ID Cover Page

Summary of WP Student Team

Shaping the future is hard.

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Work project carried out under the supervision of:

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Work project presented as part of the requirements for the award of a Master's degree in

Impact Entrepreneurship & Innovation / Management

from

the Nova School of Business and Economics

SHAPING THE FUTURE IS HARD

FOSTERING SUSTAINABLE TRANSFORMATION BY IMPROVING ACCESS TO FINANCE FOR HARDWARE-BASED CLIMATE TECH STARTUPS.

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Abstract

Scientists and practitioners recognize the great potential of startups, especially ones that are hardware-based to drive innovation and contribute to developing climate solutions. Their contribution is crucial for addressing the challenges posed by global warming. However, the hardware-climate-tech sector experiences severe challenges related to funding. This study analyzes the German startup ecosystem by conducting expert interviews, a follow-up survey, reviewing related literature, and performing a quantitative analysis based on calculations. The study (1) confirms the existence of a funding gap in Germany, (2) identifies a complex web of factors contributing across various stages of the startup's life cycle and (3) proposes potential solutions to overcome this gap. This research provides valuable insights for policymakers, researchers, investors, and entrepreneurs.

Keywords: funding gap; market failure; hardware startup; climate tech; sustainable transformation

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List of Abbreviations

Abbreviation	Meaning
ARPA-E	Advanced Research Projects Agency-Energy
BA	Business Angel
CA	California
CVC	Corporate Venture Capital
EIB	European Investment Bank
EIC	European Innovation Council
EU	European Union
FoF	Fund-of-Fund
GER	Germany
HCS	Hardware-Based Climate Tech Startup
HCT	Hardware-Based Climate Technology
IP	Intellectual Property
IPO	Initial Public Offering
IRA	Inflation Reduction Act
KFW	Kreditanstalt für Wiederaufbau
NS	Nordic States (Denmark, Finland, Island, Norway, and Sweden)
R&D	Research and Development
RQ	Research Question
SMEs	Small and Medium-Sized Enterprises
SPAC	Special Purpose Acquisition Company
TRL	Technology Readiness Level
USA	United States of America
VC	Venture Capital
VD	Venture Debt
VoD	Valley of Death

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1 Introduction

Global climate change currently represents one of the greatest challenges to humanity and creates a pressing need to build a low-carbon economy that keeps global warming below 2°C by 2050 (Polzin 2017). To achieve this objective, sectors, such as renewable energies and carbon capture, require annual investments of approximately $5.5 trillion ("World Energy Transitions Outlook: 1.5°C Pathway" 2021). Since the current investment levels are significantly below this target, the "United Nations Framework Convention on Climate Change" calls for all stakeholders to increase investment efforts to close this funding gap (Dhayal et al. 2023).

Given the urgency of the climate crisis and the redirection of capital, there has been a surge of technological innovation seeking to mitigate climate change. Startups have significant potential to act as catalysts by developing and commercializing such innovations and thereby positively impacting society (Fini et al. 2023). These so-called climate tech startups differ by type of technology, focusing either on software or hardware. Currently, software technologies attract the largest stake of funding and dominate climate tech. However, hardware inherently holds the most potential to reduce carbon emissions and to decarbonize the world (Gaddy et al. 2017; Goldstein et al. 2020; Singh et al. 2021). Still, not only compared to software climate tech startups but also compared to other hardware-intense industries such as biotechnology, hardware-based climate tech startups (HCS) are not gaining the momentum needed. Their development demands lengthy, deep-tech-like research & development (R&D) and high capital expenditure throughout the early startup cycle. This comes along with increased technological and market risk, which is enhanced by obstacles such as inadequate infrastructure and regulatory barriers (Balachandra, Kristle Nathan, and Reddy 2010), creating a shortage in funding and trapping HCS in the so-called valley of death (VoD) (Yoshino, Taghizadeh–Hesary, and Nakahigashi 2019; Harrer and Owen 2022; Clark, Reed, and Sunderland 2018).

Outline

The following research will investigate the presence of a funding gap for HCSs, examine the challenges that contribute to its existence, and explore potential solutions to mitigate the gap. This chapter, Chapter 1, aims to familiarize the readers with the context and outlines research objectives. In Chapter 2, the theoretical foundation is laid, and the terms “hardware-based climate tech startup” and “funding gap” are defined. After establishing a common understanding, the research questions and the significance of this study will be elucidated in Chapter 3. Chapter 4 provides a detailed explanation of the mixed-methods methodology applied, including the procedures of the interview analysis and the follow-up survey, the literature review, and the quantitative analysis. Chapter 5 aims to answer research question 1 (RQ1) by triangulation of quantitative and qualitative data. Chapters 6 and 7 aim to answer research question 2 (RQ2) & research question 3 (RQ3) with a thorough qualitative analysis of the HCS funding gap, giving a comprehensive overview of the challenges and solutions related to the funding gap. Lastly, Chapter 8 lists the implications and limitations of the research and gives a brief outlook for future research.

2 Theoretical Foundation

In this chapter, the authors will equip the reader with the vocabulary and concepts necessary to understand the research. It begins by introducing the term “hardware-based climate tech startup” in section 2.1, along with an explanation of its lifecycle and financing means. The chapter then proceeds with an elaboration of “funding gaps” in section 2.2.

2.1 Hardware-Based Climate Tech Startup

For this paper, a definition of HCS is needed. The terms “startup”, “hardware”, and “climate tech” will be defined and merged.

Startup: Startups are companies founded by entrepreneurs, which differ from conventional companies or small and medium-sized enterprises (SMEs). Earlier startup research distinguishes startups from other companies by focusing on the factor “novelty”, while more recent studies concentrate on “innovation” (Kuratko, Morris, and Schindehutte 2015; Shane 2003). According to Luger and Koo (2005), startups are “new”, “active”, and “independent”. On the other hand, Tülüce and Yurtkur (2015) define startups as organizations that intend organizational or technological progress in the first place and are scalable or replicable in the second place. Following this second definition, startups can be distinguished from traditional companies as their business models focus on multidimensional growth (such as revenue or employees) and bring novel goods or services based on innovation to the market (Blank 2013; Davila, Foster, and Gupta 2003).

Climate Tech: The term “climate tech” refers to a wide range of innovative technologies aiming at mitigating the effects of climate change. Companies in this sector are working on solutions to either reduce negative environmental impacts, improve approaches to coping with the consequences of global warming, or foster sustainable use of natural resources (Ottman, Stafford, and Hartman 2006; Criscuolo and Menon 2015).

The term “climate tech” is interpreted in different ways throughout literature, but most scholars connect it to the precursors “green tech” and “cleantech. The term “green tech” emerged in the 1970s for sustainable technologies, primarily renewable energy, environmental protection, and clean water (Balachandra, Kristle Nathan, and Reddy 2010). “Cleantech” evolved later and was used more narrowly for renewable energy technology. However, the term received a negative reputation among investors after the 2008 financial crisis caused the bubble to burst. As a result, a new term, “climate tech”, emerged and is now associated with developing new technologies that add value through climate mitigation (Gaddy et al. 2017; Giorgis, Huber, and Sornette 2022).

Climate tech is often divided into subcategories based on industry or sector. The authors will combine the categorizations of Goldstein et al. (2020), Yang et al. (2023), and Criscuolo and Menon (2015) to address the following sub-sectors of climate tech in the remainder of this study: energy (such as energy generation and storage), agriculture and food (such as land management, aquaculture, and sustainable food production), recycling and waste (such as waste treatment and wastewater treatment), manufacturing (such as smart production and the development of biochemicals and materials), transportation (such as advanced batteries, alternative fuels), and buildings (such as materials, insulation) (Goldstein et al. 2020; Yang et al. 2023; Criscuolo and Menon 2015).

Hardware-Based: Hardware-based companies develop and implement complex hardware solutions, often supplemented by a software component (Romme 2022). Innovation is driven by deep technical and scientific developments that require large-scale investments and highly qualified individuals (Chorev and Anderson 2006). Hardware companies often operate in industries like materials science, manufacturing, or chemistry (Gaddy et al. 2017).

Hardware-Based Climate Tech Startup: Combining the three definitions mentioned above, as illustrated in Figure 1, HCSs are early-stage companies driving innovation of physical

systems to address the climate crisis. HCSs bear the potential to generate groundbreaking innovations in the most relevant technology but also encounter unique obstacles due to their distinctive features.

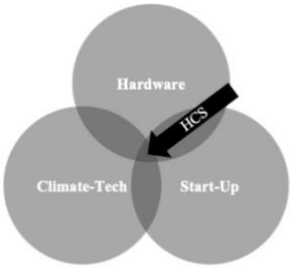

Figure 1 Hardware-Based Climate Tech Startup

Market: HCSs compete in markets with large volumes and low margins against established non-sustainable, often fossil-fuel-based technologies that are already cost-effective and mature (Temmes et al. 2021). Compared to these "grey players", the products of HCSs inherently bear a climate premium that stems from the additional costs of producing environmentally friendly in a novel way (Schwirplies & Ziegler 2016). Consequently, a lack of competitiveness arises, leading to a dearth of incentives for investors and entrepreneurs who prioritize economic factors over environmental and social considerations (Harrer and Owen 2022; Romme 2022). Therefore, HCSs are dependent on the regulatory environment as they operate in highly regulated markets with a high degree of regulatory uncertainty (Balachandra, Kristle Nathan, and Reddy 2010; Mrkajic, Murtinu, and Scalera 2019).

Time-Horizon: HCSs development cycles last above ten years on average, making it impossible to penetrate the market in the short-term and therefore unfold their large-scale impact only in the long-term.

High Need for Resources**:** HCSs require deep technological expertise and a high level of capital investment, up to $10-20 million for the first and hundreds of millions in subsequent investment

rounds. Furthermore, they require partnerships with various firms and suppliers to scale and introduce their products to the market. (Balachandra, Kristle Nathan, and Reddy 2010; Mrkajic, Murtinu, and Scalera 2019).

To give a prime example, 'Marvel Fusion' is a HCS based in Germany (GER). The company specializes in creating a safe and eco-friendly energy source using laser-driven fusion, which can potentially transform global energy production ("Dealroom" 2023). According to Pearson et al. (2020), startups in the fusion technology industry undertake complex and visionary hardware development programs. Hence, they are exposed to significant technological risk as they face great uncertainty while developing a reliable and efficient reactor. Additionally, they face immense financing risk due to the tremendous cost of pilot testing coupled with the long-term nature of development. In 2022, the company achieved a milestone by raising 35 million in a Series A financing round ("Dealroom" 2023). However, successfully navigating the VoD for fusion startups would necessitate a significant amount of high-risk investment, ranging in the hundreds or even thousands of billions of euros (Cardozo 2019).

2.1.1 Lifecycle of HCSs

Given the focal point of this study is on startups, it is imperative to gain insight into the evolutionary phases traversed by these enterprises during their initial years. Numerous studies have been published on early-stage phases, with Churchill and Lewis (1983) laying the foundation for subsequent theories, such as the research of Bell and McNamara (1991). Currently, methods categorize startups into stages by time spans, development stages, and financing options (Leach and Melicher 2011).

Figure 2 illustrates the stages of the startup journey. It typically begins with identifying a promising technology, followed by finding a product-market fit, validating the technology, receiving first commercial contracts, embarking on early commercialization, and ultimately,

scaling up to achieve full commercialization. Although most HCSs follow a similar growth path, the duration and complexity of each phase can vary (Polzin, Sanders, and Serebriakova 2021).

Figure 2 shows different frameworks proposed by Polzin, Sanders, and Serebriakova (2021), Upadhyayula et al. (2018) and Nedayvoda et al. (2021), demonstrating the flexibility of the startup lifecycle framework and offering different terminologies for each phase (Polzin, von Flotow, and Klerkx 2016; Nedayvoda et al. 2021). The Technology Readiness Level (TRL) scale is used to estimate the maturity of innovative technologies (Upadhyayula et al. 2018).

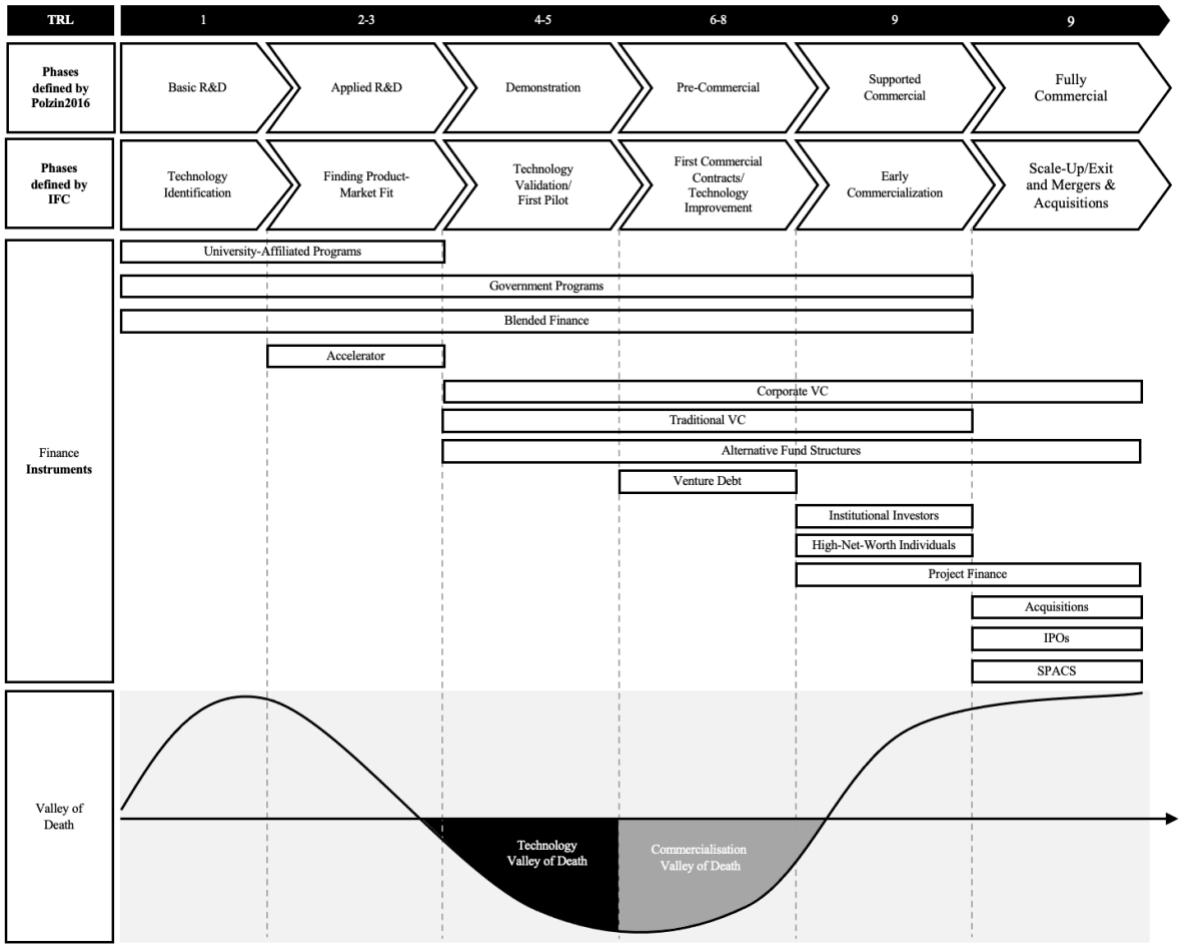

Figure 2 Lifecycle of HCS

The unique challenges of HCSs result in differences in lifecycle assessment compared to non-hardware-based peers. Again, the complexity of the technologies and the associated extensive

development times, financial demands, and increased manufacturing and distribution challenges blur the picture (Balachandra, Kristle Nathan, and Reddy 2010).

2.1.2 Funding Instruments and Stakeholders for HCSs

The financing requirements of startups and investors vary on a case-to-case basis as both parties want to effectively satisfy their respective needs. (Kuratko, Morris, and Schindehutte 2015; Balachandra, Kristle Nathan, and Reddy 2010). Table 1 outlines common startup financing methods, including instruments and stakeholders for various stages throughout the startup cycle.

University	Universities leverage their scientific research capabilities to foster innovation and entrepreneurship which leads to economic benefits and increased funding for research (Xie et al. 2018; Suominen, Deschryvere, and Narayan 2023).
Incubator/Accelerator	Incubators/Accelerators provide early-stage investment and hands-on support for startups (In, Monk, and Knox-Hayes 2020).
Business Angels (BA)	BA are high net-worth individuals taking high-risk investments for equity stakes in seed and early stages (Owen, Brennan, and Lyon 2018; Fink, Arbter, and Wagner 2023).
Venture Capital (VC)	VCs form limited partnerships, mainly with individuals and family offices that manage a fund to invest in startups (Casanova, Cornelius, and Dutta 2018).
Corporate VC (CVC)	CVCs made by corporations, make investments in startups to generate strategic and financial returns relevant to their core business (Casanova, Cornelius, and Dutta 2018).
Institutional VC	Institutional VCs are funded mainly by institutional investors providing equity financing for startups. They differ from conventional VCs in terms of capital providers (Egan 2022).
Venture Debt (VD)	VD is a debt financing option enabling startups to lend money in exchange for interest payments and a warrant to purchase equity in the company. It can be a practical way for startups to finance expansion without diluting the ownership of current shareholders (Michelfelder et al. 2022).
Blended Finance	Blended finance is a type of financing that combines public and private funds to support projects that generate both financial returns and positive social or environmental impacts. It is used to leverage public capital to attract private

	investment and includes various alternative sources of funding, such as impact bonds or guarantees (Clark, Reed, and Sunderland 2018; Jiang 2023; Dey and Mishra 2022).
Fund-of-Fund (FoF)	FoFs invest in venture funds and not companies or projects directly. They pool resources and therefore spread the risk (Nassiry and Wheeler 2011) .
Project Finance	Project finance is a financing structure that isolates project cash flows from sponsor assets and minimizes agency costs, allowing startups to execute specific projects using non-recourse debt (Byoun and Xu 2014)
Initial Public Offering (IPO)	IPO is the process of becoming publicly listed on a stock exchange, granting access to capital markets (Migendt et al. 2017).
Special Purpose Acquisition Company (SPAC)	SPACs are publicly listed financial vehicles with the goal of acquiring companies (Fink, Arbter, and Wagner 2023).
Government	Governments can support startups by regulating, incentivizing, and creating technology and capital transfer frameworks while fostering an entrepreneurial environment. Also, they launch public funding programs like Exist, the European Innovation Fund, and Climate-KIC to provide financial aid (Singh et al. 2021; Criscuolo and Menon 2015; Balachandra, Kristle Nathan, and Reddy 2010).
Institutional Investors	Institutional investors refer to entities that pool together significant amounts of money and entail, for example, sovereign wealth funds, family offices, insurances, or charitable organizations (Gaddy et al. 2017).

Table 1 Financing Instruments and Stakeholders

2.2 Funding Gap

In the following subchapters a background on funding gaps will be provided and underlying factors that contribute to its existence will be elaborated.

2.2.1 Background on Funding Gaps

In the existing literature, the term “market failure” describes a situation where market mechanisms fail to allocate resources efficiently. It is often described as the cause of the “funding gap” phenomena and “valley of death”. Both terms are specific examples of market failures in the context of innovation financing (Quas et al. 2022; Nemet, Zipperer, and Kraus 2018).

