioning to a sustainable economy, financing this innovation is an important constraint (Hall, 2010; Schumpeter, 1934). In his theory of innovation, Schumpeter (1939) describes financing as an “essential element of the economic process,” a process which would otherwise be “logically incomplete.” Proper investment can significantly catalyze development and market diffusion of new technologies (Kortum & Lerner, 2000). A lack of this investment can be limiting, or even devastating for any innovation. As such, proper financing is central to the success of any innovation process (Fagerberg, Mowery & Nelson, 2006).

In January of 2016, the UN set 17 Sustainable Development Goals (SDG) to guide policy and funding. These goals are listed in Appendix A. Within the SDGs lies vast investment potential within trillions of dollars (UN, 2019a). However, a significant financing gap remains. In the EU alone, an annual 180 billion Euro investment gap needs to be closed in order to achieve 2030 goals within the Paris Climate Agreement (EU Commission, 2019b). Naturally, a significant amount of public funding is already going toward these goals; however, the scale of the investment challenge is too large for the public sector to handle alone (ibid). Affirmed by the UN (2018), the public sources of funding in all countries, both rich and poor, “clearly do not suffice to fund the SDGs”. Private finance plays an important role in contributing to SDGs, and is an essential component of the financing of the 2030 Agenda (UN, 2018).

This paper aims to further develop the understanding of investors decision making when investing in green-tech innovation. From an impact perspective, there is an important link between private investment and impact as it helps to speed up scaling and uptake of these technologies. From an investment perspective, it shows potential for opportunity; Di Serio & Silva (2016) consider sustainability to be a coming transition on a scale comparable to the

industrial revolution. This paper aims to further develop the understanding of investors decision making when investing in green-tech innovation.

## 1.2 Problem Statement

There are numerous challenges associated with bringing an innovation to the market, including research and funding to ensure function, quality, cost, efficiency, and other aspects that ensure the ability to survive market competition (Auerswald & Branscomb, 2003). Perhaps the most difficult challenge is to cross the Valley of Death (VOD), the middle phase of the innovation chain where a successful prototype tries to successfully penetrate the market (ibid). The challenge exists in an urgent need for funding, but a low ability to raise funding (Murphy & Edwards, 2003). This is due, in part, to an information gap between investor and innovator (Auerswald & Branscomb, 2003). Ventures often fail because of the gaps between what ventures are offering to investors and what the investors are looking for (Murphy & Edwards, 2003). This failure to understand one another represents a major market failure.

In addition to these obstacles, policy and regulation have both a direct and an indirect influence on the ability of these technologies to succeed (Burer & Wustenhagen, 2009). The International Energy Agency highlights the need for effective policy in incentivizing investment, as well as the shortfall in current policy effectiveness (IEA, 2017). Other research shows that there is not a lack of capital investment available for these technologies, but rather a lack of appropriate policy measures to attract it (Masini & Menichetti, 2012; Leete, Xu, & Wheeler, 2013). Policy makers need to understand how investors behave and how they make decisions, in order to pass more effective legislation (Burer & Wustenhagen, 2009).

## 1.3 Aim and Research Questions

This project aims to contribute to the academic discourse to develop an understanding of the decision making of investors. It focuses specifically on venture capital (VC) investors. It examines both what makes these investors eager to invest in green tech innovation, and what makes these investors wary to invest. The project is framed to examine the investor perceptions. This is because of the strong link between perception and decision making; decisions are based on perceptions of reality, rather than objective reality. This paper explores the perceptions of these investors when it comes to the investment risks and opportunities in early stage green tech innovation. This leads to the following research questions:

- 1) What are the perceived drivers for investment into early stage green-tech innovation?**
- 2) What are investor's perceived risks in early stage green-tech innovation?**

## 1.4 Delimitations

This paper focuses on private venture capital investors. This is because of the degree of involvement by venture capital in early stage businesses and startups. Other sources or forms of financing are not considered; sources of debt such as bonds or loans, government grants, programs, and other sources of public funding are excluded, along with retained earnings, or other mechanisms used by a firm. VC Investors must also be involved to at least a significant extent in green technology innovation. This research is focusing on perceptions, the actual risks of investment that are not perceived by investors, although considered, are not admissible in this report. Research is generalizable only to private venture capital investors involved in green tech innovation when considering its conclusions.

It is important to specify what this report considers to be “green-tech innovation”. Definitions for this term tend to vary from person to person. In this paper, the definition is derived from the EU definition of eco-innovation. Green-tech innovation is therefore defined as: any technology innovation that makes progress toward the UN Sustainable Development Goals by reducing impacts on the environment or by increasing resilience to environmental pressures directly or indirectly. As an added constraint, incremental improvements will not be considered to be green-tech innovation. These do not create the necessary market disruption. Furthermore, improvements in efficiency are excluded. The Jevons Paradox, more commonly known as The Rebound Effect, implies that efficiency improvements boost consumption, thus adding further to resource depletion (Freeman, 2018) Innovations that change a technology as a whole, or that change the systems in which they operate, will qualify.

Important to note is the difference between invention and innovation. Shumpeter (1934) affirms in his Theory of Innovation that “as long as they are not carried out in practice, inventions are economically irrelevant”. The gap between invention and innovation is of interest in this paper. This project focuses on only particular steps in the innovation chain, specifically where a successful prototype attempts to enter the market. This is the space after research and development, but before commercialization. Innovations approaching or within what is widely referred to as the “Valley of Death” are highlighted in this report.

## 1.5 Contributions

By understanding investors’ perceptions of risk and opportunity in early stage green-tech innovation, we can develop an understanding of their point of view when making decisions. This knowledge helps in several ways. It will allow innovators and entrepreneurs to better understand investors when they try and seek funding. It also gives policy makers tools to create stronger legislation and policy instruments to incentivize more investment into green-tech innovation. This will help to nurture more investment, and more innovations through to commercialization. Thirdly, this knowledge can act as a framework for other investors that are not involved in green-tech innovation, but want to engage.

## 1.6 Report Structure

The report is structured as shown in Figure 1 below. This chapter has introduced the topic and described the aim of this report. Chapter 2 describes the research methodology and the methods for collecting and analyzing data. Chapter 3 investigates what is already known about this topic, and describes the theories and frameworks used in the report. Primary data used in this report is made available in Chapter 4, along with initial analysis. Chapter 5 discusses and analyzes in greater detail what the primary data shows, appropriates investor views, and compares and contrasts primary data with the pre-existing knowledge presented in Chapter 3. Chapter 6 draws conclusions based on the analysis of the data.



*Figure 1. Report Structure*

## 2 Methods

This section provides the research strategy and method used in this project. This gives the research a transparency that enables scrutiny over the project. This chapter also provides an evaluation of the quality of this research, and the extent to which it is valid and generalizable. Section 1 describes the overall methodology on which the research strategy is based. Section 2 describes how data was collected for the study while section 3 describes the analysis of that data. Section 4 describes the steps taken to minimize research error. Section 5 describes the reliability and validity of the conclusions drawn from the study. Finally, section 6 states the ethical consideration of the study and the steps taken to address concerns.

### 2.1 Research Methodology

This report is a qualitative study. The research will analyze words and semantics as opposed to numerical data in quantitative research. This research will use an interpretivist and constructionist approach. Interpretivism is an epistemological approach stipulating that there are differences between people, and a strategy must be used that respects the subjectivity of perception, action and meaning (Bryman & Bell, 2015). Constructionism is an ontological position that considers social phenomena and their meanings are continually being accomplished by social actors, and that social phenomena are not only produced through social interaction but are constantly in revision (Bryman & Bell, 2015). Constructivism assumes reality is constantly being constructed through each individual's interpretations. This implies a high level of subjectivity on behalf of all individuals involved in the study, including the researcher. This highlights the importance and the role of the researcher's thinking both in the collection and analysis of data.

This research will use a grounded theory approach. Grounded theory guides the researcher to develop a theoretical framework that explains the studied process (Charmaz, 2001). With this approach, a researcher collects data and analyzes it simultaneously from the initial phase of research to study the social and psychological process of the sample participants (ibid). The logic of the grounded theory method calls for the emerging analysis to direct data gathering, in a self-correcting, analytic, expanding process; early leads shape later data collection (ibid). The study will result in a mid-range theory based on the evidence that answers the research questions.

By nature, grounded theory uses inductive reasoning. As opposed to deductive reasoning, inductive reasoning starts with a question and collects data relevant to the question; the data is analyzed for patterns and themes that result in generalizations and a descriptive theory (O'Leary, 2007). Although the research questions remained consistent throughout the research process, the aim was slightly updated in order to make the aim narrower and thus better align the aim with the data and results.

## 2.2 Data Collection

This thesis will collect both primary and secondary data. The collection of this data will be conducted with a planned-systematic approach, as according to Alvesson (2003). To begin, secondary data was collected in the form of a literature review. This process was desk-based research primarily through internet databases like Google Scholar, among others. Scholarly articles and peer reviewed research were focal points, as well as information from reliable sources such as the UN. This shows what is already known about the area of study. It also provides a basis for comparison to green-tech investment where sustainability is not necessarily a factor. As the first step in the data collection process, the literature review acts as a starting point for the development of a grounded theory. It acts as data to help answer the research questions, and it will help to develop questions for interviews in the primary data collection phase. The literature review process is key because it provides a basis comparison for primary data, and can support or refute aspect or themes derived from primary data with triangulation. Literature review is therefore an invaluable step within this research. The data collected through literature review is provided in section 3.2 under Pre-Existing Knowledge.

Primary data collection begins in this research after the literature review process. The primary data process involved a series of semi-structured qualitative interviews. The unit of analysis in this process is the investor. Semi-structured interviews consist of an interview guide, along with probing questions and/or prompts that allow discussion of interesting topics that arise. The interview guide is not strictly followed in each interview. Rather, the interviews embraced a natural flow of conversation with the investor, allowing for more topics to be addressed. This flexibility is one of the benefits of this form of research. The guide served to ensure that a particular range of topics was covered in each interview.

Interview guide questions were drafted with the intention to uncover information relevant to the research question. These questions were drafted with the literature review in mind. That is, the literature review had an influence on the creation of interview questions. This allows the interview to delve deeper into the interviewees knowledge of interesting topics already discovered. The interview guide is available in Appendix B. Before each interview, respondents were made familiar with the aim and purpose of the research. This allows them to be more prepared for the discussion. The interviews consisted mainly of open-ended questions, thus allowing for responses that might not have been anticipated. With open ended questions, interviewees are not forced into preconceived notions of the researcher, and the respondent's understanding of the topics can be ascertained (Bryman & Bell, 2015). Ambiguous terms, double leading questions were avoided in the interview guide in an attempt to control for bad questions. It is not possible to fully control for this in a semi-structured interview because questions asked on the spot are impulsive and not subject to scrutiny.

All interviews were audio recorded, and then later transcribed. This is beneficial because it creates a perfect record of what was said. Notes taken on-site cannot capture the full scope or depth of what was said during an interview. Furthermore, memory is a somewhat unreliable source psychologically speaking, as memory is subject to loss and distortion. Audio recordings and transcription are also superior strategies because they allow repeated

examinations of responses, and therefore offer for a more thorough analysis of what people say (Bryman & Bell, 2015). Thus, more information can be mined and discussed in the report.

This study uses Purposive Sampling to select interviewees. This sampling approach references the goals of the research when making a sample, and therefore, interviewees were selected in terms of criteria that will allow the research questions to be answered (Bryman & Bell, 2015). It would not make sense to interview someone who is not involved in sustainable financing about their decision making. The sample consists of investors in relevant firms. The firms that are listed in the sample are the firms that agreed to be included in the study. More firms were contacted, but not all were willing and/or able to contribute. A list of the firms included in this study is available in Chapter 5.

## 2.3 Analysis

Data will be analyzed with content analysis, which Holsti (1969) defines as a “technique for making inferences by objectively and systematically identifying specified characteristics.” The analysis seeks to uncover latent content. This goes beyond the semantic content of the data and starts to identify underlying ideas, conceptualizations and ideologies that shape the semantic content (Braun & Clarke, 2006). Altheide (1996) emphasizes the role of the investigator, or researcher, in the construction of meaning of and in texts. In other words, the researcher determines what is meaningful and what is not - subjectivity is unavoidable. This researcher bias is a necessary source of error in this research.

The meaningful content in the literature review is included at the end of Chapter 3, and was determined by the researcher as such. Content analysis is applicable in semi-structured interviews. It allows results to be analyzed in a systematic and repeatable way. As per grounded theory, analysis is continuously conducted throughout the research process. Content analysis was conducted through a process of transcription, re-reading of transcriptions, coding, and a thematic analysis.