A funding gap refers to the disparity between the demanded capital by a startup to achieve its financial goals and the supplied financing options (Bonini, Capizzi, and Zocchi 2019; Clark, Reed, and Sunderland 2018; Owen, Brennan, and Lyon 2018).

The VoD, which is also shown in Figure 2, refers to the critical period in the startup journey where the funding gap represents a significant hurdle to pass from the R&D phase to the commercial phase successfully (Savaneviciene, Venckuviene, and Girdauskiene 2015; Balachandra, Kristle Nathan, and Reddy 2010; Gaddy et al. 2017; Gatto and Re 2021). It varies among startups, contingent on factors such as the nature of their product, associated risks, and the market they operate in (Gatto and Re 2021). Consequentially, many startups fail to overcome this valley, preventing them from positively impacting society with their technology (Balachandra, Kristle Nathan, and Reddy 2010).

Although the above-mentioned terms are also commonly used for startups outside of the context of this study, it particularly applies to HCSs due to their high technological risk, long development cycles, high capital expenditures and high uncertainty about exit opportunities, demonstrated by prior research (Michelfelder et al. 2022; Criscuolo and Menon 2015). Many investors divide the phenomenon of the VoD into two perspectives – the first and the second VoD (Wilson, Wright, and Kacer 2018; Gatto and Re 2021).

The first, called technology VoD, is a funding gap that startups face during lab development, demonstration and early commercialization (Criscuolo and Menon 2015; Quas et al. 2022). During this phase of high technological risk, startups heavily rely on accelerators, grants and BAs (Gatto and Re 2021).

The second VoD, the commercialization valley, occurs when startups lack funding as they move from the initial revenue generation phase to the scale-up for widespread deployment (Quas et al. 2022; Wilson, Wright, and Kacer 2018). This phase poses challenges for investors as they

struggle to evaluate the time and resources needed for HCS to achieve commercial viability. In return, startups struggle to secure follow-on financing in the form of equity and debt to support the transition (Wilson, Wright, and Kacer 2018; Gatto and Re 2021).

Startups which survive this VoD and reach commercialization lower their risk profile by starting to generate revenue and grow significantly, thereby unfolding their value for society (Michelfelder et al. 2022).

2.2.2 Causes of Funding Gaps

Funding gaps for HCSs occur for several reasons: information asymmetries and imperfections, coordination failures and externalities (Harrer and Owen 2022; Quas et al. 2022; Clark, Reed, and Sunderland 2018).

The present body of literature regarding entrepreneurship mainly credits the existence of funding gaps to information asymmetries that are present between the demand and supply sides of financing as it causes substantial risk and leads to costly due diligence, also resulting in adverse selection and moral hazard (Harrer and Owen 2022; Owen, Brennan, and Lyon 2018; Oh, Jang, and Kwak 2022). Especially in the climate tech industry, information asymmetries between stakeholders are relatively high as business proposals face a greater level of complexity, operating within constantly evolving unpredictable environments and with climate change making it challenging to accurately assess their impact (Clark, Reed, and Sunderland 2018; Wilson, Wright, and Kacer 2018; Polzin, von Flotow, and Klerkx 2016).

Coordination failures arise when communication between parties is lacking, and investors who aim to invest in projects that match their requirements for returns and risks cannot find suitable opportunities that need funding (Clark, Reed, and Sunderland 2018). Moreover, if early-stage investors lack resources or knowledge to expand their investments successfully, this can cause further coordination failures in attracting later-stage investors (Quas et al. 2022).

A third point contributing to the funding gap is that positive externalities of HCSs, such as improved environmental sustainability and reduced carbon emissions, may not be reflected in financial return, meaning that the undervaluation of natural resources can fuel an unwillingness for investors to fund such businesses (Clark, Reed, and Sunderland 2018; Quas et al. 2022)

3 Research Questions and Contribution

After having outlined the theoretical foundation, the authors assume the existence of a funding gap for HCSs, specifically in GER. This assumption is supported on the one hand, by the fact that practitioners in the industry, namely startups, reportedly experience insufficient funding. On the other hand, there is only anecdotal evidence pointing at the issue on a European level and only limited scientific papers providing evidence for a funding gap in GER (see app. 10.1). Hence, this study aims to draw attention to the issue and guide the German government's decision-making processes.

Research Contribution

This section aims to provide an understanding of the current state of literature. Dhayal (2023) notes that the first articles on finance and climate change did not appear until 2002. Only after the 2015 Paris climate agreement, research publications on the relationship between green finance and climate technologies significantly increased (Mrkajic, Murtinu, and Scalera 2019; Polzin, Sanders, and Serebriakova 2021; Dhayal et al. 2023). Still, the existing literature fails to pay attention to the financing situation of HCSs (Polzin 2017; Gaddy et al. 2017). For this reason, the present study seeks to contribute knowledge regarding the urgent issue of a potential funding gap and its extent in GER, the funding-related challenges that arise throughout the startup lifecycle, and the government's role in addressing some of these challenges.

Practical Contribution

Beyond its research contribution, the authors strive to provide practical added value. The German government is actively working towards building a major climate tech economy and has set up a Sustainable Finance Advisory Committee (SFC) to support this goal. Within the SFC, the "Startups and Venture Capital" working group will utilize the findings of this study to consult the federal government's startup strategy.

Research Questions

To accomplish the objective mentioned above, the research has been structured around the following three research questions:

RQ1: Does a funding gap for HCSs exist in GER?

As previously mentioned, HCSs generally encounter more challenges in achieving commercialization compared to their software-based counterparts which consequentially leads to a funding gap. This calls for a scientific investigation to determine whether these circumstances also apply to the German context. Therefore, the research question aims to explore potential disparities in financial support, specifically for HCSs in GER.

RQ2: If a funding gap exists, what factors contribute to the funding gap for HCSs in GER?

If evidence for a funding gap is found, it is crucial to understand the underlying reasons causing it. Hence, the second findings section will delve into identifying critical factors contributing to the issue to lay the foundation for potential solutions.

RQ3: What are the potential solutions to solve this challenge?

As this study aims to guide governmental bodies in their decision-making process, this question revolves around identifying potential recommendations for the government to act.

4 Methodology

The following subchapters provide an overview of the methodology and aim to establish a clear framework for the research process, highlighting the reliability and validity.

4.1 Mixed Methodology Research Design and Approach

Since the primary research questions are broad and only limited prior research exists a sequential mixed-method design is recommended (Creswell 1999; Creswell 2011). This section elaborates on the reasons for combining qualitative and quantitative research to answer the posed questions. More specifically, an "explorative sequential mixed methods method" is used, wherein the first phase of the research is qualitative and the following quantitative (Morgan 1998; Morse 1991). The mixed-method approach allows for a comprehensive understanding of the topic to be studied. This is deemed necessary because of the novelty of exploration facing a complex context which involves numerous interconnected factors and stakeholders in the HCS ecosystem. Since there has been relatively limited exploration regarding this topic (as explained in the chapter “Research Questions and Contribution”), it is more suitable to use an exploratory sequentially mixed method design, initiating with a qualitative approach to first establish a fundamental understanding, rather than commencing with a quantitative study, which is more appropriate for subjects that already possess a robust comprehension (Morgan 1998; Morse 1991). Such mixed methods approaches were originally used in research for social sciences but are nowadays also applied in other fields where complexity and multiple factors prevail, e.g., in the health sector or, as in the case of this research, in governmental decision-making processes.

It allows the researchers to investigate a complex phenomenon from several points of view and to obtain insights, compensating for the weaknesses of the single qualitative and quantitative

methods (Johnson and Onwuegbuzie 2004; Morgan 1998; Östlund et al. 2011). Such an approach provides valuable information thanks to the high data integrity level.

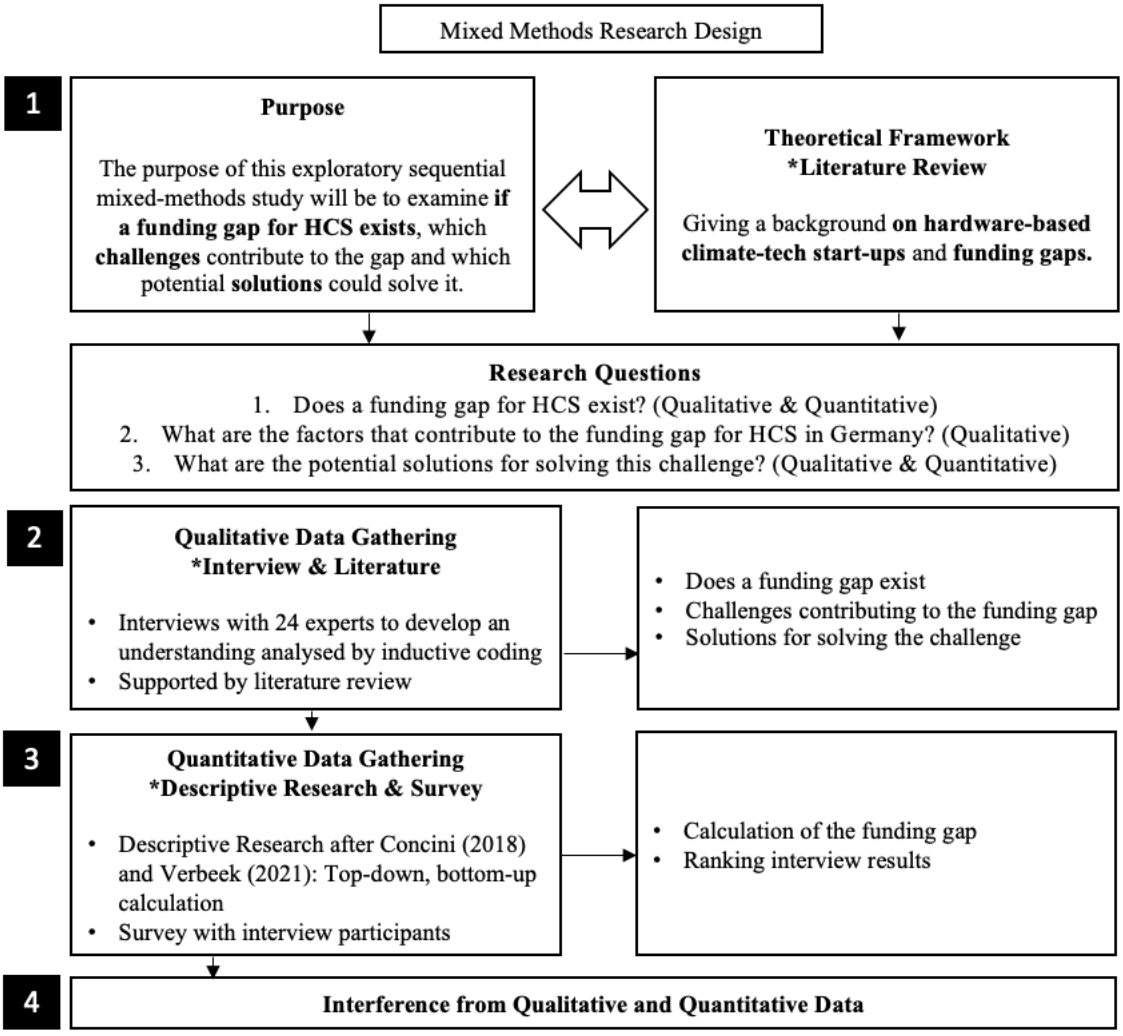

Figure 3 Research Design after Creswell (2011) and Gowan (2019)

In this study, as shown in Figure 3, the qualitative phase starts with building a theoretical framework by conducting a literature review and in-depth interviews supported by literature, allowing for initial theory building on the research questions. The subsequent quantitative phase will be conducted by performing a calculation with "Dealroom" and "Crunchbase" data to measure the prevalence of the phenomenon and then putting the interview results into perspective by using data collected through a follow-up survey (Morgan 1998; Creswell 1999).

The following will explain each qualitative and quantitative research method in more detail before presenting the results (Creswell 2011; Gowan 2019).

4.2 Qualitative Analysis

The qualitative analysis is composed of a literature review as well as an interview analysis. In the following, the two approaches are explained in more detail.

4.2.1 Literature Review

Following the approach outlined by Creswell (1999), a systematic literature review is conducted to identify and synthesize findings from a range of sources and to provide a comprehensive overview of funding gaps and HCSs as displayed in the “Theoretical Foundation”. The systematic literature review is a rigorous and transparent method for collecting and analyzing existing research, allowing for an unbiased and comprehensive review of relevant literature (J. Creswell 1999).

Keywords related to funding gaps in hardware startups were identified and an initial literature search was conducted. First, central articles were identified, and relevant articles were summarized thematically. Next, a summary of how the literature contributes to the study was created. Precise references were included. The following analysis provided a more detailed account of the process, which is also illustrated in the appendix (see 10.1).

Keyword Search: Initially, the search was focused on identifying terms related to funding gaps and in hardware startups in preliminary readings. First the terms "funding gap" and "hardware" were selected. Synonyms for "funding gap" were also identified, including "financing gap", "finance gap", and "valley of death." Related terms to "hardware" were identified as "deep tech", "green tech", "clean tech", and "climate tech."

Using these keywords, various databases were chosen based on their relevance and ranking, including Scopus, Web of Science, ScienceDirect, and Google Scholar. The selected databases were then searched using combinations of the keywords such as "hardware" AND "funding gap" or "clean tech" AND "valley of death".

Literature Analysis: The initial search revealed 661 articles, of which 526 were classified as relevant. After removing duplicates 479 articles remained. By analyzing the titles, 157 relevant research papers were identified, and 120 relevant articles were selected after analyzing the abstracts. A forward and backward search finally identified 88 relevant studies. These were then comprehensively examined to determine their relevance to the research questions and objectives and summarized to build the theoretical foundation and support the findings of the interviews as well as the quantitative analysis.

4.2.2 Interview Analysis

After identifying the problem to be studied and conducting literature research to create a theoretical foundation, the researchers' next objective is to generate a dataset from which to derive challenges and solutions for HCT funding. This chapter is divided into data collection, sampling approach and data analysis.

4.2.2.1 Data Collection

While some researchers argue that conducting an upfront literature review could lead to biased results (Mey and Mruck 2011), others suggest that it could expand the researcher's perspective and lead to new insights that positively influence the results (Corbin and Strauss 2008; Gioia, Corley, and Hamilton 2013). Considering both arguments, the authors of this paper decided to conduct a brief literature review to remain unbiased. The interview guide (see 10.3) was revised multiple times during the interview process to eliminate questions that were shown to be irrelevant to the research.

It was divided into four main parts. The first part aimed to explore the significance of HCSs in Europe and their current situation regarding financing. The second part examined the financing gap in GER, particularly its appearance along the startup cycle. Concrete insights were gathered by asking which TRLs along the startup cycle are most affected during the funding process. The third part of the interview focused on identifying the primary reasons for the funding gap. Lastly, the fourth part was about proposing measures and identifying stakeholders to help increase funding for HCSs in Europe, particularly GER.

4.2.2.2 Sampling Approach and Sample Size

The interviewees were chosen based on their expertise, accessibility, and availability. The interviewees were reached via the SFC of Germany, ensuring the relevance of the stakeholders. A total of 22 interviews were carried out, gathering insights from CVCs, VCs, the public sector, startups, FoFs, and VD funds (see 10.2 for a comprehensive list of interviewees).

4.2.2.3 Data Analysis

Miles, Huberman, and Saldaña (2014) suggest that qualitative data analysis is well-suited for identifying recurring interview patterns and developing coherent theories and categories.

In the first step, the interviews were recorded and transcribed. Afterwards, the authors used processes of content and thematic analysis as proposed by Creswell (2009) and Braun and Clarke (2006). Qualitative coding is a proficient technique to extract meaningful insights from interviews. The coding was done inductively, meaning the data was coded building from particular to general themes (Creswell 2009). It allows the themes to emerge from the data rather than imposing pre-existing categories and hypotheses onto the data.

Creswell (2009) defines three stages of qualitative coding: open, axial, and selective. In the first step, open coding was applied to the transcripts. Open coding is an essential technique in qualitative research, providing a structured approach to analyzing complex data and uncovering key themes and patterns. It is used to identify emergent themes and fragments. This process

involves breaking down the data into discrete units, or "codes," that reflect the key ideas or themes in the data. Secondly, axial coding was used to re-examine and reorganize the codes retrieved during open coding to identify patterns and connections that emerge from the data. In the third step, categories were formed using the selective coding approach. Its purpose is to identify central topics that unify multiple categories.

During the coding process, the coding scheme was continuously improved by expanding, revising, and dismiss codes. Creswell (2009) highlights the importance of maintaining an open and flexible approach to open coding, allowing the data to guide the analysis, and keeping an eye out for unexpected or surprising findings.

KPI	Value
# of interviews	22
Total interview	16h 07min
duration (average)	(44 min)
# of open codes	311
# of categories	32
# of themes	12

Table 2 Quantitative Overview of Interview Data Analysis

As shown in Table 2 eventually, 311 open codes of challenges and solutions were identified that resulted in 16 challenges and 16 solutions. Chapter 7.1 discusses potential solutions to close the funding gap identified throughout the coding process.

4.3 Quantitative Analysis

After completing both qualitative phases, the literature review and the interview research, a two-folded quantitative analysis was conducted based on the previous findings of the qualitative study.

Part one will verify whether the funding gap mentioned in the interviews exists and estimate the size of the gap. In the second quantitative part, a survey is conducted to assess the results of the interviews with the survey participants to evaluate the findings.

4.3.1 Funding Gap Calculation

This sequence of the study aims to provide a sense of the magnitude of the HCS ecosystem, especially the funding gap. A quantitative analysis will be performed by utilizing and adapting established methodologies to achieve this.

4.3.1.1 Research Methodology

There is an ongoing debate on the feasibility of methodologies to analyze funding gaps due to the complexity of the financial system and the variation in the definition and interpretation of funding gaps. Prędkiewicz (2012, 5) states that "there are no specific reliable methodologies to measure the extent of a funding gap". Existing literature from 2015 to 2023 reveals that the lack of studies that quantify funding gaps, mentioned by Prędkiewicz (2012), is still valid. However, three relevant papers analyzing funding gaps, all issued by the European Commission, can be identified (see Table 3).

The main distinction between the three authors is the approach to the "absolute" and "relative" calculations. The first study, by Mc Cahery et al. (2015), takes an absolute approach where an exact supply-demand match is done with an extensive bottom-up estimation of the financing demand of European SMEs across all sectors matched by investment data. However, this approach is not being employed in the current research. In contrast, Concini (2018) and Verbeek & Lundqvist (2021) investigate novel sectors with fast growth lacking data granularity and therefore adapt a relative approach comparing Europe to more desirable geographies,

triangulating with three different calculations. As HCSs share the same novelty and growth aspects, the authors will apply the below-outlined methodology.

Name	The European capital markets study: Estimating the financing gaps of SMEs.	Financing innovation in clean and sustainable mobility. Study on access to finance for the innovative road transport sector.	Artificial intelligence, blockchain and the future of Europe: How disruptive technologies create opportunities for a green and digital economy.
Authors	Mc Cahery et al.	Concini	Verbeek and Lundqvist
Year	(2015)	(2018)	(2021)
Target Sector	European SMEs in GER, France, Netherlands, Poland and Romania	The European sector focuses on providing solutions for urban green mobility, including low carbon, highly efficient road vehicles and automated and connected road transport.	European Artificial Intelligence and Blockchain Sector
Approach	In-depth calculation of the absolute supply and demand match overall SMEs	Calculation of the funding gap with a relative approach	Calculation of the funding gap with a relative approach

Table 3 Funding Gap Studies

4.3.1.2 Financial Advantage Calculation

Methodology: This approach uses California (CA) and the Nordics (ND) as benchmark geographies to perform a relative analysis to determine the financial disadvantage of German HCSs. The delta between the median funding is multiplied by the number of startups in GER. In addition to using the found number of HCSs, the approach will be expanded by introducing a second scenario. This approximates a state where GER's ecosystem has reached maturity,

where the funding gap is close to an extent where it does not negatively impact the number of startups anymore, resulting in a greater balance between hardware and software solutions.

Sampling: It is relevant to select appropriate benchmark geographies for comparing the maturity of the HCS sector. A higher ecosystem maturity level is considered the most critical prerequisite (Concini 2018). During the interview analysis, CA and ND were identified as regions with greater HCS ecosystem maturity, with notable achievements and best practices being cited. Further rationale behind the selection and characteristics are given in the appendix (see 10.5).

Data Collection: The platforms Dealroom and Crunchbase serve as the primary sources of data to create a unique data set ("Dealroom" 2023; "Crunchbase" 2023). Both platforms have been recognized as good sources for studying companies with high growth ambitions (Dalle, Besten, and Menon 2017). However, a main limitation of using these platforms is the assignment of descriptive tags (for example, industry type or technology focus) by startups to their respective company profiles. The lack of standardized procedures for tagging poses a significant challenge, as startups may interpret the tags differently, leading to inconsistencies in categorization. To reduce these inconsistencies, the results are compared with the database of the VC fund "Planet-A" ("Planet A" 2023).

Company and investment data were collected separately, filtering for the defined industries and subindustries (see abstract). Regarding investment data, exits and post-IPO funding were excluded from this study, as the primary focus is on analyzing the financing of startups rather than mature companies.

4.3.1.3 Ecosystem Maturity Calculation

Methodology: This approach also uses the same benchmark geographies to determine the level of investment required to assimilate the German ecosystem to a similar level of maturity. The delta in the average amount of funding per round is multiplied by the number of startups.

Sampling: The same sampling size will be used as for calculation 1.

Data Collection: The same data will be used as for calculation 1.

4.3.1.4 Global Demand Scenario Calculation

Methodology: In their third approach Concini (2018) and Verbeek and Lundqvist (2021) derive the importance of the industry by its share of Gross Domestic Product to estimate the "adequate" size of the venture capital market required to support it adequately.

When studying green finance, funding must be viewed relative to climate prevention and mitigation goals (Bouwer and Aerts 2006). The top-down approaches are significant as they allow for benchmarking current trajectories against established timely goals. Hence, the authors will anchor these calculations and deviate the necessary investment for HCT in GER for the VC market.

Sampling: Ideally, it would be preferable to have an accurate estimate of the required investment specifically for HCTs in GER. However, such specific numbers were not available. Therefore, as an alternative approach, the top-down funding demands will be derived using the global scenario analysis provided by the International Renewable Energy Agency (IRENA), following the methodology employed by Dhayal et al. (2023) and Polzin, Sanders, and Serebriakova (2021). Their newest report has great commonalities among the industries in the focus of this study, including renewable energy, circular economy, manufacturing, and carbon-capturing. It further highlights that most investment must be channeled into developing hardware solutions. Hence, the study was chosen for the secondary data collection ("World Energy Transitions Outlook: 1.5°C Pathway", 2021).

Data Collection: The energy transition report pictures a scenario that keeps global warming below 1.5 degrees in 2050. Additionally, the report estimates the capital required for innovation within this scenario. ("World Energy Transitions Outlook: 1.5°C Pathway" 2021). To analyze the funding gap for the German HCS ecosystem, two assumptions must be made. Namely,

innovation capabilities in companies, as they are not equally distributed among all companies and GER's share of global innovation in HCSs.

4.3.2 Follow-Up Survey

In the second part of the quantitative phase, an online survey was conducted to enhance the comprehension of the interviewees' proposed solutions. The survey aimed to rank the challenges and potential solutions according to their relevance.

After coding 16 challenges and 16 solutions from the interviews, the researchers presented the results to the interviewees using an online survey. The interviewees were asked to rate the relevance of the challenges and solutions extracted from the interviews. Although the sample size of the survey participants is small, with 18 respondents, it serves as a first validation of potential solutions that were deemed to be relevant by the interviewees. This quantitative analysis helps to develop the theories of the study, particularly in better prioritizing the relevance of the challenges and testing the solutions, which would not have been possible with a purely qualitative study. The survey questions and results can be found in the appendix (see 10.6).

Survey Design: Internet surveys are conducted online, and respondents are typically recruited digitally and invited directly to participate in an online questionnaire (McGivern 2009). The strengths of an online survey include the data being directly available to the researcher as well as reaching a wider audience in a faster and more effective way (Adams and Brace 2006). The survey for this research included all 16 challenges and 16 solution proposals, along with a brief description of the terms, if necessary. The survey was divided into four pages for ease of use. The first page provided an overview of relevant definitions to understand the context of the survey, and the second page asked the respondents to rank the challenges by the impact they have on the funding gap. The third page asked respondents to rank the overarching potential

solutions fields, such as smart capital and blended finance, by their impact on closing the funding gap. From the fourth page onwards, the survey asked for a ranking of specific action items, which were divided into four overarching categories. In order to mitigate potential bias among survey respondents, the selection options were deliberately randomized.

Response Type: Phillips and Stawarski (2008) discussed different types of questions that can be used in questionnaires, such as open-ended and checklist questions. This survey used a ranking scale, which required participants to rank lists of items by order of relevance. Participants had to rank the options on each page regarding their relevance to the funding gap. The ranking scale was chosen for its simplicity, although, unlike a Likert-type format, it does not establish intervals between rankings.

Pilot-Test: A pre-test of the survey was conducted between April 24th and April 30th with three researchers and a VC investor.

Sample Size: Saldaña (2011) points out that the amount of survey participants depends on the nature of the project, the research objective, and availability, meaning that if the researcher obtains enough data from the survey, it can be used for analysis. In this case, the study employed a non-probability convenience sampling method, and the sample size was reduced to the experts who had already participated in the interviews (24 interviewees). Participants were recruited using the same contact details, mainly email, which was also used to inform them about interview participation. 18 interviewees responded to the survey, resulting in a response rate of 75%. Participants were asked for consent and the survey and interview participants' responses were anonymized, so their remarks could not be traced back to them.

Data Collection: The online survey was conducted using the Typeform platform from May 1st to May 10th, 2023 (“Typeform” 2023). The respondents were provided with a link to the survey via email. Before taking the survey, they were briefed that they would be presented with all the

challenges mentioned and proposed solution approaches and were asked to rank them based on relevance.

Data Analysis: The challenges and solutions were tested and assessed through the online survey. In the data analysis, the interview responses were mapped against the survey feedback and clustered to rank different types of recommendations.

Limitations: The survey has several limitations such as the potential bias using a non-probability sampling method. Additionally, given the complexity of the HCS topic, the absence of contextual information may have posed challenges for respondents, potentially resulting in incorrect responses.

5 Does a Funding Gap in GER Exist?

The central research question of this study is to validate the presence of a funding gap for HCSs in GER. To accomplish this, the authors evaluate interview responses and analyze quantitative data using various datasets for calculation.

5.1 Interview Analysis

At the beginning of the interviews, the interviewees were asked to confirm or deny the observation of the phenomenon of a funding gap during the startup cycle. 20 out of 24 interviewees confirmed such existence for startups that specifically incorporate a hardware component or/and are based on innovative technology. As I01 (2023) states: “There is a funding gap because of the nature of the innovations that we are discussing here”. Four out of 24 interviewees confirmed the existence of the financing gap only partly, highlighting that currently climate tech benefits from a momentum, positively impacting HCT growth.

The interviewees stated that the awareness about the financing gap of HCSs is partially present amongst various players such as the government and other funding providers. However, they point out that these do not direct their focus sufficiently to reach climate mitigation goals (I01 2023, I08 2023, I13 2023). All the interviewees agree that a suboptimal investment situation exists throughout the startup lifecycle of HCSs, explicitly highlighting the lack of funding when it comes to the commercialization and the scaling of the technology (I09 2023).

Most argue that closing the funding gap primarily needs government intervention, although they consider, that it is crucial to address all stakeholders in the ecosystem to mobilize capital in a "smart way” (I01 2023, I11 2023, I15 2023).

5.2 Quantitative Analysis

After having affirmed the existence of the funding gap in GER through expert statements, the authors aim to verify this with quantitative data and simultaneously estimate the funding gap's magnitude. The latter is crucial for estimating its potential implications and validating the need for solution measurements, as Quas et al. (2022) mentioned.

In this section, the authors present the outcomes of the three relative funding gap calculations based on Concini (2018) and Verbeek (2021), which the authors modified to suit this study's requirements. The calculations are presented sequentially, with each one being briefly explained before interpreting the results. Furthermore, the findings are presented and contextualized to provide a comprehensive understanding of the funding gap analysis.

5.2.1 Financial Advantage and Ecosystem Maturity Calculation Results

Calculation Results and Interpretation: The first two calculations focus on the lower and upper bounds of the funding gap, comparing the median and average investment in GER to the ones in ND and CA, respectively.

The authors built a dataset including company and investment data for the calculation. Firstly, the search for the company data resulted in 550 companies, which were scanned individually to ensure reliability. The cleaned result was a dataset of 108 start- and scale-ups in the HCS sector headquartered in GER, indicating that hardware solutions are underrepresented in climate tech and compared to other industries. These findings correspond with the anticipation in the methodology. Secondly, regarding investment data, the total investments from Q1 2019 - Q1 2023 showed a spread, with the GER level being significantly lower at $1.6 billion compared to CA and ND at $11.8 billion and $11.9 billion, respectively. The median and average were derived by the number of deals.

Overall, the proportions of the calculations are similar to the results of Concini (2018) and Verbeek (2021). Hence, the approach seems to be viable for the sector.

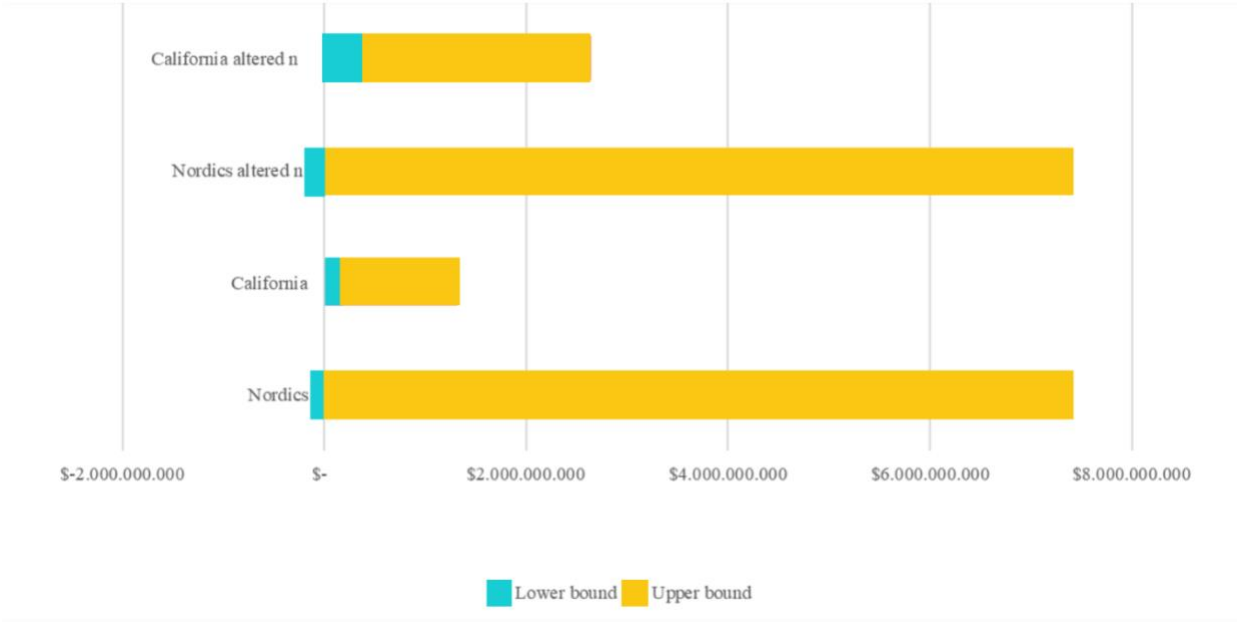

Figure 4 Upper and Lower Bound Graph

Calculation 1 takes the delta in median investment and multiplies it by the number of startups to calculate the lower bound values (Figure 4, marked in blue). The concentration of investment rounds predominantly occurs in the early stages, resulting in the median value representing the amounts typically raised during smaller Series A funding rounds. The values show slight differences: GER has a financing advantage of – $0.1 billion compared to the ND and a disadvantage of $0.2 billion compared to CA. This, in return, indicates that there is no substantial funding gap in GER.

To challenge the result of Calculation 1, Calculation 2 takes the delta in average investment and multiplies it by the number of startups to calculate the upper bound values (Figure 4, marked in orange). Average funding is strongly determined by the number and height of mega-

rounds (rounds above 100 million) at the end of the financing cycle. The upper bound reflect significant differences:

To attain CA maturity levels in GER, an investment of $1.8 billion would be required, while an investment of $4.3 billion would be necessary to achieve NDs level. Interestingly, these results indicate that the ND (even compared to CA) have reached a significantly higher maturity, and investments should increase by a factor of 3x. In this regard, it is worth mentioning that the average of the ND is driven by mega rounds of top-tier companies such as H2GreenSteel, which GER does not seem to be able to produce. This hints at a potential shortage of large funds investing and exit opportunities after these mega-rounds.

5.2.1.1 Commentary on the Ecosystem Maturity Calculation

Comparing calculations 1 and 2, the differences in outcomes of average and median show significant discrepancies. As the upper bounds (averages) are much higher than the lower bounds (median), larger and later funding rounds must have predominantly influenced the former. This indicates that a substantial part of total funding in the benchmark geographies goes into startups around the commercialization phase. Therefore, the subsequent paragraphs will elaborate on mega-rounds and IPOs. Even though mergers & acquisitions are relevant exit options too, they are mainly undisclosed for HCSs, hinting at acquisition prices below expectations (Crunchbase 2023).

Mega-Rounds

Background: As concluded from the comparison of upper and lower bound calculations, the lack of large investments through mega-rounds (+ $100 million) is concerning as they are essential in developing the first commercial applications (TRL 7-8) and preparing companies for commercialization. Thus, mega-rounds considerably influence the success and maturity of

companies in the ecosystem. Moreover, the signaling power of mega-rounds incentive the involved parties to disclose data which creates data reliability (Saller and Klühr 2021).

Globally, climate tech has seen an increase in the number of deals and amounts in megarounds. Led by the USA, in 2022, the year-over-year was over 14%, amounting to $39 billion in 169 deals, indicating increasing maturity. However, despite the upward movement, GER saw a decline (Cristoforoni 2023).

Data: To establish an overview of the current situation, data was used from the NetZero Insights Report 2022 (Cristoforoni 2023). It is important to note that the report focuses on climate tech without distinguishing between software and hardware and includes EVs, which comprise a significant proportion of funding (35%). “Dealroom” and “Crunchbase” were used to identify the top five deals since 2019 among the three geographies GER, ND and CA (Crunchbase 2023; Dealroom 2023).

Germany: In 2022, the total amount of mega deals in GER amounted to $5.5 billion. The top five deals were startups focusing on business model innovation (Massa and Tucci 2013). The only startup categorized as a HCS was “Hy2Gen” which received $227 million. Since 2019, the mega-rounds in HCT summed up to $809 million with no deal exceeding $200 million.

The Nordics: The ND were leading European tables for climate tech in 2022, and HCT accounted for 93% of total $6.77 billion in investments. Since 2019, their mega-round funding summed up to $9.6 billion, with a large amount of debt taken. One of the startups, “H2Greensteel”, received $3.5 billion in debt combined with $190 million in Series B equity funding in 2022. Moreover, battery producer Northvolt combined $1.6 billion in debt with $600 million in Series B equity in 2020.

California: CA's top 5 HCS deals were equity investments of around $350 million, adding up to a total of $2.1 billion. The deal count was significantly higher than in the ND, with many transactions in the agricultural and alternative food sectors.

Conclusion: To summarize, the ND have attracted ten times more mega-round funding, funneling a great proportion into HCT. CA was able to consistently produce large equity funding rounds. In comparison, the German ecosystem seems significantly underdeveloped. Until now, only innovation in business models, like "Enpal", could secure considerable late-stage funding (Calanter and Zisu 2022). While this is a promising start, it again reflects the gap in GER. The ND have already successfully commercialized these low-hanging fruits and are now ready to move on to pursue more complex innovation in hardware. To conclude, the mega-rounds are a further indicator for the lack of the HCS ecosystem maturity and the funding gap in GER.

IPOs

Background: After focusing on mega-rounds, this paragraph will focus on IPOs, which are seen as the gold standard exit for VCs (Cumming 2007). In other sectors, they channel large amounts of capital back into the ecosystem. The US and China have historically been more prominent IPOs markets than Europe. After the height of 2021, global activity fell drastically, and Europe became absent from the global league tables. While the ND saw some activity, GER was muted, dropping from 16 offerings to two (Newman and Picard 2023).

Data: To gain insights into IPOs in GER and Europe, it is necessary to access specific data.
IPO data is even more readily accessible than data for the mega-round stage because IPO information is publicly available. To obtain an overview of IPOs in GER, "Deutsche Börse

Group" will be examined, while "Euronext" will be reviewed to understand IPOs in Europe ("Deutsche Börse Group" 2023; "Euronext" 2023).

Germany: Examining the "Deutsche Börse Group" database between 2018 and 2022, only one climate-related company, "Veganz", went public. However, "Veganz", a vegan food brand, is driven by business model innovation and lacks significant engineering capabilities (Saari et al. 2021).

Europe: A different picture emerges when individually scanning the database of the pan-European market infrastructure Euronext for climate tech companies. An increasing number of climate tech firms went public, but the total first-day capitalization was driven by a considerable number of subsidiaries of renewable energy companies.

Analyzing the data, compared to all companies, first-day capitalization for HCSs is unsurprisingly lower on average, but interestingly the median is higher, indicating that HCSs seem to outperform more mature companies going to the stock exchange. Moreover, there is a significant range in employee counts as HCT companies have, on average, more than ten times fewer employees. Also, when turning to average revenue, similar dispersion can be found. Interestingly, the emerging pattern is like the one of biotech startups seeking funding to scale up after successful clinical trials (Murphey 2022).

Conclusion: The absence of IPOs of HCSs confirms the statement of several interviewees that the preferred exit channel of VCs is closed (I02 2023, I03 2023, I04 2023, I14 2023). This partially explains the absence of mega-rounds. Also, it indicates that the catalytic funding cycle is interrupted as money is not flowing back into the ecosystem, which leads to fewer success stories attracting investors and starups alike.