Resulting transcriptions from semi-structured interviews was first read casually without taking any notes or making any efforts for interpretations. The text was re-read, along with note taking and an effort to recognize significant observations. After an initial analysis, a coding schedule and coding manual was drafted and applied to the transcribed text. The coding schedule, as shown in Table 3, is the form into which data from interview text was entered. The coding manual, shown in Table 4, specifies the rules by which the text was analyzed, and what categories are used to classify the text. The coding manual and schedule were drafted several times throughout the research process: once after each interview, only being finalized when applied to all interviews at the end. The coding system was drafted with the intent to extract meaningful information from the data through codes. Thus, the coding manual and schedule only include dimensions and categories that are relevant to the data as determined by the researcher. The codes reflect the researcher’s interest and perspectives just as much as they reflect what information lies within the data (Charmaz, 2001). That is, the codes may not show everything within the data, but will only show what the researcher

decides to look for. The coding schedule and manual were designed with the research questions in mind; they are intended to uncover information that will help answer the research questions.

Resulting coded data will then be analyzed through thematic analysis. This is a method for identifying patterns and themes within data (Evans, 2018). Themes capture important aspects of the data in relation to the research question and represent patterns within the data sets (Braun & Clarke, 2006). Thematic analysis is popular as an analytic method because it is independent from any particular theoretical approach or epistemology persuasion, and is useful for researchers within constructionist approaches (ibid).

Coded data and related data was gathered into candidate themes for further analysis. These themes will be discussed and supported with more detailed information from the interviews. The threshold for a theme, the pattern's frequency of appearance in the data, is very subjective. It will be up to the researcher to determine what subjects will qualify as themes; this once again highlights the subjectivity of this research. Themes will then be reviewed and discussed in more detail. Themes in the primary data will be compared with pre-existing knowledge in the literature review.

Because analysis is integrated into data collection, as per grounded theory, conclusions were constantly being developed throughout the entire research process. The resulting conclusions represent a mid-range theory that generalize to venture capital investors in green tech innovation. Because the phenomenon being described is so complex, and because the population being described is so large, conclusions are forced to contain fewer details. This enables the conclusions to be better abstracted to the greater population.

## 2.4 Research Issues

It is impossible to review all of the literature on any given topic. To suggest this would be absurd, especially given the 20-week time constraint. There is simply too much volume out there to read it all. So, there will be a significant amount of relevant literature not included in the review. It is thus assumed that some aspects of what is already known about the topic may be missed and therefore not included in the report. This possible absence of information could have an influence the conclusions.

All of the data collection and analysis was done by the same researcher. However, there is an element of inter-interview variability in this study. Semi-structured interviews are meant to allow for a flow of conversation which results in a variety of responses. Furthermore, interviewees varied in the enthusiasm for participation as well as in their availability. Some investors were more sensitive in regards to time, resulting in some interviews being rushed or even cut short. In contrast, interviews that were able to fully play out were more thoroughly developed.

There is an unavoidable human factor in this research. The boundaries and pitfalls human psychology apply to the researcher, as it does all researchers. Limits such as bounded

rationality, and obstacles like confirmation bias and anchoring bias influence this research. Confirmation and anchoring bias are especially applicable to this research, where a theory is consistently under development and initial findings influence the perception of later findings. These cognitive boundaries could lead to distortions or partially complete results. This is not to say that the conclusions are invalid, but that cognitive factors put constraints and influence on the logic that resulted in those conclusions. Furthermore, it is impossible to be completely free of bias. Researcher bias will be an unavoidable source of research error. However, this is an inherent assumption of constructionism, and is embraced as a part of this research.

This paper has given a definition of green-tech innovation in Chapter 1. This definition is not the same for everyone. However, what some investors consider to be green-tech might not qualify under this paper's definition. This could mean that some perspectives may not fully apply. However, all investors observed in the sample had technologies in their portfolio that do qualify, making all perspectives relevant and valid.

Even when the observations themselves are of high quality, the sample is small. The sample size for grounded theory needs to be large enough to reach what Corbin & Strauss (1998) describe as theoretical saturation. Theoretical saturation occurs when no new or relevant data seem to emerge, categories are well developed in terms of properties and dimensions, and the relationships among categories are "well established and validated" (Corbin & Strauss, 1998). Research should continue until new observations show no new data. If grounded theory does not meet the requirements for theoretical saturation, conclusions are at risk of drawing conclusions with low validity or reliability (Thomson, 2010). This threshold of theoretical saturation is not a threshold that this study is able to meet. Due to limited resources and time constraints, primary observations (interviews) were limited to investors accessible by the researcher within the time limit who were also willing to contribute. This resulted in a small sample. Because the topic is so complex, it would take far more interviews until no new relevant data could be found. Accordingly, theoretical saturation is simply beyond the capabilities of this research. It is reasonable and acknowledged that this research could be ignorant to relevant topics. Thus, the findings are not capable of being exhaustive. Also, because of the limited sample size, the conclusions risk of having low external validity when describing all investors in GTI.

## 2.5 Reliability and Validity

Reliability considers the extent to which a study's results are consistent over time, are representative of a population, and repeatable with similar methodology (Bryman & Bell, 2015). Reliability is more of a concern in quantitative research than in qualitative research, and measuring reliability in qualitative method is difficult (ibid). This study is not repeatable in its exact form because of the high level of difficulty associated with getting interviews with these investors. The process can be repeated as it has been described, but because of the freedom granted to the researcher in analysis, researcher biases and heuristics constitute a form of error.

Validity considers the integrity of conclusions drawn from research, and whether the research measures what it is supposed to measure (Bryman & Bell, 2015). The remainder of this section discusses various relevant aspects of validity and how they apply to this research.

Ecological validity concerns whether findings within a study apply in the real world (Bryman & Bell, 2015). In the context of this study, ecological validity questions whether the perceptions that investors express in interviews are the same as their perceptions when considering real life investments. This difference is difficult to measure. For research purposes, this paper assumes that there is no difference between reported and actual views. Internal validity considers the degree to which observations match the theoretical ideas developed by the study. LeCompte and Goetz (1982) considered internal validity to be a strength in qualitative research. The conclusions derived from this study are applicable within the context of the study itself.

External validity, on the other hand, refers to the degree to which findings can be generalized outside of the context of the study. (Bryman & Bell, 2015). This is a particular problem for this research because of the small sample that was used, and the sample was not able to reach theoretical saturation. It is the nature of qualitative method to generate depth rather than breadth, and findings tend to be situated to the context of the study (Bryman & Bell, 2015). This is true in this study as well. Perspectives of each investor are examined with great detail in this report. Guba & Lincoln (1994) argue that this provides others the ability to make judgements on the generalizability of the findings. Furthermore, as constructionism considers each individual to have their own construct of reality, there are always going to be exceptions to the rule.

## 2.6 Ethical Considerations

The questions asked in this research are not designed to extract “sensitive information”. However, privacy is an important and valid issue which can be concerning to investors. Any individual who contributes to the study remains anonymous. However, the organizations are included in a description of the sample. The reason for this is to give legitimacy to the data. Any information obtained in interviews is not directly linked to any organization. Rather, patterns between interviews are discussed. When quotations are used, they are quoted as “an investor” as opposed to the individual’s name, or the organization to which they belong. All interviewed investors were provided with informed consent, allowing for an audio recording and presentation of analyzed data as described. All primary data was handled in accordance with GDPR.

## 3 Theoretical Perspectives, Conceptual Frameworks & Existing Knowledge

This chapter is broken into two major sections. The first section provides the theories and frameworks used in this paper. The second section lays out the pre-existing knowledge surrounding the topic gathered through literature review. This chapter serves as a starting point in the development towards a grounded theory.

### 3.1 Theoretical Perspectives and Conceptual Frameworks

This section lays out the theoretical perspectives and conceptual frameworks used in this research. It is broken into five sub sections. Each sub section will describe the theory or framework in detail in its relation to this research. The Valley of Death, and the Stages of Technology Maturity help to understand the context and the problems being addressed. Perception and decision making establishes the link between the two. The Impact Investment Framework for Decision Making helps to understand investors perspectives when evaluating particular kinds of investment. Behavioral Finance explains the impact of psychology on financial decisions. All are relevant and meaningful in the context of this research, and all are described in detail below.

#### 3.1.1 Valleys of Death

The Valley of Death, as described by Auerswald & Branscomb (2003) the space within the innovation chain which is most challenging to cross. After a commercial concept is verified, demands for cash flows are intensified. At the same time, access to this essential cash flow is very poor. Because of this, many innovations or startups fail. The valley of death extends until penetration of the target market. A product's potential for success is irrelevant in the VOD. The product needs ample investment from private sources. VOD is illustrated in figure 2 below; the dotted line representing VOD and the blue line representing cash flow.

Part of the cause for VOD is a disconnect between investors and innovators. The two have different knowledge, goals, experience, and expectations. Inventors are familiar with science, and the technological feasibility and novelty of their invention. In contrast, investors have an understanding of bringing a technology to market and the financing behind it. This is a clash between technology push and market pull. The ability or inability for investors and entrepreneurs to understand each other influences the success of crossing VOD.

#### 3.1.2 Stages of Technology Maturity

Foxon et al. (2005) develops a dynamic framework for technology maturity. In this model, a technology moves through several stages of maturity over time. It moves through Research and Development to Demonstration, followed by Pre-Commercial and Supported Commercial, and ends at the Fully Commercial stage. This does not imply a linear flow, as information moves in both directions; technology pushes from early stages and market pulls

through commercial demand. Technologies make progress toward technical and commercial maturity through the “systemic interaction of a complex network of actors” (Foxon, et al. 2005). Sometimes, these systems break down and a technology will fail to reach maturity (not least of these, VOD).

With each stage, the technology gains varied amounts of market penetration. Market penetration follows a pattern similar to a sigmoid curve. After the demonstration phase, market penetration rises exponentially. After supported commercial, penetration reaches the inflection point. A technology reaches the highest market penetration in the fully commercial phase, where the money is made. Market penetration is represented in figure 2 below, along with VOD. The phases of technology maturity are not named in figure 2 according to Foxton et al. (2005). Rather, figure 2 illustrates the relationship between market penetration and VOD; when enough market penetration is reached, the product becomes economically self-sustaining.

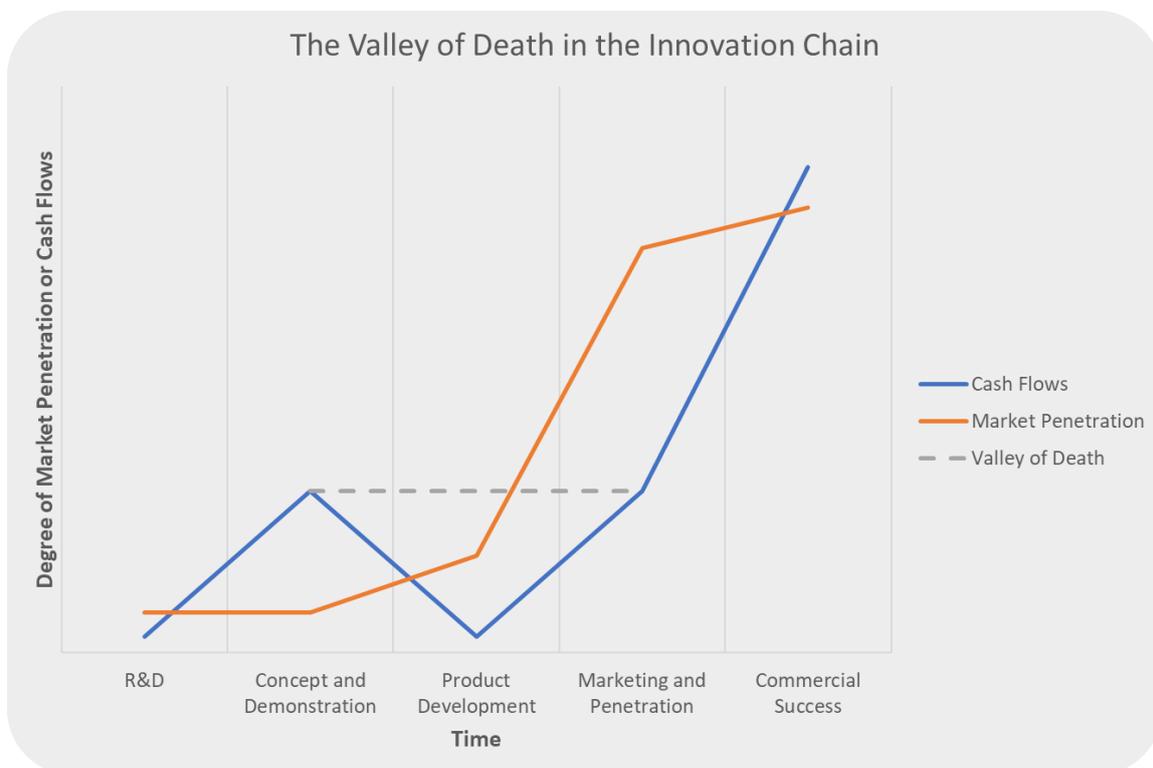


Figure 2. *The Valley of Death in the Innovation Chain*

### 3.1.3 Impact Investment Framework for Decision Making

Johnson & Lee’s (2013) framework defines impact investment as investments made to generate a market-based solution to a social or environmental challenge. Impact investing goes beyond traditional approaches of maximizing returns and minimizing risks. It also considers the social/environmental effect that an investment has. It is a strategy chosen by investors specifically because of its ability to generate social and/or environmental returns.

This framework is not specific to innovation, or any type of investment for that matter (debt, equity, stocks, etc.).

Impact investing is very investor specific. While there are so many challenges that an investor may choose from, it is important to remember that the challenge needs to be something that the investor wants to address; it is the investor's intent that matters. Social return objectives can vary from person to person; it is up to each investor to decide how much impact they want their investments to have toward their goal. The same can be said about financial objectives. Some investors might be content accepting below market rate returns as long as they are satisfied with the social impacts. Others strive for or even expect their investments to generate market rate returns.

### 3.1.4 Perception and Decision Making

Robbins & Judge (2013) give a good explanation of perception and its relationship with decision making, which is key to this study. Perception is a process by which individuals organize and interpret their impressions in order to give meaning to their environment. However, our perceptions can be different from objective reality. The perception of reality is what decisions are based on, not reality itself.

Factors that shape or distort perception of reality include the perceiver, the object or target, and the context or situation. The perceiver's interpretation is heavily influenced by their personal characteristics, such as their attitudes, personality, expectations and experiences. The characteristics of the target influence what is perceived. Because we don't look at targets in isolation, the relationship between the target relative to the context influences perception.

Every decision requires us to interpret and evaluate information. The data considered relevant to a decision is determined by perceptions. Perceptual distortions can often lead to bias conclusions. However, it is these perceptions that determine decisions, not reality itself.

### 3.1.5 Behavioral Finance

Behavioral finance incorporates psychological and emotional factors in its attempt to explain the reasoning of investors (Ricciardi & Simon, 2000). After all, investment decisions are made by humans. The main focus of behavioral finance is on the limitations of cognitive ability of investors and the role of emotions and social psychology (Bergset, 2015). Rather than some objective aspects of risk and return, a behavioral perspective would suggest that perceptions matter, and that perceptions of risk and return are influenced by cognitive factors (Wustenhagen & Menichetti, 2012). Several of these limitations and biases are discussed in this section.

Investment decisions are made by humans that act under bounded rationality (Simon, 1955). Bounded rationality is often cited as a constraint for decision making. Humans have limited information-processing capability, leading to uncertainty (Robins & Judge, 2013). This is related to prospect theory, which states that people do not always behave rationally, but psychological biases influence choice under uncertainty (Ricciardi & Simon, 2000). People

rely on a set of heuristics when making judgements under uncertainty, and this can lead to systematic errors in decision making (Tversky & Kahneman, 1974).

Other common biases in decision making include optimism bias, anchoring bias, confirmation bias, and risk aversion. With optimism bias, or overconfidence bias, we tend to overestimate our own skills and predictions for success (Ricciardi & Simon, 2000). Anchoring bias refers to our tendency to overvalue and fixate on initial information without properly adjusting our opinions and perceptions with subsequent information (Robinson & Judge, 2013). This has relation to confirmation bias, our tendency to seek information that confirms our past choices or beliefs and discount contradictory information (Robinson & Judge, 2013). Humans also have a tendency to be risk averse; people tend to avoid risk and select an outcome with more certainty (Robins & Judge, 2013). Kahneman & Tversky (1979) demonstrated that losses are weighted differently from gains, and expected gains/losses better explain investor behavior compared to final assets.

These biases and limitations are descriptions of human psychology and behavior, not of financial behavior. Behavioral finance uses these psychological factors to help describe the actions within a financial setting.

## 3.2 Existing Knowledge

This section includes data and information from the desk-based literature review portion of data collection. It shows secondary data, and things that are already known about the research area. It is focused on the perceived drivers and risks in an effort to address the research questions. Included in the review are articles of similar nature to this research, perspectives of venture capital and private equity in general, and other relevant information. Each section states and explains a driver or risk. The final section summarizes the literature review.

### 3.2.1 Technological Risk

Technology risk refers to whether a technology will achieve its expected performance, efficiency and/or cost reductions (Foxon et al. 2005). In other words, it is the risk that the technology will not actually do what it is supposed to, and is one of the major risks in technology innovation. Confidence in the capability of a technology is fundamental to investment decision of investors (Leete, Xu & Wheeler, 2013). Investors want to see a credible track record of good performance over time (ibid).

Technology risk also relates to lock-in and path dependency from previous development and investment (Polzin, 2016) Developers (and investors) can be tied into sub-optimal designs due to previous decisions and investments (Leete, Xu & Wheeler, 2013). This can result in large losses for investors.

### 3.2.2 Market Risk

A green-tech innovation is worthless unless it is able to survive in the market. Market risk refers to the uncertainty of the innovation's ability to succeed in the market, and uncertainty about future levels of reward (Foxon et al. 2005). An inability to comprehend signals from the market such as demand or biases for incumbents or alternatives hinder diffusion of technologies into the market (Polzin, 2017). Investors prioritize market criteria, such as expected demand – a major obstacle when it is lacking (ibid) It is also a common flaw of investors, however, to fail to understand the target market for the technologies (Udwin, 2015) Start-ups that are able to recognize that an entire market is not exactly up-for-grabs, but instead target niche markets, might have a better chance of success (ibid).

Local and environmental acceptance is imperative; negative attitudes or social values about a technology can hinder diffusion technologies (Polzin, 2016). This is of course only the case when there is rejection from the market. If investors perceive a high risk of social acceptance, it can result in early rejection of investment for a technology (Hu et al. 2018).

### 3.2.3 Incumbent Technology

Investors recognize that incumbent firms provide an important barrier to a young firms success (Bocken, 2015). In order to succeed, an innovations business model needs to significantly outperform the incumbent industry (31% of interviewees) (Bocken, 2015). However, economic barriers make this challenging. Economic lock-in and path-dependence due to a history of investments in old technologies can put incumbents at a large advantage (Negro, Alkemade & Hekkert, 2012). For example, fossil-fuel energy dominates the market with the help of decades worth of investment, and an economy built around its use. Investors are often involved in financing both new entrants and established actors, and are thus prone to lock-in because the incumbent technologies provide stable return (Bocken, 2015).

Investment into Green-tech innovation, such as renewables, can suffer further. disadvantages due to environmental externalities (Wustenhagen & Menichetti, 2012). When negative environmental effects of incumbents are not incorporated into costs, a fossil-fuel based technology benefits from the absence of these costs (Polzin, 2017). Furthermore, artificially low energy prices due to subsidies for fossil-fuels can spoil the energy (and cost) savings that many clean technologies depend on (Polzin, 2016). This indirectly puts green-tech at a disadvantage. Green-tech can in fact suffer a double blow from externalities as the positive externalities created are not sufficiently reflected in prices (Bergset, 2015).

### 3.2.4 Policy and Regulation

There is strong evidence in the literature that government policy and regulation have a strong influence on eco-innovation, and green-tech innovation (Faucheux & Nicolai, 1998). Regulation and policy are likely the most direct forms of risk for an investment, as many technologies are directly or indirectly dependent on these policies to be in their favor (Polzin, 2016). Proper legislation is paramount in impeding or enabling investment in green-tech. Investors are unlikely to invest in riskier technologies without effective policy support

(Arrow, 1962). It is important to keep in mind the complex dynamic between policy and investment flow; sometimes even the most ambitious policy targets are unable to mobilize the proper investments (Masini & Menichetti, 2012).

There is a debate as to whether innovations have been driven by a technological push or by demand factors (market pull), while evidence shows relevance for both (Rennings, 2000). The way regulations are written can influence this dynamic. Those advocating for market push policies articulate the need for technological breakthrough innovation (Burer & Wustenhagen, 2009). The rationale behind market-pull policies is that new technologies only make an impact if they are applied in a marketplace, and that a higher demand provides economic incentives to apply them (Dowlatabadi, 1998). Some investors believe that there should be a mix of both technology-push and market-pull instruments to stimulate investment along the entire innovation chain (Burer & Wustenhagen, 2009).

However, factors of technology push and market pull alone do not seem to be strong enough, green-tech and other sustainable innovations need specific regulatory support (Rennings, 2000). Feed-in-Tariffs is a particular mechanism highlighted in the literature. It is a more effective policy scheme in comparison to market-based approaches in reducing investment risk (Butler & Neuhoff, 2008). Feed-In-Tariffs have been shown to be highly effective in achieving deployment targets (Leete, Xu & Wheeler, 2013), and are favored by both investors and entrepreneurial firms (Toke & Lauber, 2007).

Massini & Menichetti (2012) quote Ecofys (2008) in saying “commitment, stability, reliability and predictability are all elements that increase confidence of market actors, reduce regulatory risks, and hence significantly reduce the cost of capital”. Clarity, consistency and predictability of the regulatory environment are all critical factors for investors (Leete, Xu & Wheeler, 2013; Burer & Wustenhagen, 2009). The more frequently regulations change, the more risk investors assume. Where the regulatory risk associated with policy changes is perceived to be high, investors will be less willing to factor the support mechanisms into their calculations (Burer and Wustenhagen, 2009). It is imperative that investors have confidence in the long-term stability of support mechanisms (Leete, Xu & Wheeler, 2013).

### 3.2.5 Capital Requirements

Given the nature of other risk factors, high capital requirements factor in as an important element in investment decisions (Gaddy et al. 2017; Flotow, Polzin & Klerkx, 2016). High costs for deployment is also mentioned by scholars as a barrier (Polzin, 2017). This acts as a barrier when firms do not have the necessary capital to execute an investment. However, there are some arguments that capital intensity is not a barrier. As referenced in Udwin (2015), after the 2008 crisis, “capital became incredibly scarce for anything perceived as having even the least bit of risk”. This would explain the lack of investment into more risky ventures during the last decade.

It is not just the scale of the investments, but the associated uncertainty and unpredictability that accompanies it (Leete, Xu & Wheeler, 2013). High levels of capital acts as an amplifier

of risk; if the probability of associated investment risks remains constant, the stakes are raised when capital requirements are high.

### 3.2.6 Entrepreneurial Knowledge and Skills

The knowledge and skills of the entrepreneur of business is of high importance to investors; things like leadership potential, industry experience, track record are taken into account (Burer & Wustenhagen, 2009). These skills reflect the firm's ability to be successful. This is the case with start-ups of any kind, and often adds an element of risk. Taking a technology from the lab to the market involves many challenges requires a wide variety of skills from developers; it is unlikely that any one entrepreneur or business will have all of these necessary skills (Leete, XU & Wheeler 2013).

Entrepreneurs in green start-ups can be knowledgeable in environmental issues associated with their business, but also lack proper business qualification (Bergset, 2015). This can be perceived as a lack of needed skills by investors. Green start-ups consider sustainability-related information central to the market in which they operate, even if the investor does not (Bergset, 2015). Bad business plans in which there is too much focus on environmental issues and not enough on financial planning creates a disincentive for investment (ibid). Furthermore, innovators tend to have an optimism bias in the performance, time frames, and development costs (Leete, Xu & Wheeler, 2013).

### 3.2.7 Insufficient Returns

Naturally, if a project is unable to generate the necessary return, it is considered an investment risk. Causes for insufficient return in green-tech innovation are linked to the other risks discussed in this section. Additionally, green-tech and other environmentally focused businesses may be subject to a misconception that sustainability is an added cost (Huhtala, 2003). While this is not the case, as shown by Khan, Sefarim & Yoon (2016) in section 3.2.9 along with other researchers, it is an important point because it is still a perspective held by some investors.

Innovation and start-ups are high risk investments due to the fact that the majority of them fail. The higher level of risk associated with these investments leads to higher rates of required returns (Ciccozzi, Checkenya & Rodriguez, 2003). Investors such as VCs that specialize in innovations and start-ups expect successful investments to have pay-backs high enough to compensate for investments in failed companies (Gaddy et al. 2017). This puts the start-ups under high stress to generate acceptable high levels of return.