5.2.1.2 Commentary on the Methodologies

When altering n (number of startups) by a factor of two to calculate the upper and lower bound, the lower bound does not change. However, the upper bound gets amplified to values of $3.5 billion and $8. billion and shows that GER is away from the depicted state where the double of HCSs can be supported by the ecosystem. These results seem interesting when compared to the following calculation.

Limitations of this Approach

The primary constraint of the above performed calculations is that all regions could have too low investment levels to reach climate goals. Additionally, the data points for GER and ND were limited, resulting in a loss of significance especially for the median. Moreover, it would have been valuable to divide the funding gap by stages, not feasible due to the same issue. Furthermore, not all transactions are recorded on the platforms, and there are deals with undisclosed amounts. Lastly, the alteration of n in the calculation does not consider that median and average investments change correspondingly to the number of startups.

5.2.2 Global Scenario Demand Calculation Results

Calculation: This chapter discusses the third calculation, which derives investment targets from the IRENA Global Scenario under two assumptions explained in appendix 10.5 (World Energy Transitions Outlook: 1.5 °C Pathway" 2021). By applying their respective ranges to the calculations, four distinct scenarios for the HCS ecosystem are generated.

The calculation process works as follows: The total investment demand ($4.4 trillion) is multiplied by the share of innovation (6%), resulting in $264 billion needed for global innovation. To find the investment target for the German HCS ecosystem, these $264 billion

are multiplied by the range of innovation produced by startups (30-60%) and the share the country has in global innovation (3,7-7%).

The following matrix emerges:

Responsibility of global innovation/Potential of startups to contribute to innovation	**GDP Responsibility** (3,7%)	**Stronger Responsibility** (7%)
Lower potential (30%)	$ 2.930.400.000	$ 5.544.000.000
High potential (60%)	$ 5.860.800.000	$ 11.088.000.000

Table 4 Investment Target Matrix

Interpretation: As visible in the matrix, annual investment targets are significantly higher than the amount invested in the last four years ($1.6 billion) regardless of the assumption applied, indicating that GER still has a long way to go to achieve investment goals for HCT. Looking closely at Table 4, the annual investment would need to be 1.5 times higher to reach the lowest scenario ($2.2 billion) and five times higher to reach the highest scenario ($8.3 billion). It is worth mentioning that, when putting this third calculation in relation to Calculation 2, the highest scenario ($8.3 billion) is close to the amount of the funding gap of the ND with altered n (see 5.2.1.2). Consequentially, this means that the lower bound values of the prior calculation do not have much significance in understanding the total funding gap.

Limitations of the Calculation: The primary limitations of these approaches lay within the assumptions made by the IRENA report and the authors. To test reliability, the PES scenario, depicting the current state of the world, was used as a control condition. When using the low-

low configuration, the result with $0.6 billion investment per year is close to the real-world numbers.

5.3 Interim Conclusion and Analysis

The literature review, quantitative analysis, and interviews conducted unanimously confirm that a funding gap exists for HCSs.

The literature found the VoD to be more profound for HCSs as they have high tech risk, long development cycles, high capital expenditures, and high exit opportunity uncertainty. Furthermore, the interviews confirmed its existence in GER, with 20 out of 24 interviewees fully and four partly approving. Additionally, the interviewees explained that there is an awareness of this gap in governmental and private institutions. However, both lack focus to tackle the issue.

Further, triangulation with the quantitative analysis also confirmed a lack of maturity in GER's HCS ecosystem because of the lack of mega-rounds and exits for HCSs. Attributing little importance to the first calculation, but foremost importance to the ND in the second calculation and to the global scenario high-high configuration, the range of the funding gap is estimated to be between $3.8 billion and $11 billion per year. The immense gap between investment targets to mitigate climate change and the amount invested lead the authors to identify potential challenges and later solutions.

6 Which Challenges Contribute to the HCS Funding Gap in GER?

After establishing that there is a funding gap, challenges extracted from the interviews will be presented to gain a further understanding of the reasons causing this gap. Furthermore, the interconnectivity between the challenges is displayed and analyzed in Chapter 6.2. Finally, Chapter 6.3. analyzes the survey results and compares them to the findings from the interview analysis.

6.1 Interview Analysis

In the following subchapters, several potential challenges will be explained. The challenges were grouped into four overarching categories: “Starting-Up Challenges”, “Market Creation and Commercialization Challenges”, “Regulatory and Policy Challenges”, and “Investor Challenges”.

It is important to note that some challenges are not necessarily HCS-specific but are valid for German startups in general. However, most challenges negatively impact HCSs in particular.

6.1.1 Starting-Up Challenges

The following subchapters discuss challenges that arise in the early-stages of the startup lifecycle mostly negatively impacting the first VoD.

Challenge 1.1: Entrepreneurial Skill Gap in HCS Teams

Typically, when a technology venture emerges from a university or research institute, the team consists of researchers that do not necessarily have the ability and the will to become entrepreneurs (I01 2023, I09 2023). The lack of entrepreneurial skills can limit access to finance for startups, as investors usually require the founder team to be diverse in skills and prior experiences (Owen, Brennan, and Lyon 2018).

On the one hand, I01 (2023) states that when it comes to finding the product-market fit, there is not so much a funding gap but an expertise gap from the founder team. On the other hand, it

is possible that academics are more interested in focusing on their academic endeavors rather than engaging in entrepreneurial activities (Sørheim et al. 2011).

During the stage of establishing product-market fit, it is crucial for the founder team to recognize that it is the winning technology, rather than the perfect product, that gains widespread market adoption. Thus, it is crucial to involve entrepreneurial-minded people that can fit the technology into a suitable business model to enter the market (I06 2023, I08 2023, I09 2023, I15 2023).

Challenge 1.2.: Lack of Connection Between Research and Commercialization

Several interviewees mentioned the lack of a strategic angle from the government which impacts the research regarding technologies that can accelerate change (I05 2023, I13 2023). I21 (2023) mentions that GER is immensely behind the United States of America (USA) when it comes to the commercialization of ventures. I03 (2023) emphasizes the importance of imposing a business focus early onto companies operating in green tech that emerge from science to accelerate commercialization and attract investors, which thus far is not yet established, meaning that academic institutions do not possess a clear framework to facilitate the transition from basic research to the development of marketable products. It has been stated that allocating funding early in the research process is essential to expedite the commercialization of intellectual property (IP). Interviewees mentioned the importance of strategic government funding when it comes to R&D since VC money would, in that case, be too expensive (I12 2023). Universities, institutions, and research institutes that have IP need to be given the opportunities and means to be able to produce spin-offs, meaning investors need to enter early in the process (I07 2023).

Challenge 1.3.: Lack of Standardized and Founder-Friendly Processes for University Spin-Offs

University spin-offs are new ventures developed from academic activities (Pirnay, Surlemont, and Nlemvo 2003). Part of the reason for this is that the success of scientists in universities often depends on publications and research grants, not the creation of IP with commercialization potential, such as patents (Upadhyayula et al. 2018). Moreover, accessing and commercializing the IP can be a complicated negotiation process. This is because the university's policies may not align with the spin-off founders' interests. However, the IP belongs to the university (I04 2023, I15 2023). This potentially creates a conflict of interest, as the university is involved both as an academic institution and as a commercialization partner, which can discourage researchers from engaging in entrepreneurial activities (Sørheim et al. 2011). Thus, commercialization becomes unattractive and undesirable due to unstandardised and unattractive terms for entrepreneurs (I03 2023).

"So, you end up having hardware companies being spun out where the university has 25% to 30% of the hardware company, which essentially just kills it before it even gets going."

- I15 (18.01.2023)

6.1.2 Market Creation and Commercialization Challenges

The subsequent sections explore the obstacles surrounding market creation and commercialization that appear during the second VoD.

Challenge 2.1: Lack of Offtake Agreements

Offtake agreements are mechanisms in the form of contracts between a supplier and buyer that aim to reduce the financial risk for startups when scaling up production. Offtake agreements are established when the technology is available for purchase with the goal of securing a market

for HCSs (Bonetti, Gatti, and Caselli 2010; Byoun and Xu 2014). Several interviewees highlight the importance of corporates as potential partners because they bring technical, industrial, and commercial visions and skills to the table. Thus, they do not only have the financial means but most knowledge about the scaling process to establish a customer base for innovative technology (I08 2022, I09 2023). I15 highlights that corporates should be incentivised to act as customers rather than investors. However, it has been mentioned that corporates focus heavily on their in-house R&D rather than partnering up with innovative startups and supporting their scaleup process (I10 2023, I11 2023, I08 2023). I23 (2023) and I24 (2023) point out that it is less about the lack of offtake customers in general but more about the fact that in other markets, especially the USA, they come faster and in much larger volumes than in GER.

"And so, on the corporate side, which is very important in sort of deep tech, I think there should be a lot more pressure and a lot more incentives for these companies to be customers rather than investors."

- I15 (18.01.2023)

Challenge 2.2: Lack of Strategic Procurement Programs

"Public procurement" is described as the practice of the government purchasing products (Michelfelder et al. 2022). Public procurement includes the introduction of procurement standards and long contract terms. Procurement is strategic when it plays a crucial role in promoting innovative technologies, creates a market for said technologies, and incentivises commercial and private investors to invest in innovative technologies (Temmes et al. 2021). Procurement is advanced if it funds early-stage investments in new technologies via special programs, such as the Advanced Research Projects Agency-Energy (ARPA-E) program in the USA (Criscuolo and Menon 2015).

Several interviewees highlight that insufficient governmental focus and commitment to reach climate goals in return also leads to a lack of strategic procurement programs fostering innovation and maintaining market competition (I03 2023, I04 2023, I05 2023, I10 2023, I15 2023). Therefore, the government fails to act as a reliable anchor customer for promising technology suppliers. Current regulations are inflexible to modern technologies and are rigid, thus acting in favour of products that hinder the establishment of more innovative and environmentally friendly products (e.g., cement) (I11 2023).

The companies that win in clean tech, it's not the best tech, it's whoever gets the biggest contracts first. (...) Europe just doesn't have a customer base for clean tech.

-I15 (18.01.2023)

I23 (2023) and I24 (2023) add that, like offtake agreements, procurement programs lack the volume and an effective design on how strategic procurement is done compared to other geographies. The interviewee highlights that formalised tenders are frequently designed in such a way that HCSs or startups in general have no real chance of receiving the contract. Examples such as the USA strongly suggest that the state can have a market-creating impact either as a direct purchaser or in co-owned companies. Interviewees mentioned DARPA (Defense Advanced Research Projects) as a specific example and described it as a procurement agency that has the means to invest high volume in innovative technologies which GER lacks (I04 2023, I15 2023, I22 2023).

6.1.3 Regulatory and Policy Challenges

The following sections elaborate on regulatory and policy challenges that are highly related to governmental bodies and impact various TRLs.

Challenge 3.1.: Lack of Strategic Direction and Guidelines Defined by the Government

Several problems that occur without a clear governmental direction include poor implementation of environmental regulations, a lack of a framework for green financial instruments, and a lack of knowledge about the pros and cons of green finance (Ozili 2022). Twelve out of 24 interviewees suggested that the German government lacks the establishment of long-term climate goals that allow for smart capital allocation and support impact-driven innovation. Due to the lack of vision, the market has less direction and uneven distribution of capital in relation to the potential Greenhouse Gas savings emissions and the maturity of the technology (incremental breakthrough). Stronger regulation reduces the uncertainty for HCSs and investors as, i.e., demand and margins can be estimated better in advance. In addition, several interviewees mentioned that governmental subsidies are not linked to any of these criteria but are perceived to be given without strategic focus (I01 2023, I20 2023, I21 2023, I22 2023). Interviewees perceived the government's opting for incremental innovation as risk-averse behavior (I13 2022, I22 2023). As an example, solar energy technology is mature, thus only leaving room for incremental innovation. However, the sector receives much attention suggesting that incremental innovation is essential, keeping in mind the potential carbon savings that build on existing infrastructure. I10 gives an example: "Instead of converting all the aircraft in the world to hydrogen, which would take decades, we need to find a solution for today's aircraft. And, an e-fuel that can be used now." Still, most interviewees and the IRENA (2021) attest to a substantial need for fundamental innovation (I09 2023, I15 2023, I21 2023, I22 2023).

"Norway - the coldest place in Europe. It's the one with the highest degree of electrification. It makes absolutely zero sense, right? (...) but they've done it. Just because the government took a decision to drive this transformation."

- I08 (21.12.2022)

Challenge 3.2.: Regulatory Fragmentation of Europe Single Markets Slows Down Investment Flow, Commercialisation and Exit Prospects

Schuh and Latz (2022) note that in the European Union (EU), the startup ecosystem is widely dispersed and highly fragmented, which creates a barrier to technology transfer and problems in accessing financial resources for scaling up. National environmental policies hinder knowledge transfer across borders and thus affect the expected viability and future profitably of emerging startups (Criscuolo and Menon 2015).

On the one hand, different regulations per EU state for validation processes represent obstacles for HCSs and create inefficiencies. I01 (2023) emphasizes that particularly technology-intensive startups face barriers to transferring their technology, as the validation and certification processes for their products are protracted and expensive. In return, this also makes it harder for investors to validate the market potential of the HCSs. In Europe certification processes only grant access to a single member state, requiring startups to repeat the process in multiple countries. In contrast, in the US, a successful certification process is typically recognized across all states, opening the entire market in one step (I15 2023, I23 2023, I24 2023).

On the other hand, institutional and regulatory barriers hinder cross-border investments (I15 2023). The authors highlight that this has two-fold implications. Firstly, the entire financial market has a lower volume due to fragmentation. Hence, it is harder to receive funding as a VC keeping the fund sizes smaller. In return, this means more due diligence for foreign investors who hesitate to invest. Secondly, local investors are smaller and have a more challenging time to diversify their portfolio among geographies. Hence, US-based ventures use their advantage of a strong American single market with large capital flows to invest in Europe, especially in the later stages of financing (Quas et al. 2022).

All of this puts social returns at risk of remaining uncaptured in fragmented ecosystems, which suggests that multi-level-policies such as regional–national–European regulations are missing (Brown 2001; Polzin 2017).

"There is no such thing as an integrated Europe. The Germans have their agenda, the French have their agenda, and you kind of see that play out in the government side."

- I15 (18.01.2023)

In conclusion, I23 (2023) and I24 (2023) point out the vicious cycle initiated by regulatory fragmentation in Europe. It inhibits the ecosystem's growth and therefore hinders the commercialization of HCSs which leads to fewer exit prospects.

Challenge 3.3: Public Financing Instruments Do Not Reach Full Potential

It has been frequently mentioned that financing instruments exist that could potentially help close the funding gap, but their regulatory setup hinders them from doing so. As an example, the SPRIN-D is a financing instrument designed by the German government and able to invest four to 15 million Euros per year into innovative technologies at an early stage. However, I04 explained that the instrument, in general, is too slow to interact efficiently with the market. It is only allowed to invest in subsidiary companies which leads to a suboptimal situation for the founders and massively hinders its reach (I21 2023).

"SPRIN-D or the Deep Tech Climate fund are set up like a government agency, with all these restrictions that come with it (..) it becomes an unattractive partner."

- I04 (23.01.2023)

I22 (2023) sees a positive development, where players such as the Kreditanstalt für Wiederaufbau (KFW) and European Investment Bank (EIB) provide loans at a low rate which is ideal for startups. However, the interviewee criticizes the lack of adaptation of those

instruments for HCSs. They must meet the same criteria as software but inherently have longer payback periods due to the length of technological development cycles.

Furthermore, interviewees brought forward that research grants in GER grant 25% of the amount invested but are capped at 1 million euros. This regulation seems insufficient, considering the considerable amounts of financial support HCSs need, especially in early development. On a global scale, the United Kingdom (UK) has taken a step forward by recompensating investors with 20% of any amount. This unique competitive advantage attracts startups to push their research in the UK (I16 2023, I20 2023, I21 2023).

I23 (2023) and I24 (2023) raise the point that insufficient feedback loops and an insufficiently inclusive policy design prevent the existing initiatives from reaching their full potential. Interviewees often stated that initiatives are well-intentioned but not adjusted to benefit HCSs. This was attributed to lack of inclusivity in policy design and market feedback loops.

6.1.4 Investor Challenges

The following sections are all focusing on investor challenges that arise throughout various stages of the startup cycle. The challenges are discussing financing mechanisms that are negatively impacting HCS growth.

Challenge 4.1: Lack of Technical Knowledge and Expertise in Investment Teams

The general spike in climate tech investment shows that investors understand that there is a relationship between climate change mitigation, technology, and returns. However, hardware is commonly known to be the most impactful of all technologies. Consequently, the investors should understand the coupling between the substantial potential impact and the corresponding return. Seemingly, their willingness to pay is not correlating to the potential impact of hardware technologies implying that investors may not have the technical expertise or knowledge required to fully understand these investments (Heeb et al. 2023).

Insufficient adaptation of investors to changing expectations and limited expertise in emerging technologies and projects lead to a scarcity of financing and higher costs (Polzin, Sanders, and Serebriakova 2021). 17 out of 24 interviewees confirmed that investment teams lack scientific background and expertise in this sector. Most of the investors entering climate tech were software analysts. However, they do not yet have the technical capabilities to perform the required due diligence (I08 2022)

"There are more climate funds than there are climate investors out there."

- I08 (21.12.2022)

Naturally, they now have difficulties assessing a complex technology rather than a business model within e-commerce or e-delivery. In pursuit of efficiency, VCs and their teams focus on similar types of ventures. However, this leads investors to risk adversity in unfamiliar sectors such as hardware climate tech (I07 2023, I11 2023, I15 2023, I18 2023, I22 2023).

"If you do not know it, you are going to shy away from it."

- I08 (21.12.2022)

I22 (2023) adds that investors seem less visionary than in other countries. "In the USA, most of the people ask: *How do you scale?* Here (in Germany), the question I get asked is: *What is your market?"*

Further, VC have issues understanding the complex technologies and the technical risk of scaling up (I01 2023, I08 2022).

Challenge 4.2: VC Investment Blueprint Does Not Fit HCSs

The "VC investment blueprint" refers to the typical investment criteria and expectations VC firms have when considered investment opportunities. VCs organise resources in closed-end funds with a lifetime of 10 years. I01 (2023) mentions that software has been thriving under this blueprint and, in return strongly shapes it. The technical scale-up process is simple, and

revenue can be expected within the first 2-3 years. HCSs are different, requiring extended periods of trial-and-error testing with development cycles that can last more than ten years, leading to a high initial capital expenditure (I01 2023, I06 2023, I12 2023, I18 2023, I20 2023, I22 2023). VCs might avoid undertaking projects like HCS that demand a significant upfront financial commitment. Moreover, funds are reluctant to engage in ventures that will not create returns over their lifetime (Criscuolo and Menon 2015).

Finally, I15 (2023) emphasises the above-mentioned lack of technology knowledge of investment teams that leads to misconceptions about exit potential and exit horizons and eventually to wrong investment criteria of VCs.