### 3.2.8 Investment Timeframe

One of the obstacles discussed extensively in literature is a long payback period (Polzin, 2017). Sustainable businesses are typically developed within longer timeframes; however, a short-term mindset is prevalent among many investors (Bocken, 2015). A project's timeframe, planning and duration are closely linked to budgeting, risk management and cash flows associated with investments in innovation (Scarpellini, Valero-Gill, & Portillo-

Tarragona 2016). Most investments are generally illiquid until there is an exit, usually through acquisition or IPO (Gaddy et. al., 2017). Thus, time to ROI is a significant consideration for any investor in start-ups (Udwin, 2015). A tolerance for a longer time-frame is needed for investments in sustainable entrepreneurship (Bergset, 2015)

### 3.2.9 Returns and Impact

Investors committed to sustainability usually believe that there is a dimension of accountability; they feel responsible for the well-being of future generations (Antarciuc et al. 2018). There is also a sense that business can be used as a force for sustainability, and be good for business (Bocken, 2015). Ethics and virtue are a factor, as there is a desire to solve society's major issues. They search for radical new approaches due to a disagreement with the status quo (ibid).

One of the major drivers for investment is a competitive advantage (Burer & Wustenhagen, 2009). Innovation can lead to the creation of new products and markets, resulting in new demand and vast opportunity (Antarciuc et al. 2018). New markets result in what Kim and Mauborgne (2005) describe as "blue oceans". As opposed to competing for market share in the existing "red sea" market, disruptive innovations create whole new markets where no competitors exist.

Contrary to the common misconception that sustainability is a cost, scholars suggest that there is a positive relationship between environmental, social, and governance (ESG) involvement and financial performance (Dowell, Hart & Yeung, 2000). In particular, firms that perform strongly on material topics outperform firms who perform poorly on material topics (Khan, Serafeim & Yoon, 2016). This is evidence that investment into material issues as being value enhancing (ibid). Performance on immaterial topics was shown to be at the very least not value destroying (ibid). This makes it imperative to distinguish between material and immaterial issues. It is more than often the case that ESG is material to green-tech. The misconception noted in section (insufficient returns) that environmentally focused businesses suffer lower returns is not the perspective of all investors. In fact, according to Connaker and Madsbjerg (2019), more than \$11.6 trillion USD were invested into ESG investment strategies.

### 3.2.10 Impact Measurement

Impact measurement is needed to understand the 'additionality' of an investment, whether the impact was a result of the investment, or if it would have occurred anyway (EU Commission, 2016). Impact investors often want to know about the performance of their investments in terms of social impact just as much as they want to know about the financial performance. Generating meaningful and understandable performance indicators can help entrepreneurs to generate quality reports, measure improvements over time, and attract new funding (Keyte & Ridout, 2016).

However, this measurement comes with a lot of associated challenges. As found in a study of investors in Silicon Valley, there is a lack of clarity and an inconsistency in the measurement

of impact investment success, creating more confusion for social entrepreneurs when seeking funding, finding traction, and balancing profit and impact (Rustique & Winter-Hoelzl, 2017). Measurable performance indicators are not always the most important things to investors as they are not always meaningful measurements. While impact measurement is undeniably a challenge, it is something investors get excited to see. The ability to measure impact with meaningful performance indicators is a driver for investment. “the better we get at measuring impact, the more money will flow into impact investment” (EU Commission, 2016).

### 3.2.11 Summary

Table 1 below summarizes the major drivers and risks discussed in this section. It summarizes the drivers and risks described in this section as well as those that are both drivers and risks depending on the situation. This initial analysis aids in the development in a mid-range theory to describe perspectives of VC GTI. This is used in a comparison with the primary data to strengthen the findings.

*Table 1. Literature Review Summary*

<b>Drivers</b>	<b>Risks</b>	<b>Situation Dependent</b>
Financial Return	Technology Risk	Policy
Solving Societal Issues	Market Risk	Entrepreneurial Talent
Impact Measurement	Capital Requirements	
	Timeframe	
	Insufficient Return	

## 4 Primary Data & Analysis

This chapter discusses the data from the primary sources of this research, and the initial coding analysis of that data. The primary data sample, who was interviewed in the study, is presented and discussed in section 1. The coding template used to analyze the transcribed interviews is presented and described in section 2. This section provides clarity in how the data was analyzed and reduces ambiguity. The interview transcriptions themselves will not be provided. The resulting coded data is provided in section 3.

### 4.1 Sample

The sample size of this study is quite small, with only four observations. This is largely due to the fact that interviews were so difficult to come by. Investors of this variety that meet a good standard are difficult to find. Even more difficult is getting your foot in the door. Investors were often either unable or unwilling to contribute, thus resulting in a small sample size. This is taken both a benefit and a burden. It is a burden because it is difficult to have statistically significant results with such a small sample; four investors are not able to fully represent all investors in GTI. This is not enough to reach the threshold of theoretical saturation that strongly supports a grounded theory. Thus, the external validity or generalizability of the results suffer. The small sample is also benefit because it allows for more detailed analysis to unpack what investors say in the interviews, and generate results that are more thorough.

Perhaps more notable about the sample is the list of observations themselves. The strength of this sample might not lie in the quantity of observations; rather, the strength lies in the quality of the observations. Each investor was successful, experienced, and involved, to various degrees, within GTI. Not every technology in every company's portfolio qualifies under the definition of GTI given in Chapter 1. Some investors operate in other spaces in addition to GTI. Every company's portfolio had at least some technologies that do qualify under that that definition. Some GTI's within the collective portfolio include electric airplanes, power grid optimization, heat-generated electricity, grid connected smart homes, bioplastics, bio fuels, sub-surface pumped hydro energy storage, ocean wave energy, and many more

The investors showed great insight relevant to the research aim and research questions, as well as demonstrated depth in understanding of the complex subject. The perspectives of each and every investor are valid, reliable, and highly valuable in regards to this research. While the investors themselves are not included in the sample in respect for privacy, the organizations in which they are involved are provided in alphabetical order in Table 1 below. The reason for this is to legitimize the sample's strength. The unit of observation is the investor, not the firm!

Table 2. Sampled Organizations with Descriptions

Sampled Organizations and Descriptions			
Organization	Location	Type	Description
Almi Invest Green-Tech Fund	Stockholm, Sweden	VC	Seeks ventures that, through a product or service, result in CO2 reduction either directly or indirectly. 650 Million SEK of capital under management.
City Light Capital	New York, NY, USA	VC	Aims to solve today's most pressing issues through the implementation of technology. The goal is to generate market rate returns and create social impact in the process. The firm focuses on safety and care, education and environmental companies in several sectors.
Clean Energy Venture Group	New York, NY, USA Cambridge, MA, USA	VC / Angel	Seeks to invest in technologies that will result in 100 million tons of CO2 reduction per year. 100 Million USD of capital under management.
One World Training and Investment	Silicon Valley, CA, USA	VC	Provides training and education to people who work in the social impact ecosystem as well as manages a fund which makes early stage investments into for-profit social enterprises. 800K USD of capital invested.

## 4.2 Coding Manual and Schedule

The following tables, Table 2 and Table 3, show the coding schedule and coding manual respectively. These were used in the coding of each interview. They went through a drafting process throughout initial coding, and the final coded interviews are based on these tables. The coding schedule shows the dimensions of information meant to describe each interviewee, and the manual provides the guide to how each interviewee can fit into each dimension. Each category is associated with the code at the top of the manual, and that code, if it applies, is placed into its respective dimension in the schedule. In general, categories and dimensions were added if it applied to the data in some way. Dimensions within the coding schedule and categories within the coding manual that do not result in any meaningful information are removed or excluded. It is possible to have more than one code for a dimension. The dimensions and their associated codes are described in the remaining text of this section. The description of the coding scheme is provided to account for ambiguity, to ensure agreement on the terms that are used, as well as to better clarify the analysis of the data. The order of the dimensions or the codes in the tables has no important meaning.

Table 3. Coding Schedule

Coding Schedule		
Dimension	Investor Information	Code
1	Professional Title	-
2	Impact Investor Classification	-
3	Investment Stage	-
4	Investment Criteria	-
5	Percieved Barriers	-
6	Percieved Risks	-
7	Percieved Drivers	-
8	Optimal Market Conditions	-
9	Ideal Entrepreneurs	-
10	Optimal Time Frame	-
11	Desired Policies	-

Dimension 1 describes the professional position held by the investor within their respective organization. Only titles that apply to the sample are included as possible codes. It is possible to have more than one if it applies to that investor. Dimension 2 places each investor on the impact investor scale. As discussed in section 3.1.3, an investor can be impact focused when the goal of investment is to generate as much impact as possible even if it means sacrificing return, or an investor can be return focused where the goal of investment is to generate (at least) a market rate of return, even if it means reduced impact. As it is a scale, an investor can fall anywhere in between. Investors can fall between 1 and 5, 1 being impact focused, and 5 being return focused.

Dimension 3 describes which investment stage the investors are involved in. Seed and Pre-Seed Capital refer to the earliest stages of investment. Capital in these stages are meant to get the venture off the ground, Seed Capital being the first official stage for equity funding (Reiff, 2019). Series A further develops and optimizes a business after key performance indicators develop a track record (ibid). Series B funding builds and expands and scales the well-established business (ibid). Series C funding focuses on scaling an already quite successful company (ibid). Pre-Public Stage is quite self-explanatory in that it is the stage before the company goes public (ibid).

Dimension 4, Investment Criteria, describes what qualities a technology or entrepreneur should have in order for the investor to seriously consider it. If an entrepreneur does not meet one or more of the criteria it will severely diminish investor confidence. Possible codes for Dimension 4 evaluate whether the firm has high quality entrepreneurs, (code #1), if they have the ability to scale (code #2), if they have a proven commercial potential, usually through

market research or initial sales (code #3), And if the company has a potential to generate high ROI (code #4). Code #5 considers whether the venture will solve the issues that are important to the investment firm. Many firms will target specific issues. A venture may provide a good solution to a societal issue, but if the firm is not involved in that issues, it will not be considered for funding. Code 6, evaluates whether ventures meet the performance screen of the investment firm, such as avoiding a minimum volume of carbon emissions. Code 7 evaluates any proof of initial business success; more than one investor only considers ventures that have at least 1 million USD in past revenue. Code 8 evaluates the measurability of the resulting impacts of the venture on society.

Dimension 5 describes the perceived barriers to investment. Capital Intensity is a barrier when the capital requirements for a venture are too large for a firm to handle. This is more likely the case when the firm is small. Incumbents act also as a barrier because, as discussed in Chapter 3, past investment, current market position, and an incumbent's ability to adjust can put new entrants at a severe disadvantage. Policy is a barrier when laws or regulations prohibit or limit a key aspect of a business/technology. Lack of entrepreneurial knowledge is a barrier because humans are boundedly rational. It is likely that there is at least some important knowledge missing that hinders the firm's ability to succeed. The ability to measure impacts refers to a firm's ability to measure and report performance data relevant to the issue or issues they are trying to solve.

Dimension 6 involves risks that occur after investment has been made. Among the investment risks considered are technology and market risk as described in Chapter 3; there is a risk of a lock-in or a technology not achieving expected performance, and there is a risk of failure in the market. Policy risk (code #3) considers when policy changes against, and when pre-existing policy has larger negative effects. Entrepreneurial Shortfalls (code #4) involves the inabilities of the entrepreneurs to handle the unpredictability of the start-up journey. Insufficient Returns (code #5) refers to the occasions when a venture does not achieve the necessary rate of return required by the investor. Long Investment Time Frame (Code#6) is a risk because a venture may have a longer pay-back-period than initially thought. Capital Intensity is a risk for two reasons: an investment may require additional funding down the road, which may exceed a firm's limitations, and/or capital intensity can act as a risk amplifier. When more capital is invested, the probability of risk does not necessarily increase, but the severity of the risk increases. Product Defensibility (code #7) refers to a firm's ability to protect its technology or platform from being mimicked by other firms. This can be reduced through patents and trade secrets. Myopic risk (code #8) refers to an investors ignorance of what is beyond their view; that is, it is the risk that an investor assumes when they focus too much attention on what is directly in front of them. This will be discussed in greater detail in Chapter 5. Downstream Investor Support (code #9) refers to the ability for a firm to obtain funding in future investment rounds. Fast Pace is a risk as well because of the speed at which change occurs. Windows of opportunity are becoming increasingly shorter.

Dimensions 5 and 6 are related in that they both represent the perceptions of things that negatively affect a potential venture. Barriers must be overcome for an investment to succeed, and thus the prevalence of barriers influences the investment risk; barriers are a form of risk. Risks, on the other hand, are not necessarily barriers.

Dimension 7 describes the investors perceived drivers. Code #1, Strong Financial Return, refers to the desire to invest because the investment will generate a strong financial return to the investor. That is a competitive, at least market rate return. Risk Reduction (Code #2) is a reduced investment risk associated with investment in this space. Code #3 refers to an investor's desire to invest because it will solve important issues important to them and/or society. Industry Macro Tailwinds (Code #4) refers to trends in the market or operating context of a business that help it to improve or succeed more easily or more rapidly. Note that this is in reference to the large scale. Policy and Regulation in Code #6 can be a driver as a venture can take advantage of existing policies to work in their favor. Code #7 represents an investor's drive to invest due to the quality of the entrepreneur or entrepreneurs involved in a venture.

Dimension 8 describes an investor's perception of the ideal market they would want for their venture to target. The first four codes are self-explanatory: large, small, new and old markets. Code #5 represents a market that is in transition. Code #6 is related to the Macro Tailwinds mentioned in Dimension 7, when overall market trends work in favor of the venture. The last Code 7 represents a market or industry that is struggling and in turmoil.

Dimension 9 describes the entrepreneurs that an investor would consider to be ideal, and what qualities are desired in the entrepreneurs they invest in. This helps to determine what entrepreneurs might fit into Dimension 7 to be considered a driver for investment. Code #1 evaluates the entrepreneur's knowledge and skills within the context of their business; is this a journey they have done before? Code #2 considers the team of entrepreneurs. How well do they work together? How long have they worked together? Do they understand one another and do they have the same goals? Code #3 evaluates their understanding of their target market. How do they expect their product/service to be received, and do they understand the consumers? The Investor-Entrepreneurial Fit (Code #4) refers to the match between the investors and the investment firm and the entrepreneurs in terms of their goals, but also in their ability to work together and help each other. This is discussed more thoroughly in Chapter 5. Lastly code in Dimension 9, Code #5, considers the CEO of the venture. It evaluates their ability to understand the business they are building, what skills are needed, their leadership abilities, and whether their talents suited for the business and industry.

Dimension 10 determines each investor's optimal time frame. That is, how long the pay-back-period for investment. Rather than having specific codes, the number in dimension 10 will represent the number of years an investor considers desirable for a pay-back-period.

Dimension 11 describes what kinds of policies or regulations an investor does not see (at the time of this report), but wishes to see put in place. Cap and Trade and a Price for CO<sub>2</sub> are coded as #1 and #2 respectively. Code #3 considers the desire for worldwide policy – having a policy in just one country is not enough. Code #4 represents the desire for municipal governments to become more involved and more risk taking in this space in order to help along the small players. Code #5 represents the desire for subsidies.

Table 4. Coding Manual

CODING MANUAL											
Dimension	Code 1	Code 2	Code 3	Code 4	Code 5	Code 6	Code 7	Code 8	Code 9	Code 10	Code 11
1	Investment Manager/Director	Partner	CEO	Founder							
2	Scale: 1=Impact first 5=return first										
3	Pre-Seed Capital	Seed Capital	Series A	Series B	Series C	Bridge or Pre-Public Stage					
4	High Quality Entrepreneurs	Scalability	Proven Commercial Potential	High Return Potential	Solution to Relevant Issues	Meet Performance/Result Criteria	Proven Business Success	Measurable Impacts			
5	Capital intensity	Incumbent Technology, Market, or Actors	Policy	Lack of Entrepreneurial Knowledge	Ability to Measure Impacts						
6	Technology risk	Market Risk	Policy	Entrepreneurial Shortfalls	Insufficient Returns	Long Investment Timeframe	Capital Intensity	Duplicability	Myopic Risk	Downstream Investment Support	Fast Pace
7	Strong Financial Returns	Risk Reduction	Solving Important Issues	Industry Macro Tailwinds	Policy & Regulation	High Quality Entrepreneurs					
8	Large	Small	New	Old	Transitioning	Macro Tailwinds	In Turmoil				
9	Knowledgeable, Skilled, and Experienced in Field	Experienced, Aligned Team	Understanding of Target Market	Investor-Entrepreneur Fit	CEO-Company Fit						
10	(Number of Years)										
11	Cap & Trade	Price for CO2	Global Policy	Municipal Engagement	Subsidies						

### 4.3 Coded Data

Table 4 below show the coded data of each interview, based on the schedule and manual provided in section 4.2 above. The interviews are represented as interview A, B, C, and D. The interviews are placed into the table in no particular order. They are put into the same table simply because having a different table for each interview would be redundant. This coded data is useful for identifying the patterns. However, it does not do the data total justice because it fails to capture the important nuance and variance within the data. This nuance is discussed in Chapter 5, along with a deeper discussion of the trends and themes. The remainder of this section discusses the contents of the table and the patterns within.

Dimension One shows that all of the observed investors had a higher position, if not the highest position, within their organization. Two were investment managers or directors while two founded their organization. The table shows that every investor considered themselves to be a market rate return seeker on the impact investment scale; all of them are self-defined as return first impact investors. All investors were early stage investors in the seed rounds, some occasionally extending into series A or series B. What this table does not show is the degree of involvement in each stage. As a general rule, each investor was most focused within Seed Capital or Series A investments.

Table 5. Coded Data

Coded Data					
Dimension	Investor Information	Codes A	Codes B	Codes C	Codes D
1	Professional Title	1	2,4	1	3,4
2	Impact Investor Classification	5	5	5	5
3	Investment Stage	1,2	2,3	2,3	1,2,3,4
4	Investment Criteria	1,2,3,4,5,6,	1,2,4,5,6,7,8	1,2,3,4,5,6,8	1,2,3,5,7,8
5	Percieved Barriers	3,4,	1,2,3,4	1,2,3,4	1,4,5
6	Percieved Risks	1,2,4,5,8	1,2,3,4,5,6,7,11	1,2,3,4,5,6,8,9	1,2,4,5,7,8,10
7	Percieved Drivers	1,2,3,4,5,6	1,3,4,5,6	1,2,3,4,5,6	1,3,4,6
8	Optimal Market Conditions	5,6,7	1,6	1	1
9	Ideal Entrepreneurs	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4,5
10	Optimal Time Frame	10	10	10	N/A
11	Desired Policies	1,2,3	1,5	N/A	N/A

Some of the investment criteria were expressed by every entrepreneur. Of these were High Quality Entrepreneurs, Scalability, and Solutions to Relevant Issues. Other highly occurring criteria include a Proven Commercial Potential, High Return Potential, an ability to meet performance or result criteria, and Measurable Impacts. Of the perceived barriers, only one was shared by all investors: Lack of Entrepreneurial Knowledge. The highly occurring barriers in this table were Capital Intensity, and Policy - to a lesser degree, the incumbents.

There are several perceived risks in the table that are shared by all investors, namely Technology Risk, Market Risk, Entrepreneurial Shortfalls, and Insufficient Returns. The only other highly occurring risks include Duplicability. Almost all of the risks were perceived by at least one other investor. There was a wide variety of risks expressed by the investors, hence the high number of categories. This is partly due to the fact that a few risks, Myopic Risk and Fast Pace, were only perceived by one of the investors.

The perceived drivers are fairly consistent between the investors, and two of the investors shared the perception that all the drivers in the table apply to them. Of the drivers shared by all investors are generation of a financial return, the ability to solve important and relevant issues, and High-Quality Entrepreneurs. All of these are factors that make each of these investors want to invest their money. Other highly apparent drivers include the potential to generate a competitive advantage and/or an above market rate of return, and Policy and Regulation. Every driver was perceived by at least more than one investor.

There are no optimal market conditions that are acknowledged by all investors; however, large markets seem to be an important trend. But there seems to be a general agreement in what an ideal entrepreneur should like. Every investor is in consensus about almost every factor, save one: CEO Company Fit, which was expressed by only one investor. All investors were in agreement about the rest of the qualities of their ideal entrepreneur. Knowledgeable, Skilled and Experienced Entrepreneurs, Experienced, Aligned and Competent Team,

Understanding of Target Market, and Investor-Entrepreneurial Fit were expressed as important by all investors.

There was a general consensus among the investor that the desired investment timeframe was 10 years. Some allow for the possibility of extensions, and one investor did not consider timeframe important at all. Not all investors expressed a desire for policy changes, but the ones that did offered a range of suggestions for policy changes that would help encourage investment in this space.

## 5 Further Analysis & Discussion

This chapter develops a deeper analysis discussion of the data. While chapter 4 identified the major trends and patterns of perceived risks and drivers in the primary data, this chapter analyzes the transcribed interviews to a depth that the previous chapter is unable. This chapter discusses the drivers and risks themselves in depth. There are many interesting findings and noteworthy remarks made by investors that are discussed in this chapter, which help to understand why investors have the views that they have. This “why” is important because it appropriates and substantiates their views. The important details, complexities and idiosyncrasies associated with investor’s views are also highlighted throughout this chapter. This chapter compares and contrasts the primary and secondary data. The chapter is broken into 4 major sections. Initial discussion in section 1 explains important notions to consider when analyzing the data. Sections 2 and 3 discuss the perceived drivers and risks, respectively. Section 4 wraps up the discussion and summarizes the chapter. All quotations in this chapter are direct quotes from interviewed investors unless clearly stated otherwise.

### 5.1 Initial Discussion

In this section describes all of the primary data, as well as secondary data, and brings up important elements to consider when trying to understand the data. It serves to better understand the drivers and risks discussed in latter sections of this chapter. Broken into three sub-sections, it discusses investor variability, a return-first investment approach, as well as the complexity of the data.

#### 5.1.1 Investor Variability

No two investors are completely alike. Investors vary in their knowledge, goals, skills, focus, scope, strategies, preferences, size, the list goes on. Most importantly for this paper, investors vary in their perceptions. Investors have various opinions on what they consider the drivers and risks to be, and will perceive each of those risks and drivers with varying degrees of conviction. The degree to which perceptions vary varies. This depends on the individual investors being compared. This variance is clearly evident through the empirical observation of investors. This variability comes with no surprise given the complexity of the topic.

This variability is for both objective and subjective reasons. Variance due to subjectivity comes from the variance in knowledge, goals, and heuristics. Because of this, two investors can perceive the same potential venture differently. Subjective variance comes from situational circumstances. The same venture may be perceived differently if it is considered in different contexts. To illustrate this with an example from the data, we can consider Time Frame. Time frame was important to three out of the four investors, to varying extents. However, one of the four investors did not consider time frame very important to him. That was his subjective opinion because he happens to have different investment goals.

Variance in opinions can also be explained for objective reasons. Investors operate in different geographical regions, in different sectors, and with different settings. The

perceptions of risk or opportunity vary partly because they don't always apply to the same extent. As an illustrative hypothetical, investors in renewable energy will have different perceptions of policy if they operate in a country with a price on carbon in comparison to a firm that operates within a country without this added cost. This goes to show that perceptions can vary between investors both for objective reasons and subjective reasons. Thus, this variability is an unavoidable source of variance that must be embraced as part of the result.

The remainder of this chapter will discuss the emergent patterns that appear in the data. Chapter 6 will arrive at conclusions that describe the sample and attempt to describe the larger population. Throughout this process it is imperative to keep in mind that there are always some elements of variability between individuals. There is not cookie-cutter, one-size-fits-all framework that will describe all investors in this space comprehensively. While some perceptions are applicable to all investors, it is not implied that all aspect that is discussed applies to all investors, or that any aspect will always apply to the same extent. Given the high variability, the patterns that do emerge are more meaningful.

### 5.1.2 Return-First Impact Investing

Every investor classified themselves as a market rate seeking investor. On the spectrum of impact investors that was explained in section 3.1.3 everyone was on the "return first" end. This is something that is consistent among all investors that were interviewed. This suggests that if a potential investment will not be able to achieve at least the market rate, then it will not be seriously considered by the investors. Entrepreneurs should pay close attention to this pattern. Investors reported that they would only consider investment if a venture had a potential to achieve 10X ROI. One investor conveyed with strong conviction that "we are in this to make money." Another investor discussed the strangeness of the idea that suggests investors might be looking for below market rate returns, something that traditional investors would never consider.

There are some very important reasons behind this view of a strictly market rate seeking investment strategy that deserve examination and discussion. Firstly, early VC involves a high level of risk, and it is not uncommon for a venture to fail entirely. Thus, the successful ventures must perform well enough to compensate for the failures. Furthermore, contrary to what some believe, impact investing does not need to exist below the market rate of return. "People hear (impact investing) as essentially concessionary investing, and there's a strong belief that it is not a concession, that it is a theme." Impact investment is often thought of as having tradeoffs between impact and financial return. But the impact space is perfectly capable of achieving market rate return if approached properly. One investor uses the term profitable social impact. "It's social impact, yes, but it's done in a way that's synergistic to the business." When profitability is directly connected to the positive impact, the tradeoff notion can be disregarded. This view of using a for profit business to generate social change is powerful, but it is far from universally accepted.

While these investors refuse not sacrifice financial return, they still insist on having strong social and environmental impacts. Not sacrificing return does not imply that there is a

sacrifice in impact. In fact, according to these investors, it is quite the contrary. “To generate any impact, there has to be a very solid business behind it.” In other words, the best way to solve the issues is through a strong successful business. A successful business that is able to scale and generate high return on investment (ROI) has a greater ability to achieve the desired social or environmental impact. This is because of the ability of a successful business model to grow to larger scales.