Challenge 4.3: Lack of Risk-Taking Angel Investors with High Investment Power and Signaling Capability

BAs play a crucial role in providing early-stage financing for startups because of their high investment power and the expertise and network they bring (I09 2023, I14 2023, I19 2023, I20 2023, I21 2023). Moreover, the involvement of BAs, especially those who are actively involved in angel syndicates, may be beneficial for the performance and survival of HCSs due to their signaling capability (Bonini, Capizzi, and Zocchi 2019; Blaseg and Hornuf 2023). Nevertheless, in comparison with the US ecosystem, European BAs have not yet shown themselves to be a viable alternative to VCs. This may be due to several reasons, such as the limited investment power of individuals, the large amount of virgin angels and the negative incidents they experienced on the market (Aernoudt, San José, and Roure 2007).

I09 (2023) and I21 (2023) state that BA investors are suitable investors for HCSs as they are willing to embrace high technical risks and demonstrate a readiness to invest in emotional and relevant technologies such as space technology or health. However, BAs are more incentivized to invest abroad (I15 2023, I21 2023). This is due to more attractive tax laws, a wide range of

educational and networking opportunities and a regulatory environment that eases raising capital from investors such as BAs (I15 2023, I21 2023).

Challenge 4.4: Lack of Institutional Investment

In general, institutional investors consist of several types of organizations, such as sovereign wealth funds, pension funds, family offices or insurance companies (Gaddy et al. 2017). To attain the necessary scale in climate tech investment, there is a need for greater participation from institutional investors like pension funds and insurances, as they hold substantial amounts of money. Hence, they could be suitable to provide large-scale and long-term catalytic capital (Cotton 2020; Hafner et al. 2020; In, Monk, and Knox-Hayes 2020; Migendt et al. 2017; Temmes et al. 2021).

However, comparing the German institutional investment landscape to the one in the USA, it becomes clear that there is a lack of institutional investors. I15 (2023) explains that German institutional investors remain hesitant towards investing in HCSs and mainly invest in activities that rely on fossil fuels. I16 (2023) points at a vicious cycle:" (…) because the funds are so small, we do not get the big institutional tickets, because institutions do not want to put any due diligence into the fund managers. The effort is too high for them, and the risk of being involved with too much risk is too great for them." It is essential to point out that institutional investors can enable immense VC funds, which must exist to meet the funding demands of HCS, since small funds hesitate to participate in large rounds as it would ruin the risk profile of their portfolio.

I15 (2023) further explains that institutional investors keep a traditional mindset and perceive VC as high-risk investments. Hence, I01 (2023) states that institutional investors lack teams with the skills to analyze the VC market and understand its more complex investment areas to funnel investments.

"The more institutional the money is, the more risk averse it gets. This is my observation in Germany."

- I09 (04.01.2023)

Furthermore, institutional investors in Europe and especially in GER are restricted by regulations, making it difficult for VC firms to raise money, consequently limiting the investment process for follow-on investments in HCSs (Migendt et al. 2017). Moreover, unlike the UK or the USA, the German financial system lacks an institutionalized finance structure, such as pension funds that participate in VC (Polzin, von Flotow, and Klerkx 2016).

Challenge 4.5: Lack of Co-Investment Between Public/Private Money

Blended finance is used to leverage public capital to attract private investment and includes various alternative sources of funding, such as impact bonds or guarantees, that can be used to close the HCT funding gap (Clark, Reed, and Sunderland 2018; Jiang 2023; Dey and Mishra 2022). Harrer and Owen (2022) mention that government-backed funds play a role in technology-heavy ventures because they can attract private-sector investment. However, blended finance is not yet established as a standard financial product for several reasons, such as the lack of an appropriate regulatory framework, government support, and workable exit strategies for impact investors (Dey and Mishra 2022).

Several interviewees agree with the findings mentioned above. They suggested that using blended finance instruments is crucial to bridge the funding gap (I20 2023, I21 2023, I22 2023). However, I20 (2023) touches upon the regulatory environment and states that a form of blended finance, namely guarantees, cannot explore its full potential. Firstly, guarantees are not as accessible for early-stage ventures as other instruments, and secondly, the process to obtain guarantees is not standardized. I07 brings up the concern that debt providers such as banks

have the means to provide sufficient money. However, they have limited capabilities to take on the required risk due to regulation barriers and procedural limitations.

Moreover, it was mentioned that investors, as well as HCSs, lack an understanding of blended finance which inhibits its development. There may be a lack of awareness regarding the benefits of blended finance and the opportunities it presents for co-investment among potential investors and HCSs (I23 2023, I24 2023).

Challenge 4.6: Underdeveloped Private and Independent Fund-of-Funds Ecosystem

Investment structures such as FoFs invest directly in other funds rather than companies or projects. They spread the risk by pooling a high amount of capital and investing in several funds, such as VC funds (Nassiry and Wheeler 2011). For instance, the £330 million UK Innovation Financing Fund (UKIIF) was utilized to implement this strategy (Owen, Brennan, and Lyon 2018). I23 and I24 (2023) suggest that besides public FoFs, private FoFs are known to be crucial vehicles to benefit first-time funds, small funds, and solo general partners that bring not only capital but also HCT expertise to strengthen the ecosystem with knowledge. In contrast, public FoFs face limitations due to the regulatory environment incorporating standards that slow down financing processes. The interviewees further explains that large-scale private FoFs are absent from the German FoF-ecosystem, while large-scale international FoFs with a different regional focus only occasionally participate.

However, I06 stresses the importance of public FoFs that can act as reputable players within the ecosystem, for instance KFW FoF. They can lead risk-averse players, such as institutional investors, towards alternative investments through trust and displayed expertise.

Challenge 4.7: Venture Debt and Alternative Forms of Capital Remain Underdeveloped in Europe

VD is an alternative capital source and can decrease investor risk and grant startups greater ownership (Michelfelder et al. 2022). I01 (2023) highlights that VD extends the startup cycle, which allows companies to stall and establish a foothold in the market. This is why VD is suitable and interesting for HCSs, especially during the development processes and testing, which are known to take longer. The interviewee adds that having access to debt products is essential to attract investors in early stages, where working capital is needed to start building manufacturing facilities and so on.

However, with a projected market volume of $1.5 billion in 2020, this instrument remains underdeveloped in Europe, whereas in the USA, it has been a major factor contributing to round size growth (Quas et al. 2022). Its underdevelopment potentially stems from numerous factors. Firstly, I14 (2023) mentions that the EIB VD product given out as grants (0% interest rate) is known to have slowed down the nascent VD ecosystem in Europe. Moreover, the German financing instruments, among other European ones, tend to give out subsidies to finance startups. Thus, startups are culturally not used to taking on debt (I14 2023). Secondly, as VD requires pay-back of the loans, the timing is crucial. I12 adds that the startup is required to produce recurring revenues, which is hard for HCSs, questioning the suitability of VD. However, HCSs cannot be overly developed, as other forms of financing might then be more appropriate. The problem is that, due to comparable information barriers, finding the optimal timing for HCSs is as challenging for VD as it is for VCs (I02 2023). One interviewee suggested that pre-IPO companies may use VD to fund their expansion plans and extend their cash runway before going public (I15 2023). However, the problem in Europe and specifically GER is that there is a lack of liquidity events such as subsequent funding, revenue or IPOs which hinder HCSs from paying back debt.

I02 states that private VD providers are known to be more successful in financing technology ecosystems (i.e., Silicon Valley). This highlights that instead of creating public VD programs, the government ought to play a key role as Limited Partners investing in private VD.

Challenge 4.8: Lack of Exit Opportunities

I15 (2023) points out the systemic issue that in GER, exit opportunities in general, but particularly in the form of IPOs are absent. Compared to the US, there have been significantly fewer European companies going public. Also, industries such as the energy sector, contrary to biotech, have witnessed fewer acquisitions. This is due to the competitive nature of innovative alternatives that challenge corporate products relying on fossil fuels (Gaddy et al., 2017; Ghosh and Nanda, 2012; Hargadon and Kenney, 2012).

Firstly, HCSs demand high capital investments and thus large rounds to scale their technology. However, the investments are only issued if the investors anticipate a timely exit. Generally, if early investors do not see any exit channels, the amounts invested will be lower or none at all, and the startups face illiquidity from the start. This inhibits the growth of the VC industry in Europe as a whole and prompts HCSs to seek exits overseas, particularly in the US (I04 2023). Which, as a by-product, results in money being reinvested in foreign ecosystems instead of strengthening the European or German startup ecosystem (I21 2023). In the end, this might restrict how quickly and fiercely competitive the European startup environment grows compared to the US (Quas et al. 2022).

"No IPO, therefore little growth capital. (...) 85% of exits from high tech founder funds go to non-European countries, thus breaking the cycle."

- I04 (23.01.2023)

I23 (2023) and I24 (2023) add that one way to resolve the challenge are SPACs.

However, due to a temporary surge in interest and enthusiasm in 2021 in the US, the initial post-IPO performance of SPACs garnered significant attention and engagement. However, following this initial hype, the performance of SPACs proved to be weak and disappointing. As a result, this negative experience deterred further utilization of the instrument on a larger scale. (I15 2023).

6.2 Interim Conclusion and Analysis

It is worth noting that there may be additional challenges contributing to the funding gap, which were not mentioned in the interviews and thus not extensively discussed in the research paper.

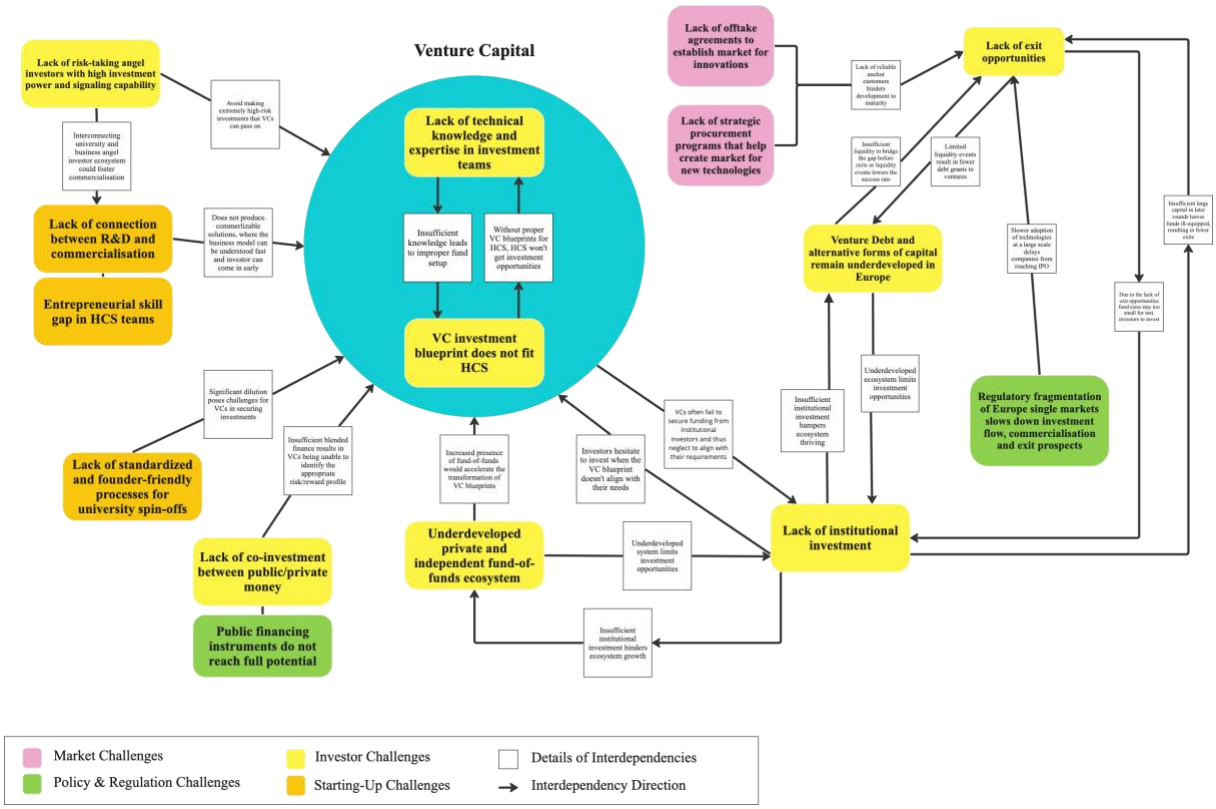

Figure 5 Interdependencies of Challenges

The diagram (Figure 5) above illustrates the identified the interdependencies between challenges, highlighting that some are more impactful than others. This should be considered especially when discussing fundamental challenges and potential solutions. The interdependencies of Figure 5 are explained in the following.

The first VoD is exacerbated by the entrepreneurial skill or expertise gap in HCS teams that often consists of researchers. On one hand university spin-offs in GER suffer from a lack of standardized processes and founder-friendly spin-off terms which inhibit their introduction in a market that is yet to be established. On the other hand, the lack of knowledge about business requirements could partially be responsible for an unsuccessful commercialization of the IP, where HCS teams fail to attract early investors. Furthermore, investors lack technical knowledge and expertise, which hinders them from investing early on. This is primarily due to their perception of elevated technological risk and the assessment of such risk within the investment team. Moreover, as mentioned, BAs are suitable sources of funding during the seed and early stages of HCSs. However, the lack of BA investors in GER complicates the funding process in the early stages.

Moving on to the second VoD, it should be mentioned that a lack of offtake agreements which encompass both the adaptability of corporates to embrace innovation and substantial volume commitments, hinders the market creation for innovative technology and impedes commercialization of HCSs. The is true for the lack of extensive and easily accessible procurement programs by public actors and publicly backed enterprises. The success of said programs is crucial for the early development of HCT.

To further understand the importance of individual challenges, the results of the survey with the interview responses are shown in Table 5. When analyzing survey responses, it was found that the "Lack of procurement programs" was prioritized the highest in the survey, which is in line with the importance it was given in the interviews (mentioned by over 45% of the interviewees). This indicates that the lack of procurement programs strategically fostering cutting-edge innovations is perceived as highly relevant. This is further reinforced by the high ranking of "Lack of strategic direction and guidelines from the government". These factors

collectively suggest that more precise strategic direction and establishing defined investment areas could lead to aligned procurement programs and ease the market for innovations.

Moreover, as highlighted by the interviewees, there is an urge to mobilize catalytic (private) capital for HCSs to produce scaleups. Institutional investors seem suitable investors to provide such capital. However, the lack of big institutional tickets for HCSs can be linked to the fact that the VC funds are relatively small which discourages institutional investors from investing. This is due to a perceived disproportion between risk and return as larger institutional ticket sizes imply acquiring a substantial share of the fund at their minimum level. When considering the survey responses, the challenge of “Lack of institutional investors” seems undisputed. Indeed, this perspective seems logical, given that institutional tickets are substantially large and, as a result, can exert a significant influence on numerous other stakeholders.

The problem of insufficient fund size in VC funds is intensified by the underdeveloped state of an independent, private FoF ecosystem in GER. The current German FoF landscape lacks significant participation from large-scale domestic FoFs and has limited involvement from international FoFs. Consequently, the vital role of serving as investors in VC funds remains unfulfilled. Interestingly, survey participants highly ranked the challenge of "Underdevelopment of private and independent FoFs," while this aspect did not frequently arise during the interviews.

Additionally, recognizing that the VC model does not align well with HCSs, it becomes more crucial to explore alternative forms of capital, such as VD and public-private finance, more extensively, which will be discussed in more detail in Chapter 7.2.2.

Lastly, several interconnected detrimental cycles can be observed within the funding gap, an important one being the following one: On the one hand, HCSs necessitate substantial investments. On the other hand, the VC investment horizon is limited to seven to ten years which means that VCs rather invest in startups with a high probability of timely exits. However,

the quantitative analysis in Chapter 5.2 revealed a scarcity of mega-rounds and the closure of IPOs for HCSs. Meaning that there is no money to be reinjected into the cycle through IPOs, that would lead to further investments. Surprisingly, the challenge "Lack of exit opportunities" was ranked low and mentioned by only a limited number of interviewees. This discrepancy could be attributed to the perception of interviewees viewing the funding process for HCSs as a linear progression rather than recognizing its cyclical nature.

In conclusion, successfully introducing intricate technologies to the market requires the presence of catalytic capital that can effectively rally a diverse range of investors. Additionally, collaboration among various stakeholders is essential to deliver meaningful and effective solutions that can bridge the funding gap.

Challenges	Prioritised in survey	Mentioned in interviews**
Lack of Procurement Programs that Help Create Market for New Technologies	1	■■■■
Underdeveloped Private and Independent Fund-of-Funds Ecosystem	2	■■□□
Lack of Institutional Investment	3	■■■■
Lack of Strategic Direction and Guidelines Defined by the Government	4	■■■□
Lack of Technical Knowledge and Expertise in Investment Teams	5	■■■□
Regulatory Fragmentation of Europe Single Markets Slows Down Investment Flow, Commercialization and Exit Prospects	6	■■■■
Venture Debt and Alternative Forms of Capital Remain Underdeveloped in Europe	7	■■■□
Lack of Connection Between Research & Commercialisation in Research Institutions	8	■■□□
Lack of Co-Investment Between Public/Private Money	9	■■■□
Lack of Risk-Taking Angel Investors with High Investment Power and Signalling Capability	10	■■■■
Lack of Offtake-Agreements	11	■■□□
Public Financing Instruments Do Not Reach Their Full Potential	12	■■□□
Lack of Exit Opportunities	13	■■■□
Lack of Standardised and Founder-Friendly Processes for University Spin-Offs	14	■■■□
VC Investment Blueprint Does Not Fit HCS	15	■■□□
Entrepreneurial Skill Gap in HCS Teams	16	■■□□

** % of reported levers in the sample: ■□□□<15%; ■■□□<30%, ■■■□<45%; ■■■■>45%

Table 5 Ranking of Challenges

7 Which Solutions Could Close the Funding Gap of HCSs in GER?

After identifying the potential causes of the funding gap, the focus now shifts towards addressing the question of what measures should be implemented. A similar approach to answer RQ2 will be employed. The findings from the interviews and literature will be presented, and their significance explored by using the survey results.

7.1 Interview Analysis

This subchapter lists the solutions mentioned during the interviews (Table 6). Following an inductive coding process, the solutions were first divided into 16 action items, which were then subdivided into seven categories. In the end, overarching categories were formed to facilitate the reading process, namely "Market Environment", "Financing Environment", "Policy and Regulations", and "University Spin-Offs". Since this study addresses the German government, the solutions are formed in a way to provide guidance for governmental decision-making processes. Here, it is important to highlight that the solutions obtained from the interviews not only differ in the players they address but also vary in terms of depth and level of detail. Furthermore, some solutions are generic to the German or the European startup-up ecosystem, for instance "*Incentivize and strengthen institutional investors to invest"*. However, these challenges become particularly relevant within the context of HCSs due to the significant investment requirements involved. In case of this example, while augmenting institutional investments in VC would inherently contribute to the overall improvement of the ecosystem, the creation of substantial funds as a byproduct still assumes particular significance for HCSs. Hence, the authors make the distinction in the table with one or two *, with "*" being an indirect lever to benefit HCSs and with "**" being a direct lever that increases HCS funding. Moreover, as the challenges are heavily interconnected, so are the solutions that impact multiple levels.

Framework listing the potential solutions to decrease the funding gap for HCS			*non-HCS-specific measures but can benefit HCS more than other startups	**HCS-specific measures
Category	**Solution**	**Lever**	**Descriprion of lever**	**Best Practice or example**
I) Market Environment	**Align Regulatory Environment and Perform Smart Capital Allocation According to Defined Environmental Strategy****	Perform Strategic Subsidy Allocation To Incentivise Private Capital*	The government should be assigned to measure and increase the amount of funding to HCS within existing governmental programs such as the Deep Tech and Climate Fund to punctually push climate topics.	
		De-Risk Market Through Regulations/Legislations**	Governmental legislation is a way to ease investment decisions and derisk innovative transformational paths in individual HCS sectors such as e-mobility, Carbon Capture Storage and space clean-up.	Strategic procurement programs Carbon tax
		Signalise Commitment Through Action**	Governmental is ought to use its signaling power when it comes to technological innovations to facilitate investor decision and incentivise other market participants such as corporate to act as customers rather than "only" investors.	
	Establish Procurement Programs to Create Market**	Create Advanced Market Comittment Mechanisms**	AMC is the commitment to buy a product that is not fully developed. AMC are crucial to create a market-pull mechanism and decrease market risk for HCS.	ARPA-E (USA)
		Strengthen Strategic Procurement Through Public And Public/Private Purchasing Clubs**	SP is the opportunity for the government to accelerate HC innovations and act as an anchor investor through 1) Establishing public and private/public procurement clubs that focus on the purchasing of innovative and enviornmentally-friendly products 2) simplifying start-up applications to government tenders, reserve tenders for startups and reduce related barriers to increase chance for HCS to receive contract.	DARPA (USA)
II) Financing & Collaboration	**Strengthen Collaboration and Co-Investment Amongst Players***	Diversify Investor Knowledge in Investment Teams**	Tech expertise in investmentteams needs to be elevated in order for the investors to make informed decisions in favor of HCS. 1) The government is advised to include metrics of measurement and commitment to annual target improvements as part of regular DD and investment requirements for public investors. 2) Government can create a panel that includes tech experts from universities and other institutions to support VCs.	Measurement should include level of 1) diversity (gender, socio-economic, ethnic) and 2) tech expertise in all funds it supports (eg., FoF of KFW) and make the data transparent to show of any progress or lack thereof.
	Increase Use of Blended Finance and Alternative Capital for Startups*	Promote Publicly-Backed Programs for Long-Term Patient Capital (Blended Finance)**	Blended finance instruments provide patient and flexible capital that is well suited for HCS and foster co-investment among different players. Blended finance can be promoted through 1) Matching grants that attract private investors through initial public grants that signalise confidence. 2) Private Public Partnerships: Combination of grant funding with equity investments. BPI offers milestone-based financing for HCS which provides funding certainty for HCS throughout the startup lifecycle and maintains ownership for HCS. .Debt programs such as venture growth financing loans are especially useful for HCS to be covered in case of delays and time lags. Since traditional banks are not keen to finance large demonstrators, the government can 1) step in with guarantees provided by a catalyst fund specialized on scaleups 2) promote venture debt and loan instruments.	BPI Milestonefinancing (FR) Promote more matching grants to incentivise private capital like EXIST Gründerstipendium (DE) EIC, EIB and KFW venture debt programs (EU), KFW venture growth financing loans (GER)
		Keep on Funding Private Venture Debt Patient Funds with Public Institutional Money*	Venture debt funds are crucial to financially support HCS because they help to bridge the gap between equity funding rounds and provide additional capital to support growth. Private venture debt funds are said to be more successful which is why the government should increase the funding volume going towards KFW Capital fund business and establish co-investmet schemes with private venture debt funds.	Fund KFW Capital's Venture Debt fund and establish co-investment schemes
III) Policies and regulations	**Strengthen and Incentivise Inst. Investors to Invest in VC/VD/FoF****	Promote Investment Facilitation and Encourage Institutional Investors*	A regulatory framework is needed that allievates the risk averse behavior regarding alternative investments and removes constraints that hinder insitutional investors to invest in VC.	Incentivising institutional investors to invest in VC an growth capital funds by taking on the default risk for a certain amount (DEN). "Zukunftsfonds" (GER)
		Strengthen Private Fund-of-Funds Ecosystem with Public Funding*	Private FoF's systems help overcome the limitations of public FoF's (processes, speed). Private FoF are known to invest in emerging funds, specialised funds (eg., climate tech) and solo GPs with tech expertise. This in return can provide the ecosystem with more informed investor decisions.	KFW Capital Zukunftsfonds should allocate pocket to invest in private FoFs.
	Establish Good Policy Design & Review*	Establish Inclusive Co-Design with Wide Range of Market Participants*	To improve the efficiency and effectiveness of existing financing instruments that are already conceptually elaborated and backed with capital, the government is advised to seek expertise amongst important market players. It is advised to create a process for incusive co-design of financing initiatives.	Collect independent expertise from a wide range of voices representing ecosystem. It is important to assess and qualify outside expertise (check particular expertise for conflicts of interest with other experts).
		Create Regular Independent, 3rd Party Review of Effectiveness*	To ensure effective policy design and development, review processes are important where initiatives are regularly and independently reviewed by verified experts within a short timeframe. The government is advised to include review and feedback loops every 6 months after program establishment.	Design policy initiatives to automatically be independently reviewed by verified experts within a short timeframe (6 months, 12 months, 18 months and thereafter once program is established).
	Mobilise/Incentivise Private Capital*	Establish Tax Incentives for Business Angels & Public Co-Investment Schemes with Susiness Angels*	Private capital providers such angel investors are able to take high technical risk and strengthen the startup ecosystem by usually reinvesting in ventures after successful exits. The government can support business angels by 1) improving tax incentives for business angels (uncapped tax deduction) and 2) replicating an EBAN (European Business Angels Network) at KFW level.	Madelin law (FR), EBAN on EIF level (EU)
		Introduce Stock Pension Model to Provoke Shift In Mainstream*	A way to gather private capital in a catalytic amount is to introduce a pension model to create an investment vehicle that is able to provide catalytic capital for big private funds and indirectly HCS.	Norway Government Pension Fund Global (GPFG)
IV) University spin-offs	**Create More Favorable Environment to Produce University Spin Offs***	Build Knowledge Hubs to Concentrate IP**	Regional knowledge and tech hubs are a suitable vehicle to concentrate talent, intellectual property and accelerate their commercialization. Tech hubs should be based close to research heavy universities and institutions.	Build tech knowledge hub around anchor university to attract investors (eg., Eindhoven tech hub (NED))
		Standardise IP Terms and Regulations for Startups**	Universities are adivsed to revise spin-off terms that allow disproportionate stake for universities in company which reduces the numbers of promising university spin-offs.	

Table 6 Potential Solution Framework

7.2 Interim Conclusion and Analysis

To evaluate the significance of the proposed measures, their relevance is assessed based on two key dimensions: the frequency of mentions during the interviews and the priority assigned in the subsequent follow-up survey. When plotting among these, the upper right quadrant of this evaluation represents the measures that were both frequently mentioned and given high priority. Three solutions are seen as most relevant 1) "De-risk market through regulations/legislations", 2) "Promote publicly backed programs for long-term patient capital (blended finance)" and 3) "Promote investment facilitation and encourage institutional investors".

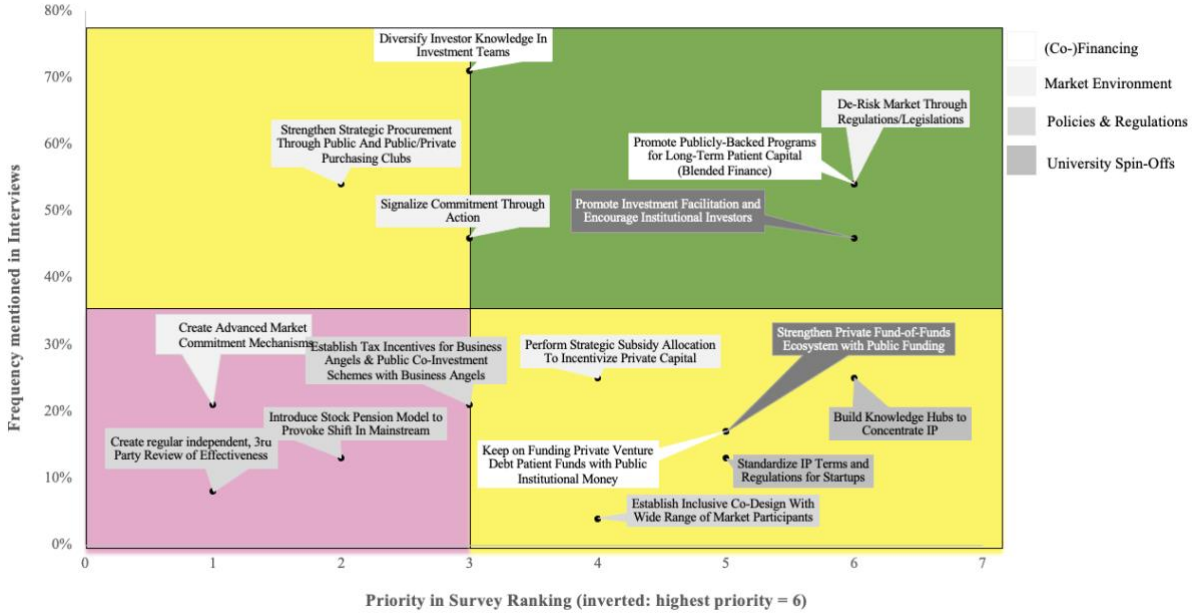

Figure 6 Solution Clustering

It is noteworthy to observe that the ranking of challenges and solutions does not display a complete correspondence. As an example, the highest prioritized challenge reported by the interviewees was the “lack of procurement programs.” However, the corresponding solution proposal, "Strategic procurement," was ranked much lower and is found in the yellow quadrant. This observation suggests that the survey lacked shared understanding given in the verbal interviews and underscores the need for a nuanced approach in evaluating the feasibility and

effectiveness of solution proposals. In the great picture of this study the result of this plotting should not imply that the alternative measures presented in the yellow and pink fields lack relevance. It is crucial to recognize that these alternative proposals could potentially yield significant benefits not identified in this study.

Nevertheless, to maintain the focus and coherence of this research, the analysis will primarily concentrate on the solution proposals of the green quadrant. By emphasizing these prominent solutions, this study aims to provide the most reliable recommendations to the German government by synthesizing literature and interview data, giving best practice examples.

7.2.1 De-Risk Market Through Legislations and Regulations

What is the underlying mechanism?

In the theoretical foundation, it was elaborated that HCSs compete against already established players, often with fossil-fuel-based technologies in high-volume and low-margin markets (Temmes et al. 2021). This introduces significant market risk for HCSs, as it remains uncertain whether their sustainable products can effectively compete against previously mentioned technologies. However, the perceived value of sustainability (sustainability premium) is contingent upon the externalities that legislators require to be internalized (Ostrom 1999). As a result, the competitiveness of developed technologies is determined by legislation and regulation.

The literature provides robust evidence that public legislation can reduce uncertainty by targeting this premium and significantly increasing the profitability of green sector ventures (Balachandra, Kristle Nathan, and Reddy 2010, Harrer and Owen 2022). This has a powerful effect in the later stages, as investors financing large scale-up rounds need certainty about the

ability to compete against established “grey” players. Subsequentially, a more robust framework also enhances greater exit opportunities.

When the regulatory environment is characterized by long-term legislation, it increases the likelihood of risk-averse (institutional) investors allocating the necessary capital. Further, interviewees argue that adequate legislation and regulations would impose more responsibility on corporates (I05 2023, I08 2023, I09 2023, I13 2023) as they must begin to either fund and acquire HCSs or develop in-house climate technologies.

I13 criticizes: *“Legislation is necessary and an aligned legislation instead of what we've seen so far (...). It's super fragmented in the way it's done.”* This means that legislation should be formulated and aligned to a defined strategy to accelerate HCSs commercialization.

However, this can only be done if the government sets an overarching strategic framework. Several interviewees pointed out that the government is a crucial player in setting a direction for investors and startups (I03 2023, I04 2023, I08 2023, I20 2023, I21 2023). Strategically defined focus areas regarding sectors such as public goods, infrastructure, mobility, and aligned pockets would ease investment decisions and make them more effective (I20 2023). For instance, Canada established a clear governmental strategy that focuses on sustainable infrastructure. As a result, Canada's pension fund created a team built around infrastructure where ¼ of the funds are allocated to infrastructure projects only (I05 2023).

Moreover, it is worth mentioning that legislation such as the Inflation Reduction Act (IRA) enacted in the USA serves as a significant factor for business actors, as it provides a higher level of certainty regarding transformational paths in specific sectors of HCSs. This legislation, aimed at reducing carbon emissions among others, particularly impacts areas, such as e-mobility, carbon capture storage, and related fields (I10 2023, I13 2023 , I23 2023, I24 2023). However, I23 and I24 (2023) bring forward that the IRA has sometimes been interpreted as an act of state protectionism in the eyes of some EU observers and officials.

What could be done more specifically:

As a concrete measure, several interviewees mentioned that a carbon tax would de-risk the market for investments and provide more certainty for HCSs (I03 2023, I08 2023, I13 2023). Carbon tax aims to provide a predictable and stable market signal for low-carbon technologies, creating a level playing field for financial actors investing in these technologies. Investors would be drawn to invest in HCSs due to the increased profitability they would offer. (Ghisetti 2017).

Moreover, strategic procurement was mentioned frequently as an instrument to de-risk the market for HCSs. Strategic procurement is a crucial market pull and market push instrument as mentioned by interviewees. On the one hand, I11 (2023) states, "I think very little thought is given to how regulation can be used to create new technologies in the market.", which means that the government can use regulations to pull the market towards a specific direction. On the other hand, the interviewee mentions that the government should explore more options on how regulations can favour new technologies by e.g., promoting green cement. This would decrease investor uncertainty and provide trust (I11 2023). I11(2023) highlights ARPA-E's speed regarding the provision of capital, which is lacking in Germany.

Recommendations:

De-risk the market through the definition of strategic focus areas and pockets, subsequent implementation of regulations such as carbon tax, and introducing procurement regulations in favour of HCT (incl. signaling for investors) according to strategy.

7.2.2 Promote Publicly Backed Programs for Long-Term Patient Capital

What is the underlying mechanism?

In addition to the utilization of legislative and regulatory measures, the green premium can be effectively addressed through the application of blended finance instruments. By combining

public and private resources, blended finance can reduce the financial burden and provide patient and flexible capital which is well suited for HCSs (see Chapter 2.1.2.).

The application of debt- and equity-based instruments has been frequently mentioned as a solution to bridge the funding gap and should be promoted through government action (I09 2023, I20 2023, I21 2023, I22 2023, I23 2023).

What could be done more specifically:

Several instruments were brought forward as solutions during the interviews. Matching grants are a funding mechanism where a grant provider, usually a governmental agency, agrees to match a certain percentage of the capital raised by the grantee (Hossain, Mabiso, and Garbero 2022). Additionally, to an increased amount of funding, matching grants signal commitment and are said to be especially helpful to bridge the 1st VoD (I11 2023).

Moreover, Private Public Partnerships were mentioned frequently as a second approach to increase funding amongst various market players. They are a combination of grant funding with equity investments, that can be used to ensure HCSs receive sufficient funding across the startup lifecycle. The public French investment bank Banque Publique d' Investissement was mentioned in the interviews as a best practice example. As it offers milestone-based financing for HCSs, providing funding certainty throughout the startup lifecycle and thereby decreasing dilution (I09 2023, I12 2023, I20 2023, I21 2023, I22 2023). I20 (2023) explains: "Normally (the government) makes a funding pot somewhere, and someone can apply, but it is much smarter when (the government) makes instruments available where it gives milestone-based money to a private investment when certain milestones are reached, like this (the government) always incentivizes that primarily the money comes from a private source first and also hands over the topic of due diligence to a private investor". It is worth mentioning, that German HCSs can already apply to the €10bn deep tech EIC program of the EU, that combines public grants with public equity or debt (I23 2023, I24 2023).

The importance of debt-based instruments for HCSs to cover long development and commercialization timelines was established. Still, traditional banks are hesitant to finance large demonstration plants (I06 2023). Private and public programs such as venture growth financing loans were seen as particularly useful to bridge this gap (I23 2023). The government can (1) step in with guarantees provided by catalyst funds specialized in scaleups and (2) double down on already existing loan instruments like the KFW or the EIB VD products.

Recommendations:

Review existing blended finance instruments and evaluate their effectiveness. Further investigate which new instruments should be introduced with the involvement of relevant stakeholders, especially HCSs.

7.2.3 Promote Investment Facilitation and Encourage Institutional Investors

What is the underlying mechanism?

The importance of large-scale catalytic capital was highlighted during the study and is particularly needed in late-stage financing rounds (2nd VoD). The interviewees saw the potential suitability of this investor type for HCSs as they typically seek long-term investments aligned with the longer lifecycles of HCS (I10 2023, I15 2023, I16 2023).

In addition, the significant amounts of capital held by institutional investors were associated by interviewees with a substantial social responsibility to invest in HCSs (I10 2023).

What could be done more specifically:

(I13 2023) highlights, "Insurance companies and institutional investors must be allowed to invest larger parts in venture capital. That's why we only have small funds throughout Europe as it is not allowed because of the risk." More specifically, the EU Solvency II regulation leads to the classification of VCs as a high-risk investment class, that in return requires high capital

adequacy making investments less profitable (I16 2023). A substantial number of interviewees agreed and reasoned “In order to bring these large players, such as pension funds, into the game, we would have to make things a little easier on the regulatory side.”

However, I03 (2023) states: “(…) it is always easy to say: Well, that's because of Solvency II and regulations that are imposed on insurance companies, for example and that is simply not true.” Further elaborating, insurance companies are hiding from their responsibility to invest in HCT behind Solvency II regulations. Which when loosened would increase their entire profitability immensely.

Therefore, the focus should not solely be on deregulation but also on utilizing positive regulation to mitigate risk-averse behaviors associated with alternative investments in HCSs. Incentives should encourage institutional investors to invest in VC funds, VD funds and FoFs. For instance, I23 (2023) and I24 (2023) suggest that more funding volume is needed for the VD part of KFW Capital.

It is crucial to create co-investment schemes to accelerate the development of VD funds. The recent German initiative “Zukunftsfonds” is a promising step in this direction. Since this initiative requires the public FoFs in Germany to be significantly expanded, a private-sector friendly approach would encourage to strengthen independent, private FoFs in parallel. This could be achieved, for instance, by creating a distinct funding pocket for those FoFs as part of the “Zukunftsfonds” (I23, I24).

Moreover, I01 (2023) highlights the point again that risky investment areas are unfamiliar for institutional investors and can be tackled as follows: “Why not try to Give to these institutional investors a more steady return by avoiding the ups and downs of a highly risky investment area such as venture capital to channel a lot more money coming from the institutional investors into the venture capital market and then increase considerably the size of the funds”. I09 (2023) mentions Denmark as a best practice example where the Danish Government incentivizes

institutional investors to invest in VC and Growth capital funds. This is accomplished by the Government by taking the default risk to a certain amount. Despite the debate, I23 (2023) highlights that only since recently the risk appetite and regulatory environment under which German institutional investors, such as insurers operate started to shift in favor of allocating a higher portion of their assets to the VC asset class.