“A lot of people talk about, you know, impact at scale. But you know you might have the best intentions in the world, but unless you’re really funding robust businesses led by capable entrepreneurs that are going to get the business off the ground, then, you know, it doesn’t matter, right?”

The view is that a business should sustain itself and grow in order to reach the scale to achieve greater impact. If a business is small or will not survive long, it is not going to generate much impact. Strong successful business is a better path to solving issues. One investor emphasizes his underlying philosophy.

*“We’re very passionate about the idea that making money by averting climate change is the best way to avert climate change. Um, and so if you’re a good impact investor you should be a good financial investor or you won’t have as much impact as you intended.”*

These investors perceive the two factors, return and impact, as correlated and linked. According to them, the idea that impact investing requires trade-offs between impact and return is outdated. Occasionally, tradeoffs may be necessary, but it should not be considered as the rule. You can have one without the other, return without impact, and impact without return. But the strongest impact is achieved hand-in-hand with strong financial return.

### 5.1.3 Complex Interrelationships Between Drivers and Risks

There is a relationship between the different barriers and risks. The categories of risk and opportunity influence one another. It is inappropriate to look at just one without considering the rest. The factors are connected through a complex web of influence. An example to illustrate this point: in the context of renewable energy, subsidies on fossil fuels, or a lack thereof, will have a large influence on the incumbent carbon-based fossil fuel industry. This can result in incumbent actors as being more or less of a barrier. This in turn influences the ability for a venture to be financially successful, its market acceptance, its market risk and thus the willingness for investors to engage. This is to show that if the proper policies were put in place, barriers to innovation and thus investment could be reduced or even eliminated. The contrary is also true in that policy can create larger barriers and increase investment risk.

The interconnectivity forces all aspects to be considered when making investment decisions. If steps are taken to decrease one particular factor of risk, it will have an influence on the other elements of risk and element of opportunity. Investors need to consider all the pieces as parts of a larger picture, and the influence that their means of risk management has on that picture. Furthermore, each specific venture is going to look different. Some barriers might be larger, some risks might be larger. Even if a venture is incredibly effective in managing some forms of risk, it may not be enough for the venture to be successful. Many different factors come together to determine the success of any one venture. The importance lies in how the

drivers line up with the risks and barriers. This interrelationship is incredibly important. This complexity is difficult for anyone to understand, but it is what investors must recognize and discern when making investment decisions.

## 5.2 Drivers

This section discusses the perceived drivers that were prevalent in the data. It discusses each driver in detail, and examines why investors have the perceptions that they do. This section is broken into 6 drivers. Not all drivers are perceived by all investors, or considered to have the same intensity.

### 5.2.1 Strong Financial Returns

Naturally, one of the main drivers for investment is to generate a financial return. Investors commit to this space because they believe that there is financial value to be found. This is self-evident. But there was a pattern here that not as obvious: investing in this space has the potential to generate a stronger rate of return in comparison many alternatives.

This is not a perspective that is held by all investors in the sample – as stated, investors vary on their perceptions. But for those who agree with this, consider the environmental space to involve a competitive advantage in comparison to the alternative. “It’s essentially contending that um, you know, a portfolio based on mitigating climate impact will outperform a portfolio that exacerbates it or does nothing,” explains one investor. This belief stems from the notion of momentum behind a societal shift away from un-sustainability. The opportunities are vast. As the investor explains, “we have more deals than we can handle.”

There is also a shift away from where the green-tech space was in the 2000’s. During that time, the green-tech space was struggling. This is what many will point to when they say green-tech is a high-risk space. Now, there is a perception of a healthier market, as demonstrated by some of the investors in the sample.

*“The industry wasn’t as ready then as it is now. The pressure is much, much higher and the readiness is much, much higher. So um, I think there is a big difference now compared to (10 years ago).”*

This excitement of both investors and others contributes to the perception of an undervalued sector and a space that is full of competitive advantage over unsustainable alternatives.

### 5.2.2 Risk Reduction

Some of the investors choose to involve themselves in this space not just because they are seeking value or high ROI, but also because it involves lower investment risk. True, this is not a driver observed by all, but it is still important for several interviewees. They believe that the trends over the coming years and decades will not only reward those that move away from unsustainability, but punish those that do not. “Investing in things that don’t mitigate climate change, or do the opposite, uh, is actually a bad investment strategy” says one

investor. The general view is that things will change in a way that will make business operating in an unsustainable space riskier and more difficult. “It’s not saying that it wouldn’t be very successful, but you are then facing more risk – would be less resilient compared to if you would be hitting all of the sustainability goals,” explains another investor, referring to the effects of policy changes and increasingly constrictive environmental pressures.

### 5.2.3 Solving Societal Issues

One of the most important drivers for investor involvement in this space is a willingness to solve important issues within society. Every investor in the sample sighted this as a driver for investment. Investors are not all trying to solve the same issues; some investors are specific to one particular problem like CO<sub>2</sub>, others take a more horizontal approach and involve themselves in many environmental and social issues. However, the desire to solve important issues is consistent. It is an important driver for investment in GTI.

Investors got excited when discussing their engagement in the issues through doing business. “The win-win for me and the double whammy is the fact that these are actually companies that are doing work to improve lives and improve the planet in some way.” This is something that investors can be very passionate about. Others brought a more business sided financial discussion in affirming that solving the issues, such as climate change, is good business. One investor was more serious about the gravity of our problems. He explained that environmental problems are the most important and pressing issues today. He acknowledges Bill Gates, and agrees with his view that “even though we get a better vaccine around the world that would save millions of lives, or billions, it wouldn’t be worth much if we can’t fix our environmental problems right now.” The view is that the environmental problems can become so severe that it will make solving the social issues like poverty and disease much less relevant. Solving the issues then becomes important not just for ethical reasons or for business reasons, but because it is paramount for the well-being of society.

### 5.2.4 Impact Measurability

As discussed above, investors are driven to invest in GTI in part by a willingness to solve important issues. Just like investors like to know what financial return is generated from investment, they like to know what impact is generated from their investments. In the sample, there was a strong pattern to show the importance of impact measurability as it was expressed by almost all investors to have varying degrees of importance. This means that a venture should be able to accurately measure the social or environmental impact that their firm has. A rigorous report on social impact is increasingly demanded by investors. The degree to which a firm can do this is an important quality that could potentially make or break a startup.

This is more or less difficult depending on what sector a firm is in. Which indicators get measured is important to determine as well. For instance, a firm in renewable energy is capable to measure the CO<sub>2</sub> avoided in comparison to various kinds of fossil-based energy. This is quantifiable and trackable. It is more difficult for the same firm to measure the indirect impacts on health. This deeper data is more difficult to collect and is not as easily quantifiable. It may be the case that a firm cannot accurately measure its impact at all. How

does the This will depend on the technologies themselves, the goals they are trying to achieve, as well as the resources that the firm itself has.

What gets measured gets financed. There is a vast volume of reports and research out there dedicated to impact measurement alone. This highlights the attention dedicated to this area. Entrepreneurs often need to have as much transparency in their social and environmental impacts as they have with their finances. They should invest the necessary time and effort in collecting and presenting that information, when possible.

### 5.2.5 High Quality Entrepreneurs

Entrepreneurial talent was recognized by all observed investors as being a major factor that influences decision making. Some of the sampled investors regard the quality of entrepreneurs to be the most important factor to consider when it comes to making investment decisions. Entrepreneurs with the right knowledge and skills was expressed as a major driver for investment. However, lack of entrepreneurial knowledge or skills is considered a risk. Thus, the quality of entrepreneurs is paramount in investment decisions. “It’s all about people.” Having good entrepreneurs is a factor that is given high value in most all types of VC. Early stage GTI is no different.

Observed investors agreed on the importance of having quality entrepreneurs, but also seemed to agree on what makes a good entrepreneur. As shown in the data, entrepreneurs matched in Dimension 9, which in broad strokes describes an ideal entrepreneur. According to the sample, they should be knowledgeable, skilled, experienced in their field, and be part of an aligned and experienced team that works well together, and have a deep understanding of their target market. One investor explains the importance of the entrepreneur:

*“Someone should be able to articulate to me why whatever they’re doing is valuable to a real customer who will pay you for it and they will pay you significantly more than it costs you to deliver it...Have they bothered to figure out how customers really do think? What customers, you know, what scope matters?”*

If an entrepreneur is not able to answer these questions adequately it can lead to a lot of uncertainty about the success of an investment. This highlights the importance of entrepreneurial knowledge and skills. Strength in relevant knowledge and skills is valuable in the eyes of the investors. Not having these qualities can degrade the perceptions of the investor, and can even be considered a risk. This makes the knowledge and skills meaningful qualities in an entrepreneur. However, there is more to consider when evaluating an entrepreneur.

Investors described in great detail the nuance involved in how they evaluate the entrepreneurs, and how entrepreneurial capabilities can have different effects on the ability of an investment to succeed. Of course, entrepreneurial talent has to span a lot of different kinds of skill sets since there is so much to handle in a startup. One investor describes how entrepreneurial talent can consider a lot of different elements dependent on stage. “Even if they look very good at the stage they’re at, it’s not obvious they’ll scale to the next stage.” No

entrepreneur can be an expert in everything, and this needs to be understood by both the investor and the entrepreneur.

*“If I find someone who is brilliant at X, assuming that they’re also brilliant at Y and Z, um you know that’s not fair. But if they’re brilliant with X and they know they need help with Y and Z, um you can get somewhere.”*

This investor describes his ideal entrepreneur as “both sufficiently self-confident to start something, and sufficiently humble to know that they’ll probably need help, which is a delicate balance.” It is up to the entrepreneurs need to prove they have sufficient knowledge, but it is up to the investor to understand where the gaps in knowledge exists and try to account for those gaps.

The skills and knowledge of an entrepreneur are important, yes, but it is also necessary for that knowledge to fit into the context of their business. As one investor explains:

*“What’s really more relevant is it’s less about product and market. It’s more about CEO and company. It’s not enough for a CEO to just, hey they went to a great business school, their undergrad and they worked at Google, they’re obviously going to be a great entrepreneur. Um what really matters is what’s the fit between that person and their company.”*

This refers to their familiarity with their target market, their product, their ability to work together with a team and be a proper leader. There is a lot to consider when evaluating the quality of an entrepreneur. This adds another layer of complexity onto an already complex context for decision making.

The early GTI space is a difficult space to be successful. Even so, one investor maintains that “I feel pretty good deploying capital into it because I think we’re seeing better talent creating better solutions.” Quality entrepreneurs is an undeniable driver for investment. Furthermore, low quality entrepreneurs can be considered a risk to investors, thus making the quality of an entrepreneur paramount to the willingness of an investor to execute on making an investment.

## 5.2.6 Investor-Entrepreneur Fit

One subject that all investors are in agreement on is the importance of an investor-entrepreneur fit. Investor-entrepreneur fit is considered an element that determines the quality of an entrepreneur. This fitness is determined by multiple factors. This involves the ability for an investment firm to help the venture beyond just investment capital, and the alignment of the goals between the two entities.

If an entrepreneur has a different set of goals, it is not a suitable venture for the investor. For instance, it is important to agree on the time frame of the investment. “We have a 10-year fund” reports one investor. “And so, if a company is saying they have a 20-year horizon, I mean venture capital is not the right fit for that.” What’s also important is that the end goal is the same for the entrepreneur as the investor. Another interviewed investor speaks to some entrepreneurs’ disinterest in an exit. He explains how some entrepreneurs “want to do a different kind of journey as a founder and they want to keep control and they want to grow in a quite organic way.” VC on the other hand generally wants to do an exit within their time

horizon. Scalability is also important for VC for both financial reasons and impact reasons, as was expressed by all investors. Some entrepreneurs seek funding for something that can't scale. "It's not always understood that some ventures aren't meant for venture capital." This is to say that it may be the case that a start-up, although it may have potential for success, may not be suitable for venture capital to begin with, and perhaps should consider different forms of financing. An inability to line up on these factors, and others, can make or break an investment.

What a bit more nuanced in the investor-entrepreneur fit is the ability for an investment firm to aid a startup or entrepreneur beyond just the value added through financial capital. Investments are made when "we think we have some semblance of expertise and abilities to helping skills of venture companies." Part of the value added by VC firms is their ability to provide advice, leverage their network, and use their own skills in support. An investor describes how his firm can "bring to bear other resources including our network and our training company to help the companies go even further." This is often part of the investment decision making process. One of the investors evaluates: "Do I understand their barriers to entry and can I lower them with financing and partnerships and whatever else they (the entrepreneurs) need?" Investors are then able to "pre select to some degree, do we even want to make this investment, and if we choose to do so how do we best support these entrepreneurs? What is it that they really need?" This investor-entrepreneur fit is a selective screen that firms can use when determining their investment portfolios.