To design impactful policies, Mitgendt et al. (2017) suggest considering conducting further research and engaging with relevant stakeholders to identify potential regulatory barriers for institutional investors and explore ways to remove them. Interestingly, this would Go in hand with another solution extracted from the interviews, which is "Good policy and design review." This highlights that solutions are highly interconnected, meaning de-risking the market through regulations especially benefits risk-averse financial actors such as institutional investors. Thus, the implementation of one regulation can have a positive impact on various market participants. Moreover, it is important to highlight in this section that institutional investors were seen risk-averse by most interviewees, suggesting that it is not only the regulations that have to be removed and improved but also the mindset that needs to change (I02 2023, I15 2023, I10 2023, I16 2023).

Recommendations:

Remove regulation barriers that hinder alternative investments for institutional investors, but simultaneously ensure with strong incentives the allocation of capital to the HCS ecosystem. In example by taking on default risk, providing more steady returns, only for HCT. However, acknowledge the ambiguous nature of the situation, as both deregulation and maintaining the status quo can have detrimental impacts.

8 Conclusion

This chapter serves as a conclusion to the study conducted, summarizing the implications, limitations and gives direction for future research.

8.1 Implications

At this point, the implications of the studies will be outlined. Through both qualitative and quantitative analysis the study (1) confirmed the existence of a funding gap in the HCS sector in GER and estimates that investment between $3.8 billion and $8 billion annually is needed to close it, (2) identified 16 main challenges and came to the conclusion, that the lack of institutional investors, exit opportunities and the setup of VCs seem to be most impactful, (3) identified 16 solutions and recommended further investigation of three highly ranked measurements: “de-risk the market through regulation”, “promote publicly backed programs to incentivize long-term patient capital”, and “remove regulatory barriers for institutional investors”.

Besides answering the main RQs, the study discovered that (1) challenges and solutions of the HCS ecosystem are complex and highly interconnected, (2) challenges stemming from macroeconomic conditions impacting the entire startup ecosystem are especially relevant to HCT but are particularly challenging to overcome, (3) specialization in the ecosystem is driven by the circulation of capital and the funding gap is disrupting this reinforcing cycle. This cascades up from individual funds specializing on HCSs to entire national ecosystems. In return this means that whoever gets the funding cycle flowing will gain an advantage, creating competitive pressure to act fast and decisively.

Due to the urgent concern of climate change and the potential of HCSs in addressing this issue, it is imperative for the German government to take action. This entails addressing the challenges

identified in this research and actively contributing to closing the funding gap by thoroughly investigating the proposed solutions derived from this study.

8.2 Limitations

This study is subject to several limitations that impact the generalizability of our conclusions. Overall, the complexity and interconnected nature of the issue pose a challenge to identifying and comparing specific challenges and solutions. Additionally, it is important to acknowledge that the recommended actions may carry undisclosed risks, such as for instance the consequences of deregulation of institutional investors, which were not thoroughly examined during the study.

The literature review also imposes certain limitations that need to be acknowledged. Firstly, a systematic literature review was conducted, and some research articles were excluded according to the methodology, which may have led to bias in the results. Furthermore, due to the novelty of the topic, many papers found in the literature review target renewable energy technology, which already possesses a higher level of maturity. Hence, to supplement specific topics, literature, that was not included in the systematic review was incorporated into the analysis of this study. Moreover, since there is no universal definition for the term "hardware-based climate tech startups," different interpretations could potentially affect the coherence of the analysis.

The interview segment also poses some limitations as the findings are limited to a small sample of 24 respondents, with a bias towards the opinions of investors. Further, interviewees often spent more time elaborating on challenges than on solutions. This could be attributed to the fact that they experience the problems in their practice and do not take on a macroeconomic

perspective to find solutions. Also, the fact that the interviews were conducted in the beginning of the study limited ability to ask follow-up questions for clarification.

The quantitative analysis is limited by the availability of data on the platforms. Not all startups are registered, and the investment data is limited by undisclosed rounds. Further, the third calculation is limited by the reliability of the assumptions made.

Looking at the bigger picture, a concern arises from the prevailing notion of climate mitigation, which focuses on advancing technological progress through greater economic activity. However, this viewpoint often fails to consider the adverse impacts on nature that arise from economic activity in the first place.

Finally, this research paper has laid the initial groundwork necessary to explore the topic. Therefore, it could not reach the depth to develop sophisticated recommendations. If the government decides to act, it is necessary to further assess the recommendations for feasibility and impact which leads to the next paragraph.

8.3 Future Research and Outlook

This research investigated a novel field and identified a pressing issue, in necessity for further investigation. To mitigate the limitations of our study mentioned in the previous paragraph, future research areas are suggested in the following.

Although the question regarding the presence of a funding gap has been addressed with clarity, further investigation is warranted to ascertain its magnitude. For instance, investigating bottom-up funding demands of HCSs would allow absolute calculations of the funding gap for existing startups. Furthermore, a top-down approach deriving top-down demand more precisely would be beneficial to evaluate required investments levels.

Conducting such an analysis would offer benefits on multiple fronts. Firstly, it would facilitate an assessment of whether GER is gaining a competitive edge over other nations. Secondly, it would provide a comprehensive understanding of GER's potential to contribute to global climate mitigation technology. In this regard, it is crucial to consider the given conditions in relation to technology maturity and their potential impact. This evaluation could be achieved, for instance, by correlating GER's comparative advantage with specific sectors and the maturity levels of respective technologies.

To address the limitation of incomplete understanding regarding the complexity of the challenges, it is necessary to conduct further exploration. This entails not only identifying additional reasons but also comprehending the causal relationships and interdependencies among them. Such understanding is essential for effectively intervening and resolving the nested issues at hand.

The analysis conducted on potential solutions is constrained and insufficient to construct a distinct action plan for the government, as it requires additional granularity and depth. For instance, further investigation into the dimensions of impact and feasibility of the proposed solutions would be valuable. Additionally, it would be pertinent to evaluate the risks associated with each recommendation. In particular, the ambiguous nature of deregulating institutional investors warrants attention and the weight-off requires further investigation.

To conclude, considering the immense importance of climate change and its implications for the future of humanity, more empirical research on how to increase innovation and lower barriers in hardware-based climate tech is crucial to address the limitations of this study and enable the next generation of HCSs.

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10 Appendices

10.1 Literature Review Documentation

The first table shows a concept matrix listing all articles found through the systematic literature search which are considered relevant for knowledge generation. All included papers reflect the content used for results and discussion.

Article	Topic				Focus		Geography				Else
	Funding Gap	Climate-Tech	Hardware-Based	Other	Challenges	Solutions	Germany	EU (General/Non-German)	US	Others/Generic	Methodology
Adams and Brace (2006)											x
Aernoudt, San José, and Roure (2007)						x		x			
Balachandra, Nathan, and Reddy (2010)	x	x	x		x	x				x	
Bell and McNamara (1991)				x						x	
Blank (2013)				x							
Blaseg and Hornuf (2023)				x		x					
Bonetti, Gatti, and Caselli (2010)				x		x					
Bonini, Capizzi, and Zocchi (2019)				x		x		x	x		
Bouwer and Aerts (2006)											x
Braun and Clarke (2006)											x
Brown (2001)	x	x							x		
Byoun and Xu (2014)				x		x					
Cardozo (2019)	x	x								x	
Casanova, Cornelius, and Dutta (2018)				x		x				x	
Chorev and Anderson (2006)			x			x				x	
Churchill and Lewis (1983)				x						x	
Clark, Reed, and Sunderland (2018)	x	x			x						
Concini (2018)											x
Corbin and Strauss (2008)											x
Cotton (2020)	x			x	x			x	x		
Creswell (1999)											x
Creswell (2009)											x
Creswell (2011)											x
Criscuolo and Menon (2015)	x	x			x					x	
Cristoforoni (2023)		x					x				
Cumming (2007)				x		x				x	
Dalle, Besten, and Menon (2017)											x
Davila, Foster, and Gupta 2003				x						x	
Dey and Mishra (2022)	x	x	x			x				x	
Dhayal et al. 2023	x	x				x				x	
Egan (2022)				x		x			x		
Fini et al. (2023)			x		x				x		
Fink, Arbter, and Wagner (2023)			x		x	x				x	
Gaddy et al. (2017)	x	x			x					x	
Gatto and Re (2021)	x	x						x			
Gioia, Corley, and Hamilton (2013)										x	
Giorgis, Huber, and Sornette (2022)	x	x			x					x	
Goldstein et al. (2020)		x				x			x		
Gowan (2019)											x
Hafner et al. (2020)	x	x			x	x		x			
Harrer and Owen (2022)	x	x			x	x		x			
Heeb et al. (2023)				x	x					x	
In, Monk, and Knox-Hayes (2020)	x	x							x		
Jiang (2023)		x			x					x	
Johnson and Onwuegbuzie (2004)											x
Kuratko, Morris, and Schindehutte (2015)				x						x	
Leach and Melicher (2011)				x						x	
Luger and Koo (2005)				x						x	
Mc Cahery et al. (2015)											x
McGivern (2009)											x
Mey and Mruck (2011)											x
Michelfelder et al. (2022)	x	x				x		x	x		
Migendt et al. (2017)		x			x		x		x		
Miles, Huberman, and Saldana (2014)											x
Morgan (1998)											x
Morse (1991)											
Mrkajic, Murtinu, and Scalera (2019)		x						x			
Murphey (2022)				x						x	
Nassiry and Wheeler (2011)		x				x				x	
Nedayvoda et al. (2021)				x						x	
Nemet, Zipperer, and Kraus (2018)	x	x	x		x					x	
Oh, Jang, and Kwak (2022)	x		x	x						x	
Östlund et al. 2011											x
Ottman, Stafford, and Hartman (2006)		x				x					
Owen, Brennan, and Lyon (2018)										x	
Ozili (2022)		x								x	
Pearson et al. (2020)		x	x			x				x	
Phillips and Stawarski (2008)											x
Pirnay, Surlemont, and Nlemvo (2003)				x					x		
Polzin (2017)		x			x	x				x	
Polzin, von Flotow, and Klerkx (2016)		x			x		x				
Polzin, Sanders, and Serebriakova (2021)		x						x			
Prędkiewicz (2012)											x
Quas et al. (2022)	x			x				x			
Romme (2022)			x			x		x			
Saldaña (2011)											x
Saller and Klühr (2021)				x						x	
Savaneviciene, Venckuviene, and Girdauskiene (2015)	x			x		x		x			
Schuh and Latz (2022)			x		x	x				x	
Shane (2003)				x						x	
Singh et al. (2021)		x					x				
Sørheim et al. (2011)	x			x	x					x	
Suominen, Deschryvere, and Narayan (2023)				x	x						
Temmes et al. (2021)				x		x		x			
Tülüce and Yurtkur (2015)				x						x	
Upadhyayula et al. (2018)	x					x				x	
Verbeek & Lundqvist (2021)											x
Wilson, Wright, and Kacer (2018)			x							x	
Xie et al. (2018)			x			x				x	
Yang et al. (2023)		x								x	
Yoshino, Taghizadeh–Hesary, and Nakahigashi (2019)	x	x								x	

This second table shows the overall search hits per data base during the literature review process.

Database	Link	Query	Hits	Hits according to Document Type	Hits Titel and Abstract Analysis, excluding Duplicates	Full Text Analysis	Comments
ScienceDirect	http://sciencedirect.com	("startup" OR "startups" OR "start-up" OR "start-ups" OR "new venture" OR "new ventures") AND ("hardware" OR "deep tech" OR "deep technology" OR "clean tech" OR "clean technology" OR "manufacturing" OR "heavy asset" OR "high tech" OR "high technology") AND ("funding" OR "financing" OR "capital")	**245** (Last Check: 13.03.2023)	219	**46**	**25**	Further containment of initial search query in order to include (challenges etc.) in the t**itle** and the 2nd field of research in the **topic**. Also, too broad if I use normal keywords, that why i use: "green tech" OR "clean tech" OR "climate tech" AND "funding gap" OR "finance gap" OR "financing gap" OR "valley of death"
scopus	https://www.scopus.com/	("startup" OR "startups" OR "start-up" OR "start-ups" OR "new venture" OR "new ventures") AND ("hardware" OR "deep tech" OR "deep technology" OR "clean tech" OR "clean technology" OR "manufacturing" OR "heavy asset" OR "high tech" OR "high technology") AND ("funding" OR "financing" OR "capital")	**156** (Last Check: 13.03.2023)	**99**	**30**	**23**	Further containment of initial search query in order to include (challenges etc.) in the t**itle** and the 2nd field of research in the **topic**.
Google Scholar	https://scholar.google.de/	("startup" OR "startups" OR "start-up" OR "start-ups" OR "new venture" OR "new ventures") AND ("hardware" OR "deep tech" OR "deep technology" OR "clean tech" OR "clean technology" OR "manufacturing" OR "heavy asset" OR "high tech" OR "high technology") AND ("funding" OR "financing" OR "capital")	**120** (Last Check: 13.03.2023)	**80** (Article)	**46**	**12**	only "allintitle" possible
Web of science	https://apps.webofknowledge.com/	("startup" OR "startups" OR "start-up" OR "start-ups" OR "new venture" OR "new ventures") AND ("hardware" OR "deep tech" OR "deep technology" OR "clean tech" OR "clean technology" OR "manufacturing" OR "heavy asset" OR "high tech" OR "high technology") AND ("funding" OR "financing" OR "capital")	**140** (Last Check: 28.03.2023)	128	**35**	**28**	Further containment of initial search query in order to include (challenges etc.) in the t**itle** and the 2nd field of research in the **topic**.

10.2 List of Interviewees

Code	Position	Type
I01	Head of Unit for Financial Instruments	Public Sector
I02	Ministrial Director	Public Sector
I03	Senior Advisor	Public Sector
I04	Director	Public Sector
I05	Head of Capital Market Strategy	Public Sector
I06	Head of Investor Relations	Public Sector
I07	Managing Director	Public Sector
I08	Partner	CVC
I09	Managing Director CVC	CVC
I10	Co-Founder	VC
I11	Senior Manager EU	VC
I12	Partner	VC
I13	Founding Partner	VC
I14	Managing Partner	Venture Debt
I15	Venture Partner	Fund-of-Fund
I16	Founder & CEO	Fund-of-Fund
I17	Associate	PE
I18	CO-Founder & CEO	Startup
I19	Chief Evangelist	Startup

I20	CFO	Startup
I21	COO	Startup
I22	CO-Founder & CEO	Startup
I23	CEO	NGO
I24	Co-Founder	VC

10.3 Interview Guide

The following outlines the questions which were asked during the interviews.

The goal of the Interviews is to assess the following topics:

- The current state of the hardware/cleantech industry in Europe in general.
- The potential backlog in financing in Europe compared internationally.
- The main reasons for a possible financing gap.
- Measures to increase hardware-based cleantech financing.

1. **Current status in the HW/DT industry**

- In which area do you see the greatest potential for positive change for society (hardware, deeptech, climate tech)?
- To what extent is the success of these startups important for society?
- Are certain measures being taken in Europe/Germany, e.g. at a political level, to increase investment in promising technologies for them to be able to commercialize more quickly?

2. **Lack of capital and main drivers of the problem**

- My hypothesis is that there is too little capital in Europe due to a problem on the supply side, especially in the stage between Technology Validation and Early Commercialization. Do you agree with this hypothesis?
- Do you see the success of said startups threatened by insufficient funding?
- How do you assess the investment in hardware-based climate tech startups in Europe compared to the development internationally?
- What do you think are the biggest challenges for hardware-based climate tech startups in Europe?

- What do you think are the biggest challenges for capital providers in Europe?

3. **Reasons for the lack of capital**

- What do you think are the reasons that the funding gap exists? What are cultural factors and what are systemic factors?
- How do you evaluate awareness and knowledge among capital providers around hardware/deeptech?
- How do you evaluate the general conditions for investors and founders for hardware-based climate tech startups in the EU?
- How do you assess the mentality of investors towards Hardware-based climate tech startups in Europe?
- How do you assess the "awareness" on a political level for these issues?
- What do you see as the biggest regulatory obstacles in Europe? And how could these be improved?
- What is your opinion on governmental support for hardware and cleantech?

4. **Possible support measures**

- What are, in your opinion, concrete measures that can be put in place in Europe to close the financing gap? (Alternatively, what are, in your opinion, measures on the part of different stakeholders to promote the ecosystem in Europe)?
- What best practices have been established in the past that have already contributed to the success of more hardware-based climate tech startups?
- Who do you think is an effective player in successfully enabling funding (for said startups)?

- What do you see as the biggest success factors of countries like the US or China that Europe should learn from?
- What could founders improve in the growth phase to be more attractive to investors and thus be able to better attract growth capital?

10.4 Interview Transcripts

In the following all interview transcripts of the interviews which were conducted for this study are being presented.

Interview with I01 1st of Feburary 2023

Olivia Suchy: In which areas do you see the greatest potential for society through investment into hardware innovations, for example, in which sectors do you see the biggest potential?

I01: Well, it depends what you mean by civil society and how this is being channeled. But I would say that a lot of the innovations that we're working on are all fact driven. From the experience I have, we don't invest in things just for the sake of testing to achieve a return. We invest in areas that have a positive impact for society, mostly in three sectors which are green, everything related to the zero emission challenge. So we barely touch fossil fuels and everything that has to do with it. And we invest in digital innovations. So the type of innovations that now are catching the headlines like AI and so on are a certain form of tech as well. The so-called digital deep tech, which is also quite important today and is getting a lot of traction and a lot of attention. And we invest into health related innovations which have, of course obviously benefits for human welfare and society and on which, of course the challenge is there from a financial point of view are quite high. I don't know if you know how these health innovations are coming eventually to the market, but they face very, very daunting challenges at the beginning of their lives when they are being tested in the lab. The rhythm, the pace of going from one clinical trial to the next is extremely difficult. And the risk level, therefore perceived by potential investors in those ventures is very high, leading many of these innovative companies that are carrying these innovation startups that are doing these innovations not to be in very great difficulties to find the necessary financing. So basically, this is what we invest. I mean, I would say that we've been in contact with civil society organization, if you want to call them like that, in a wider sense, meaning philanthropist in the first and the third area, not so much in digital, of course, because the commercial nature of it is much more apparent or at least visible, even if it's more long term than I would say a simple app. But of course, for everything we do in green, so in green tech development, for example, or whatever we do in health related issues, usually you have a number of partners that are coming, let's say from the philanthropic sector, that are finding ways to either give grants which is their traditional way of intervening, or increasingly they are looking at ways to invest as well directly into those companies or find mechanisms, risk sharing mechanism as those pioneered, for example, with the European Investment Bank, in order to find ways to channel support to this type of ventures. And I've been involved in complex schemes, usually with the EIB, in order to attract this type of service with state organization. Of course, there is another area that we don't touch very much in our work, which is crowdfunding and everything that has to do with this mobilisation of small, I would say, investors through platforms and so on. We don't touch much of that because at the segment in which we operate, we tend not to be closely involved or in these type of developments. But I know that they exist and they represent quite a powerful tool also to channel, I would say finance into activities that are broadly speaking, positive impact, positive for society.