The alignment of goals and the ability to provide support beyond financial capital are important highlights within an investor-entrepreneur fit. Other factors influence the fitness between investor and entrepreneur as well. One investor reports a whole class of investments that are not suitable for the screens used by his firm. Aside from the levels of alignment discussed above. Other aspects that determine the level of fitness involve whether the venture aligns with the other criteria the investment firm has. Does the venture solve the relevant issues? Is it a good investment opportunity in general? Does the firm operate within the proper geographical context? Put simply, an entrepreneur must meet the investor criteria in order to be a good fit. In any case, fitness between investor and entrepreneur is an important part of the screening process by investors.

## 5.3 Risks

This section discusses the perceived risks that are prevalent in the data. It discusses each risk in detail, and examines why investors have the perceptions that they do. This section is broken into seven risks. Not all aspects of risk are perceived by all investors, or considered to have the same intensity.

### 5.3.1 Capital Intensity

Capital intensity was addressed by all sampled investors, as well as the literature review, as a barrier to investment. This is only a barrier when the capital required by a venture is greater than the volume of capital that a firm is willing or able to commit. This is usually more of a

factor when capital under management is low. When a firm becomes larger and larger, this barrier becomes smaller and smaller.

Capital intensity is also a factor of risk after an investment is made. Capital intensity can become an added factor of investment risk when a venture begins to demand more subsequent injections of capital. This can create a supply-demand problem between the two, and lead to serious financial problems. Making investments with higher capital requirements is not always itself a risk, but instead an amplifier of risk. The probability of the investment failing does not necessarily go up. Rather, the losses that are realized if the investment does fail are exaggerated. This is only perceived to be the case by some of the sampled investors.

### 5.3.2 Technological Risk

Technology risk was acknowledged by all of the sampled investors, and was addressed in the literature review as a key element of risk. In this early stage GTI space, technology risk is quite an obvious risk. Investors discussed in more detail how they perceived the specifics of technology risk, which varied a bit between investors. Functionality of a technology is in the more obvious category of risks: “If the product stops working, we are either going to fix it quickly or we’re going to lose money.” Success is directly linked to the technologies ability to perform well and function with the expected performance standards.

Less obvious is that the technology itself can be a risk. Indeed, it is possible to get locked into technologies that are less than adequate. But even when a technology performs spectacularly, the product can still be vulnerable to other kinds of technology risk. An interviewed investor explains that the best technology doesn’t always win:

*“The technology part is by no means sufficient. And sometimes actually is a barrier. If your technology is too advanced for the supply chain to cope with, then you’re significantly hindered in your ability to make a successful business out of it.”*

This is contending that it is possible to be locked in to a technology that performs spectacularly, but for whatever reason is not received as well as anticipated. The technology needs to be able to fit within its intended market, and it needs to survive the other challenges beyond just technological ones. This is where market risk and technology risk begin to overlap. Technology risk is a fundamental risk, present in perceptions sampled investors as well as in the literature review.

### 5.3.3 Market Risk

Market risk is determined by an innovation’s ability to succeed in the target market. Market risk is a standard form of risk that applies to most any product in any market. It is generally determined by the market itself, the conditions that the market is in, along with several other factors. All investors acknowledged in some form the existence of market risk.

The intensity of market risk is perceived by some investors as quite high. It is even considered as more significant than most other factors of risk. One investor describes his perception of market risk as more serious than even technology risk.

*“The demonstration that a technology can do something really neat is often not the hard part. The hard part is often getting into the market channel, getting it into the hands of customers, getting people to trust it enough that they will rapidly deploy it, and that’s very expensive and very risky.”*

While market risk might be an obvious form of risk, it needs to be addressed with adequate vigor. Like most things, navigating the market and managing market risk is easier said than done. “There aren’t that many people who have built a business successfully and wanted to stay in this marketplace because it’s so difficult.” Like any of the elements of risk, market risk does not always exist to the same degree, and it is not perceived by investors to have the same level of intensity. Nevertheless, market risk is a crucial element in early stage GTI.

### 5.3.4 Target Market Conditions

In order to succeed, it is important to understand the target market. It is also important to understand which target markets and conditions are optimal for an entry and which have more risk. After all, the state of the target market will influence the dynamics of market risk. Some conditions are optimal for entry, others far more challenging. For instance, size and maturity of a market are important here. Target markets help to frame where the technology will exist in society and will largely determine its ability to succeed.

Along with the macro tailwinds, or major trends in an industry that act to a ventures benefit, sampled investors tended to perceive large markets as being ideal in order to achieve success. This is simply because there is more volume to take advantage of. This is helpful in that can generate more revenue with economies of scale. As an added bonus, it will generate more impact as well: “if you insist on having the level of impact that we’re talking about, the market have to be pretty large.” Put simply, there is a common perception that with larger markets come larger financial and social opportunities.

However, there can be serious obstacles when selling into a large, mature market. One investor discussed how large markets can be complex, and success can involve competing against or changing a lot of stakeholder’s business models or habits. Mature markets can be difficult unless you can find a way to differentiate the technology in a way that consumers will perceive as better or otherwise the same. In contrast with immature markets,

*“you can get into the market much more easily, um but there’s a risk to understand if the market’s really going to be there or how it’s going to grow or what the pricing’s going to look like. You’re kind of trading risks depending on what market you go into.”*

This trade off of risk is derived from the differences between market sizes. Each target market is associated with its own pros and cons, but it is up to each investor to determine how the pros and cons align with them, where they think the best opportunities lie.

Another noteworthy, yet uncommon perception in the data in terms of market conditions was the perception that an industry in transition or turmoil is prime for entry. When issues and changes exist in an industry, “there becomes anomalies and... imperfections that small players can utilize.” This is important in reducing barriers to entry and creating opportunity when trying to enter into an existing, large market. This quoted investor considers this to be the most important thing when considering target market conditions.

Target market condition influences the ability for a venture to succeed. Target markets are not themselves a form of risk, but rather it will determine the level of market risk, and influence the other aspects of risk. Its influence is itself complex, adding yet another layer of complexity.

### 5.3.5 Incumbents

Incumbent technologies, firms, and markets was recognized as a barrier by several investors as well as in the literature review. This stipulates that an incumbent’s control over the existing market increases the barrier to entry, that incumbent benefit from high volume of past investment, and that infrastructure is set up in a way that benefits incumbents. The incumbent actors put green innovations at a disadvantage, forcing them to overcome higher barriers and market risk; the innovation must outperform the incumbent without these benefits.

There is always an incumbent factor in early stage VC. There is always risk that incumbents, when they exist, will adjust to changes or simply create a barrier to entry too large to overcome. The environmental sector has incumbents that are particularly stubborn. In this space, the forces of the incumbent can be exaggerated. As a sampled investor affirms in a discussion of energy:

*“There are a bunch of utility companies, oil and gas businesses, that really don’t want this change to occur. So, there are forces of resistance that exist that may not occur in other market places to the same extent.... There are large financial incentives for the status quo to stay the same for existing players who basically have, you know, power companies are basically monopolies.”*

Bringing about necessary change is incredibly difficult given the state of the economy and the strength of the economic forces. The reason for this stubbornness and active effort to conserve the existing system is because of the large benefits to the incumbent, as the investor explains. For these reasons, the challenges presented by the incumbent create large barriers to entry for many GTIs. Of course, the strength of an incumbent will vary, and they will not always be as prevalent as in the energy sector. Nevertheless, investors consider incumbents to major barrier to the success of GTI.

However, there are some slightly conflicting views in this space. One investor describes that incumbents do not necessarily take the stonewalling approach to keep the status quo as described above. Rather than continuing on the current path, he describes how “market incumbents and the petrol companies are also diverging,” creating a macro tailwind in favor of GTI. He describes businesses within and across sectors making changes are being made to shift away from unsustainability. “So I think you see this across the board and this is really

happening... These are major shifts that are taking place.” The shift and transition by incumbents and in the market can in fact turn incumbents into a driver for investment in GTI. This is not a perspective that is shared by many, or that is common in this sample. It is, however, important to highlight this view. Overall the view is that incumbents represent a barrier in the market within the environmental sector.

### 5.3.6 Time Frame

As mentioned in the literature review, business investments in the environmental sector can have a longer payback period than traditional investments. The primary data shows a general consistency between investors that the ideal time horizon is 10 years, which is akin with traditional VC. The only investor that was inconsistent did not consider timeframe as important at all. Interviewees were fairly inconsistent, however, in their interpretation of time frame as an investment risk. One investor self identifies as being more patient than normal VC, describing how there is a need to consider things that have a more disruptive impact on until after 2030 and 2040; a business needs time to grow and generate a sustained impact to help achieve the sustainable development goals. Others consider it to be a more significant investment risk, weighing much more heavily into their decision making. Timeframe can be just as important as any other aspect of risk.

*“(a technology) might be the most important innovation that you’re going to run into, but it also might be a terrible investment because it might take too long, um, to, to happen.”*

That is to say that even when a technology has the potential to revolutionize an industry, it may be a waste of the investor’s time simply because the investment takes too much of just that: time. Thus, a GTI can be disqualified because of the financial costs associated with longer timeframe. Long payback periods are of course suboptimal and inconvenient, but that added time is also an added cost. “If it takes somebody 3 times as long, that’s just more cash that they’ll need to get it right.” Longer time frames can increase the capital requirements of an investment and thus add to the financial risk.

There is variance on how lenient an investor is on time, and disagreement on the degree of risk involved with timeframe. Some allow for extensions, or even anticipate a longer time to maturity, while others are firm on deadlines. Generally, the timeframe to be expected from investors is 10 years.

### 5.3.7 Myopic Risk

Myopia is a term analogous with near-sightedness. In this report, myopic risk is not meant to describe a short investment time frame. Myopia within the context of this paper is explained by focusing only on what is directly in front of you and ignoring other important aspects outside of immediate view, there is a risk of making bad decisions through the ignorance of other important factors or important information. This can apply to a specific investment, or an investment firm entirely. Myopic risk was perceived to be a risk by only one investor, and it did not come up in a literature review.

In the context of one specific investment, it is possible to get caught up in the novelty and excitement of an innovation. Ignoring how the technology fits into the large context is the kind of myopia that can have consequences.

*“Just looking at the parts that you think are interesting right then is a big threat in terms of making good decisions about where to invest. If you ignore those other phenomena you can get whipped out. So I think a big error that people make is they’re behaving as though there aren’t external forces or broader scope, uh, or that the incumbents actually aren’t making progress fairly rapidly.”*

He is essentially contending that investors that operate as though they wear metaphorical blinders run a high level of myopic risk. Ignoring the forces that act upon you outside of your view can have disastrous consequences. Investors need to understand how their product will fit into their target market, and how their consumers behave. Not doing so can lead to major errors. This is illustrated by an example:

*“So fuel cell people will frequently talk about having the best fuel cells, but most people aren’t deciding which fuel cell to buy. They’re deciding on buying energy, and the fuel cell never entered the conversation until much later.”*

By ignoring this aspect of consumer behavior, the investor behaves differently and does not take action to account for this fact. When the technology that an investor is excited about may for example solve a problem that is addressed by a variety of unrelated technologies, there is a significant level of risk. This is illustrated with an example:

*“People make a big mistake in thinking that energy storage is going to be batteries, when it could be thermal storage, it could be chemical storage, it could even be mechanical storage or just demand response.”*

By ignoring the other possibilities to solve issues that do not involve the technology in front of you, there is an important element of risk. That form of technology could potentially be whipped out by an alternative form of innovation. Not considering these factors is when myopic risk is present in investment. As candidly put, “The errors that people make are extreme.”

Myopia can also influence an entire firm and the range of technologies they consider for their portfolio. It is reasonable to assume that a firm might only invest within the geographical context in which it operates. This, in a way, can be an advantage. It can allow a firm to better leverage a network and understand the context in which a venture operates. It becomes a risk because when the focus of the firm is only within that context, it does not fully grasp everything that happens outside of that context. Silicon Valley is considered by many to be the tech hub of the world. According to one investor,

*“we don’t really recognize that the vast amount of innovation and deployment is happening in China and India. And so we think Tesla is what represents battery powered cars, and you know it’s the fifth biggest battery powered car company.”*

This is contending that firms are ignorant of the global picture, and thus make inaccurate assumptions about market trends. This aspect of myopic risk is less significant, as it suggests

that global trends will overcome the national markets. It would take major market trends for it to become a serious element of risk.

Myopic risk plays into behavioral finance in that it highlights the shortcomings and biases of the human psyche as they apply to real life; bounded rationality, anchoring bias, confirmation bias, all at play in this form of risk. Because the limits of the psyche apply to all humans, some level of myopic risk is assumed no matter the case. Myopic risk by nature is not a perceived risk – it is the risk that is assumed by not perceiving risks to investment. Instead, it is an actual risk. This is a risk that any investor must assume. Myopic risk will not be considered in the conclusions to be a perceived risk.

## 5.4 Situation Dependent Factors

This section discusses the aspects that can be perceived as either drivers or risks depending on the specific situation. It discusses these factors which are prevalent in the data in detail, and considers why investors have these perceptions, and how they might change in different situations. It is broken into 3 sub sections. The perceptions of each aspect will vary on the investor, and also on the situation.

### 5.4.1 Policy

Policy and legislation have an important influence on the ability of GTI to succeed. Policy is paramount in that it is capable of both drastically hindering and highly enabling the development of GTI. It can act as a barrier, it can be a driver, and it can be a risk. This will depend on the way the legislation is set up and the effect it has on any specific technology.

Policy barriers exist when they prohibit aspects of a technologies ability to function in the market, and when they enable the incumbents, for instance. Policy can be a driver for example through subsidies, or prices on negative externalities, which can often work in favor of a GTI. Even the absence of policy can influence an innovation greatly; not having a cost for carbon is a benefit for carbon-based fuels. The literature review discussed much policy and its influence. In the sample, almost all the investors considered policy to be a barrier as well as a driver, but also to hold its own element of risk.

What was interesting about the interviewed investors was their ability to manage policy. In an effort to shelter the portfolio, investors insulate themselves from policy, tending away from even those that take advantage of policy benefits. “We want all of these businesses to, kind of, stand on their own two feet from an economic perspective” explains one investor. “We typically don’t like companies that are relying on policies for their only existence or tax credits to make their projects economically viable. We’ve never made money doing that.” This investor avoids these businesses because he considers them to be a bad idea financially. Another investor who holds a similar strategy explains that “the business has to be rational without a change in policy. It has to create, you know, customer value above its cost without aspirational policy changes.” Staying away from these policy dependent businesses limits the volatility associated with policy changes, and reduces the risk that favorable policy will be

absent. This is not a complete aversion from policy, but rather a cautious approach to how it is embodied within a portfolio.

“It’s not that we would never take subsidies or that we wouldn’t need subsidies for the company to succeed, but I think that there’s a pretty steep belief that you need subsidies that don’t exist yet, that’s a bad idea, and if you need the subsidies forever, that’s a bad idea.”

It is impossible to completely insulate yourself from policy, but sheltering yourself to a degree is a good idea, according to these investors. Taking policy into account is important when evaluating investment, and the way in which policy is managed can help determine the success of an innovation.

There were some investors who expressed a desire for policies that do not yet exist. The desired policies differed, as investors operate within different geographies, different sectors, and with different heuristics, as previously discussed. Some of these desired policies included a global carbon tax and cap and trade. The policies discussed in the literature review trended toward feed in tariffs. The optimal policies for GTI are going to vary based on the technology itself.

#### 5.4.2 Downstream Investor Support

There is some concern from investors about the fate of their investments down the road. As presented in Chapter 5, most of the sampled investors focus on the Seed and perhaps Series A rounds of investment. However, firms often have a need for funding further down the road. One investor highlighted this in his explanation of the risks.

*“Once companies need a series A or series B there’s probably fewer funds that would say ‘we are, you know, doing series A and series B’... And as an investor there’s not the downstream investor ecosystem that will help, uh, make sure that your investment continues to get funding and stay alive.”*

If a venture does not continue to get the necessary funding down the road, it will influence its ability to survive. This investor acknowledges the risk that this downstream support may not exist in all cases. This is a view that came up only once in the data in terms of perceived investment risks. Others have networks that can control for this risk, such as partners “who have very deep pockets and the ability to take care of the rest of the deployment.” A lack of downstream support is not a risk that was very commonly expressed, but it is an element of risk that is worthy of discussion.

#### 5.4.3 Duplicability or Defensibility

Duplicability accounts for a technologies ability to defend itself from being replicated or mimicked by other firms in competition. Duplicability was recognized as a risk by a majority of the sampled investors. The extent to which a technology is duplicable is a combination of technology risk and market risk. The more duplicable a technology, the higher the risks. However, when a technology is protected or remarkably difficult to replicate, it can be a strong competitive advantage. This makes an innovation’s duplicability a point of interest,

something particularly important to protect. Depending on the degree to which an innovation is defensible, it can be regarded as either a driver or a risk.

A common way to minimize this risk is through patents. But there are several other ways to protect the secrecy of an innovation. An investor describes that “defensibility, it’s not just about patents, it’s about trade secrets and first mover advantage.” Being the first mover into a market can come with a lot of rewards, such as a lack of competitors to take market share, or even seek to mimic the technology. Trade secrets on the other hand require a level of confidentiality that will reduce the transparency of the firm. Heim (2018) argues that “maximizing short-term extra-nominal profits resulting from sustainability innovations may involve reducing transparency in order to maintain exclusivity of the innovations.” Transparency can be important to businesses operating in the environmental sectors, and this might involve a tradeoff between secrecy and transparency. Trade secrets can be effective when appropriate, it will depend on the business and the technology itself which method of defense is best.

Some innovations might be more defensible than others. In any case, the degree to which a product is defensible is an important quality measured by investors. It will help to determine its business success in the short and long term. Duplicability is considered either a risk or a driver, depending on the degree to which the innovation is able to be duplicated.

## 5.5 Further Discussion

This section wraps up the discussion of the findings. It is broken into two sub-sections. The first compares traditional venture capital investing with venture capital in green technology or environmental investments. The second section summarizes the major findings discussed in this chapter.

### 5.5.1 A Comparison: Traditional VC vs. GTI VC

Traditional Venture Capital, or VC without any particular environmental focus, in comparison to Green-Tech Venture Capital have some important differences, but overall, the two are more similar than they are different. When comparing the two, one investor explains, “We look at similar things as any other early VC would do, but we just add a layer of also that you have to have significant CO2 reducing impacts.” The argument here is that GTI is just an investment theme available to venture capitalists. The procedures and goals of scaling a business for a return on investment is the same. The differences are in the specifics of the firms and the sectors. Another investor compares traditional and green VC:

*“I’m trying to bridge a gap between an interesting concept with the potential to do something that people want to do, and I’m trying to get my entrepreneurs from here to there with a combination of money and coaching and strategic relationships, uh, we all do the same job. But the details vary rather a lot depending on who are the friends, what is the market, how stable are the policies”*

On the macro level, when speaking broadly, GTI and traditional Venture Capital are the same. They are trying to do the same thing the same way: scale a product with commercial potential to make high ROI. Many of the questions and criteria are the same: scalability, market diffusion, consumer preference, and so on. On the micro level, when analyzing more of the details, traditional and green VC have some big differences. GTI VC has to have different approaches when you look at the market and analyze the risks. The effect that the risks and even some drivers have is different between the two. It is these differences that emphasize the relevance of this research. Traditional and Green Tech VC are similar when painting in broad strokes, but much of the details and other features are very different.

## 5.5.2 Summary of Important Findings

Perceptions of investors can vary, in part due to the complexity of this subject. The important findings discussed in this section in describing the perceived risks and drivers are presented in Table 4 below. It shows the perceived drivers and risks that are most prevalent in the data, as discussed throughout this chapter. Because the research questions are “what” questions, the table summarizes what the perceived drivers and risks are. It does not show the complexity and variance of the data or the variability between the intensity of the risks or drivers, neither does it make clear the frequency to which these aspects are present in the data. In order to get a complete understanding of the results, it is best to consider this entire chapter and not just this summarized account.

Table 6. Summary of Important Findings

Drivers	Risks	Situation Dependent
Financial Return	Technology Risk	Policy
Solving Societal Issues	Market Risk	Product Defensibility
Quality Entrepreneurs	Incumbent Actors	Downstream Support
Impact Measurability	Capital Intensity	Entrepreneurial Skill/Talent
Risk Reduction	Long Time Frame	

As shown in the table, financial return is a main driver; the conviction for above market-rate returns falls into this category. The desire to find solutions for major societal issues, and the appetite for performance indicators and measurements of that impact are important drivers. High quality entrepreneurs are a driver perceived by all, with the investor-entrepreneurial fit influencing the quality of the entrepreneurs.

The common perceptions of risks were technology risk, market risk, incumbent technologies and firms, and when it is prevalent, capital intensity. Policy, product defensibility, and the talents and skills of the entrepreneur will be drivers or risks depending on the situation, and how they apply to the technology in question. This can be a bit misleading because all of these factors are to a degree situation dependent in that the situation will effect the perception of each driver and risk, and the intensity of their influence.

While Table 4 summarizes the important findings, it is not recommended that this table be taken in isolation. The table fails to capture the data's complexity, it does not show the varied levels to which the drivers and risks are acknowledged, and does not present the fascinating and stimulating insights of investors. In order to fully understand the perceptions shown in the table, it is recommended to read this chapter in its entirety.

## 6 Conclusions

This research aimed to develop an understanding of venture capital investor decision making in regards to early stage green-tech innovation. It sought to do this by answering two research questions: what do investors perceive to be the drivers for investment in green-tech innovation; what do investors perceive to be the risks for investment in green tech innovation?

The conclusions below were generated through a combination of literature review and semi-structured phone interviews. This information serves to help entrepreneurs at or near the valley of death to understand investors and align their goals when searching for funding; it will help legislators to draft more effective policy to attract funding; it provides a guide for investors who were not previously involved with green tech innovation but wish to engage.

The perceived drivers for investment include strong financial return, solving societal issues, impact measurability, risk reduction, and high-quality entrepreneurs. The perceived investment risks include technology risk, market risk, incumbent actors, long time frame and capital intensity. All of these drivers and risks will be perceived differently depending on the specific situation. Aspects that are particularly situation dependent include policy, entrepreneurial talent and skills, and product defensibility, which can be perceived as either drivers or risks depending on the situation.

Investor perceptions vary. This variance is due to several factors: investors have different knowledge, heuristics, and goals; the target of what is being perceived varies as they operate in different contexts; different situations will lead to a difference in perceptions. Furthermore, the complex nature of the topic generates a lot of nuance. Thus, all investors do not recognize a common list of drivers and risks, nor do they all agree on how significant each aspect is on that list. While some of the perceptions mentioned above are more or less universal, the investor's specific goals and specific context should be considered before making presumptions about all of these views.

In order to give these findings more external validity, this study should be compared to other similar studies. This would serve to confirm these findings and to build on them. Future research can further develop the academic discourse. This research can also be compared to research investigating the perspectives of entrepreneurs and innovators in order to get a completed picture.

Green technology innovation is an important solution to our environmental issues. Financial investment enables and hastens the development of these technologies. This paper contributes to the academic discourse within this space. Still, within the larger context of society's ecological crisis, green technology innovation is but one of many solutions. Given the complexity, scale, and time sensitive nature of the issues, there is a need for extensive, wide-ranging responses to those issues as well as a crucial demand for urgency. Immediate action is momentous.

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# Appendixes

## Appendix A – The 17 UN Sustainable Development Goals

1. No Poverty – End poverty in all its forms everywhere
2. Zero Hunger – End Hunger, achieve food security and improved nutrition and promote sustainable agriculture
3. Good Health and Well-Being – Ensure healthy lives and promote well-being for all at all ages
4. Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5. Gender Equality – Achieve gender equality and empower all women and girls
6. Clean Water and Sanitation – Ensure availability and sustainable management of water and sanitation for all
7. Affordable and Clean Energy – Ensure access to affordable reliable, sustainable and modern energy for all
8. Decent work and Economic Growth – Promote sustained inclusive and sustainable economic growth, full and productive employment and decent work for all
9. Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10. Reduced Inequalities – Reduce inequality within and among countries
11. Sustainable Cities and Communities – Make cities and human settlements inclusive, safe, resilient and sustainable
12. Responsible Consumption and Production – Ensure sustainable consumption and production patterns
13. Climate Action – Take urgent action to combat climate change and its impacts
14. Life Below Water – Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15. Life on Land – Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
16. Peace, Justice and Strong Institutions – Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17. Partnerships for the Goals – Strengthen the means of implementation and revitalize the global partnership for sustainable development

## APPENDIX B – INTERVIEW GUIDE

1. Please provide your personal background, a description of your organization and your current role.
2. How do you approach investment risk?
3. What would you consider is “innovation”?
4. How would you define the term “sustainability”?
5. Where is the line between technology innovation and green-tech innovation?
6. Could you provide some examples of your sustainability work?
7. What do you consider to be the drivers for investment into green-tech innovation?
8. What criteria do you use when selecting green-tech firms (or innovations) to invest?
9. Are these criteria different when sustainability is not a factor?
10. Do you have a preferred investment time frame for green-tech investments?
11. What do you consider to be the barriers of bringing a green-tech innovation to market?
12. What do you perceive to be the risks associated with green-tech innovation?
13. Are there any other topics you think we should discuss?