Olivia Suchy: Do you agree that there is a funding gap when it comes to hardware startups, hardware projects and hardware innovations?

I01 : There's a funding gap because of the nature of the innovations that we're discussing here. If you are in deep tech area there are two types of defects. There is the digital deep tech, which is basically working on machines. A typical example is quantum. You're working on cutting edge technologies in this digital deep tech area, the type of investment you need to make in order to generate eventually your machines that can be sold on the market and generate your return takes much longer than if you have an app which is usually mainstreaming on the new sectors, on a new business idea, a technology that has been tested and is on the market basically and we know it works. So you just transfer that idea into another sector. And the fact that it's an app, meaning it's purely digital, allows the financial sector, in other words, the venture capital industry to maintain its model of 5 to 7 years, to get a return and have an exit. And therefore based on that exit, cash in and then send back the money to the investors, because the venture capital has this cycle, which is that they raise funds over one or two years, then they invest the funds. And when these funds are invested into companies, they usually wait out the time horizon of five years, sometimes seven years, but usually very, very rarely beyond that in order to cash in on it and get an exit that then allows them to pay back the investors. And then what they do is that then they raise funds yet again. Often if they have been very successful, the investors are quite happy to put back the money that they have just collected into the next fund. But the time horizon we're talking about here, this three to 5 to 7 years of the commercial VC market is very ill suited even for the digital deep tech area, because even in the tech area, in Quantum, basically it's a shot in the dark right now. We don't know that the technology could be absolutely tremendously impacting lots of things like cryptography and all these other protective, protected areas and so on. And we know that. But it's a promise. And in the meantime, in building those machines, there's lots of testing taking place, there's lots of trial and error. And usually the timeline gets further and further away as we get closer. I mean, it's not as bad as nuclear fusion, but I mean, it is a bit like that. And therefore, it's very difficult to keep within the commercial VC time horizon for a return on investment.Now, there is a more complicated part of the deck. Already touched upon is the one connected to health because of the clinical trials and the high risk level. And the more it involves, I would say, building complex machinery in order to arrive at a result, the more difficult it is. And then of course there's everything related to some kind of manufacturing in photonics, in automotive and whatever. And as we know, we've been talking about autonomous vehicles for a very long time. There have been a lot of testing going on and they are trials of fleets appearing in some cities. I was in San Francisco two weeks ago and you see on the street some of these cars, autonomous cars, very clearly before it reaches mainstream. It will take a long time. And reaching mainstream doesn't guarantee a return. Is a big difference here between the two. Reaching Uber is mainstream, but a return on investment is another story. So therefore, for commercial VCs, again, this is an extremely long time horizon that they have difficulties to stomach. And and of course, there are a number of impact investors that are coming in. But usually what happens is that you have a huge funding gap that is there to finance appropriately these type of innovations, especially if you want to give a fair chance to those that have the most potential to be financed. Hence, I would say the suboptimal investment situation, as we call it in our jargon. And therefore this suboptimal investment situation requires public intervention of some sort. The public intervention has to be designed in a way as to basically crowding the market, derisk for the market, and not chase away the market. Because if you chase away the market, you deepen the problem because there is some money coming from the market. But what you want is to accelerate the money coming from the market and therefore increase the amounts that can come from the market. And you have to design smart instruments in order to use the public intervention in a very scarce public money, which is never enough of it in a way that has the maximum leverage effect to attract private investors into coming in. And therefore you have to understand what private investors need in order to come into this type of intervention. So it's

very much a logic of looking at the world of investment and understanding how these decisions are being made in order to design the public intervention. For a long time, public intervention was not designed that way. It was not designed by looking at the needs of private investors and trying to reach an engineer where the public intervention was supposed to do. It was designed the other way around. But the political system, by definition, is under pressure from lobbying by different groups that want money. And usually it was just simply easy to hand it over and schemes more or less competitive in the form of grants and traditional subsidies to these politically desirable goals. But here, the logic of this is, of course, to turn it around and to look at the world of investment in order to address this considerable funding gap because of the risk level and the time it takes for the technology to mature and eventually reach the point where it generates a return on the market and therefore it creates a problem for private investors to come in and at the same time find a way to bridge that gap by designing instruments that can basically incentivize the private sector to come in, but by absorbing in a reasonable way the risk level perceived by the private investors in order to facilitate their entry into this type of of investment.So that's basically what I would say. Yes, there is a considerable funding gap. And because of that, I would say the central investment model that for better and for worse, is the situation in which we are today.

Olivia Suchy: We have something prepared, a slide that I would love to show you and just ask you for your. Let's start with this one for your opinion. Where do you see the biggest challenges for hardware startups and where you see the biggest challenges for hardware investors? In which faces this funding gap exist the most?

I01 : It mutates. Indeed, what public (what I mean by public: I mean universities, public programs, but also research organizations and corporates have also a lot of research activities) they are quite good at is identifying the technology and nurturing the technology. So there are a lot of things emerging at the beginning of your slide and there is the money in the form usually of grants and subsidies to finance these research. Europe is not the worst place in the world to do this. I mean, there's still a lot of money there, especially in powerful countries like Germany and so on. There are a lot of innovations emerging from the ecosystem in Europe. Then to find a product market fit, you have not so much a financial gap but an expertise gap. And this expertise gap is particularly difficult in Europe. I mean, it exists also in the US. Again, we always idealize America, but it's not exactly it doesn't work exactly that way. They have the same problem as us, but maybe they are different. Differently sized, let's say. Let's put it that way. But basically, when you have a team of innovators, researchers, people working in the universities area, the jump to a company level, which is usually the point of moving to the accelerators and connecting to the right people that can help you put this jump is very difficult to do for lots of reasons. Usually researchers, they just want to do research projects they want to do to the next one. They don't necessarily want to become entrepreneurs. And if they become entrepreneurs, often they become very bad entrepreneurs. One reason of that is that researchers tend to want to be perfect in the product that they are trying to develop when actually in order to be successful on the market, you don't need a product that is perfect. You need a product that actually sells. And we know from the past 40 years in technology that this is the best product that eventually makes it and becomes mass marketed on the market and eventually becomes the winning technology. So there there is not a financial gap, but there is a gap of expertise and finding the right entrepreneur minded people to actually take that company into the right business model and finding the right what you call product market fit in order to actually enter the market. Technology validation, depending on the sector in which you are. This can be very costly and very lengthy. And of course, this has an impact on finance. Of course, if it's costly, you need to pay for it. But if it's lengthy it is the same because time is money. So if it takes a

long time to go through the certification process, the technology validation, then you need somebody to basically keep the team paid. While this technology validation process is taking place. Hence why we lose here in Europe, a lot of innovations that cross the Atlantic, because in America is usually faster and usually it's more money efficient because usually you do one certification process and boom, you have access to the entire US market. While in Europe, you do it once and usually you have access to one member state, even the biggest one, Germany. But it doesn't necessarily give you access to the entire EU market. And then you have to restart your certification. For example, in medical devices, an area related to health, for example. This is a problem that we face quite often. So here a lot of the money, for example, we spend in our program and that we give to our companies aimed at absorbing that particular challenge in terms of cost and helping them get the technological validation or the regulatory approval that is needed. And then, of course, when you get to the first commercial contract, that technology improvement, this is where you are in a situation which corresponds to what we believe is, you know, kind of a mix of R&D finishing, R&D cost finishing and the commercialization cost emerging. And usually because the you don't have the capacity, you have very few customers yet. The technology has been maybe tested or is finalizing it's testing, but it's still being improved. You have a situation of risk level being perceived by the private investors to be relatively high. So usually at that stage investors will tend to be pausing before they go in. They will want to see, I would say, more evidence that there is a market traction that the product can be sold, that they are the beginning of manufacturing taking place. And they have a kind of a visibility of how the business model could be scaled. And there in Europe, it's particularly problematic because there's lots of money in venture capital but in America, they tend to reach out further and further upstream in order to get an edge over the other VCs. And therefore, the risk appetite of American VCs is greater than in Europe in the sense that in that basically schematic representation that you have, they reach out further and further to the left in comparison to where European VCs and provider of capitals are. So therefore they tend to accept, but you find VCs that eventually are ready already to be investing significantly here at that particular level, which often needs to be also compensated by access to some kind of working capital, which you need in order, for example, to start building your manufacturing facilities and so on. Hence the importance of having access to debt products such as venture debt products in order to be able to develop your market. But then again, the venture usually traditionally is conceived as a very short term type of product on the market, which is basically a bridge financing, if you wish - risky, but nevertheless a bridge financing. Hence the access to it is not necessarily the easiest. When you move to early commercialization: There lots of problems can potentially happen. But normally if you already reached that stage, the situation from attracting the necessary finance becomes less severe. You will be able to highlight the successes that have been there and you will be able to attract a variety of of investors that are coming in that way in Europe. Then the next stage, which is the one that takes you to to the scale up phase, is also problematic because of the of the limitations of the size of the tickets that investors in Europe can take to invest. Usually the funds in Europe are not that big. Therefore, for them to take big tickets in order to accompany this phase of scale of companies is not limitless. So usually, again, here we tend to be edged out in Europe by big American VCs that are coming in and and coming in and providing these big tickets, which again introduces a risk of the technologies being scaled up more in the US than in Europe. In order to summarize you have a problem of expertise and an adequate type of support in more of the development of the technology is very early on a problem of finding free money, money that addresses the high risk level when you are in the technology validation and then when you are at the beginning of the development to address the risk level due to the risk adverse nature of the VC market in Europe. And then later on, when you are in the scale phase the size of funds in Europe is too small usually to accommodate these larger tickets that we that this type of startups need in order

to realize a scale up process. I would say there are these basically three areas. One of them being not necessarily financial but being, I would say, difficulty there.

Olivia Suchy: Do you see governmental issues, regulatory boundaries that lead to the funding gap?

I01 : You mean from the investment perspective? What are the regulatory obstacles? There is an easiness to conduct investment and turn out a return that is considered to be quite an obstacle. This is also true. I mean, again, if we contrast Europe with the US, it is due to the fact that in Europe in every one of these European countries, you have a different legislation that the regulatory environment that apply for investments in startups. So it's all a bit different. If you run an investment operation you will need to get acquainted with - which means that there are legal costs in order for you to actually be able to operate in all these different geographies. In the US, usually you create a Delaware Corp. model. If you don't want to bother with all this and then you have a very streamlined governance regime and also tax regime that is very favorable to investors. It doesn't mean that in Europe you don't have comparable ones. But again, European companies tend to emerge from very different places. They don't all emerge in Luxembourg when the environment for setting up funds is of course, comparable to our model that you have in the US. But as a consequence, from the point of view of of investors, this is often being perceived as an impediment, even for large investment operations, even American coming from the US, for example. Now I've got used to invest in certain geographies in Europe. Mostly the UK, sometimes the large European countries in which there are lots of startup activities like Germany, France, Sweden and Estonia but they are very rarely present in ten countries. They are usually present in one, two, three countries in Europe where they are feeling comfortable because they have the legal backing to invest. If you look at it from the point of view of the entrepreneur.. I'm not going to do a very deep analysis of the different obstacles. There is true entrepreneurship in Europe. I mean, there are many schemes, many European countries are putting out schemes at national level or regional level in order to help entrepreneurs grow their business quicker. But at the same time, Europe is often perceived as being not necessarily the best environment. This is due to the general bureaucratic costs that are usually being perceived as impacting, especially disproportionately small companies because they don't necessarily have the capacity to absorb it. I mean, this is known. Probably also slightly exaggerated in my view, as a reason why entrepreneurs want to migrate to the US. But nevertheless, it is a reason given often. I think the most important thing here from a European perspective, of course, because when you look at it from a national perspective, it's a very different way of looking at it. Especially when you are a large country like Germany. But from a European perspective, I think the main problem here is not so much that you have those regulatory environment constraints. It is that they change from country to country. And if you want to build a business and go European before going global, the problem that you face is that you you will face upfront a lot of costs in making yourself familiar with the different requirements that exist in different countries. While often entrepreneurs that are in the US, they just do it for the US market. Everything is in English, the information is extremely available and therefore it is much easier. So often even in our area where we have now invested in many companies and supported many, of them, thousands of them with subsidies. What we have observed is that when a company is successful in passing the early stage phase and starts the process of scaling up, they will in most of the cases, they will never go into another European country. They will go to the US first and then come back to Europe later on once they are successful. So this type of, we grow in Paris and then we jump over the Atlantic and then we come back to conquer the European market is of course not very good for Europe as a consequence. But unfortunately the reality that many of the companies are telling us is

unavoidable in the area in which they operate. Often this is mixed with a particular regulatory approval process. For example, in areas that are heavily regulated like medicines, medical devices and so on, where they of course, the perception is that the US application of US legislation is much faster to get regulatory approval to put a drug on the market, for example, a medical device on the market than it is in Europe.

Olivia Suchy: So in your opinion, what are concrete measurements that can be taken in Europe to close the funding gap and to support hardware innovations and startups, Maybe to get to a level that Europe would not lack behind America, for example?

I01 : Well, I would say it has to be smarter and it has to be bigger. I mean, it has to be smarter in the sense that, money is not extended to the infinite, so we need to be smarter in the way we use the money, but it has to be smarter. The mechanisms have to be really built up in a very subtle manner, in a very impactful manner, in order to have maximum impact. That's the first thing. But the second thing: the design of them has to really address the problems seen by the investment world, not the problem seen from the point of view of university funding. That, of course, would like to get its innovations on the market and I just want to carry on with more subsidies. Subsidies are great, but they consume a lot of capital, a lot of money because you generate 1 to 1. You just pay a subsidy that doesn't leverage very much private capital. So the design of the mechanism has to be smart in order to basically increase the leverage so we can do much more with the limited amount of money, which always will be a constraint. But it has to be also bigger in the sense that we need to put more money in it. And the reason for this is that we are being outpaced by the Americans, but also by the Chinese, because they are putting in a lot more means than we can in those areas. And when I say a lot more, I'm also saying public resources . In America, they do it differently than us. They are doing it through tax incentives as we saw with the Inflation Reduction Act. They are also doing it through procurement. They buy innovative products. They promise to buy things at a certain fixed price, which creates a market for these innovative companies. And then they are doing it. They are much better at using these types of tools than we are in Europe. So they put a lot of resources into it. So we need to address the smart way of doing it, but also to increase the capacity that we give to these schemes in order to really make a difference.

Olivia Suchy: Are there certain instruments, financial instruments that you can think of that should be established more in Europe?

I01 : Well, I mean, what we've done at European level is try to address this funding gap by early stage by putting a lot of money in crossing this first and second valley of death that I mentioned. So to move from Lab to fab, so from something that emerges successfully from the lab and transform it into a company, like I said, it's not only financial, it is mostly a problem of mindsets or problem of getting access to the right expertise. And that is of course a big loss of time and potential opportunities there if you don't have a scheme that can actually incentivize the creation of these companies or reach the markets quickly and provide the necessary seed money for these companies to grow. VC aThat gives us the capacity to prove that they can start the process of developing manufacturing capacities and so on. So these two areas are what I'm working on, so I'm quite familiar with it. But of course there is another area that I also look at and on which we've been working that is not early stage, it's more later stage. But like I said, this consumes a lot more resources. It's less risky because the companies have proven themselves on the market. So basically in series B, post series B up to pre IPO, these areas of the later stage requires a lot more capital and it's less risky for the public purse as well. But unfortunately we need to find a way to incentivize in Europe the creation of bigger private funds

and unfortunately there's not going to be any other solution than to throw more public money in a smart way in order to incentivize the creation of these big funds that can then take these tickets. So I would say those interventions are what is needed right now in order to really make a big difference.

Olivia Suchy: That was the last question and was incredibly insightful. So thank you for that. And Elizabeth, I guess you have a question or something to add?

Anonymous participant: Yes. Thank you, Olivia. No. Thank you so much, Stefan. This was really, really I mean, we see that you're speaking from experience. I just wanted to say one thing not to take away from the, you know, results of our study. But I found quite interesting one topic which has emerged in a few interviews with regards to your last point about the the way how to increase fond sizes in Europe, especially for the growth and pre IPO stages. Two topics have emerged, and I just wanted to give this to you as a sneak preview of our results, but one of them is to strengthen not only the volume but also the level of professionalism of institutional investors in Europe. And this I think that there is a big difference to the US in that sense that we do have in most European countries and at European level, a very strong, of course public base of institutional money through EIF capital, etc.. But the private large institutional investors are aware. We don't have that. I know that the commission - I think you had a mandate with EIF a few years ago to also provide money to fund funds - and so I think in the UK is today the largest European fund of funds that has emerged from that program. So yeah they have really seeded Isomer and I think this was a very great initiative. Not wanting to influence your policy, but I think we see in the interviews that this point of volume and professionalism by institutional investors in Europe is considered lacking and this could be strengthened to public policy, I believe. But this is just my opinion.

I01 : No, I agree. The problem is that the pension funds in particular that have lots of money available, they don't usually have the teams to do such. For them it's like pocket money. I mean venture capital is very small in comparison to the masses of money that they do. And of course, the masses of money are very easy because they are very standardized and therefore the teams that they have are very good at generating a return on much bigger volumes on products that are extremely predictable. So they don't have the teams to analyze the VC market and this type of more complex investment areas. I wonder whether this is only going to work because basically there is an issue of providing instruments that can replace the expertise that the teams don't have in order to reassure them. So that's one issue. Another issue that maybe could be explored is that they also perceive all this because some of them are investing and not all of them. Some of them are investing a bit in venture capital, but they always perceive it a bit as a kind of a casino type of betting type of thing, because it often turns out very, very well, But often they don't understand why it turned out alright. And they always fear that they were just lucky and actually things could go seriously wrong. So I wonder whether this instrument should not take into consideration also another aspect, which is to try to give to these institutional investors a more steady return by avoiding the ups and downs of a highly risky, highly prone to ups and downs of investment area such as venture capital and and that would be another role for public institutions in order to channel a lot more money coming from the institutional investors into the venture capital market and then increase considerably the size of the funds.

Anonymous participant: Exactly what you say is the experience in Germany by the private insurance industry. There has been a mentality of considering tech investing as a casino. And I know that only carbon varta of the EIF came to hold a big presentation to representatives of the insurance industry executives, and they were surprised to see the, you know, the strong and

consistent returns that the EIF has made. I would say two things. One is there has been a pretext of solvency. Two laws to not invest in venture, but at the same time they do invest in private equity and it's the same asset class from a regulatory standpoint. But at the other hand, I would also say. They need exactly as you say. They need teams to build a diversified portfolio because venture capital is a power law. You you need to be in the the dispersion is very high. As you say, the volatility is very high. So you need to be consistently in the best quartile of funds and you need to be investing consistently in funds. So this these two factors require that you take a very professional approach to building a diversified portfolio of fund investing in venture capital. And this is essentially a fund of fund approach. This is what the EFF is doing, this is what CF W or B force is doing. And if I think if private insurance had more option to to invest in big fund of funds like isomer or I mean F is open I think a bit to private investors as well and k w capital is opening itself up now then they they would I mean part of this hurdle would be reduced. But you are right that also a sort of baseline by a public instrument could be a way to increase incentive.

I01 : Have you interviewed some of the beneficiaries in the venture you program that you are mentioning, the one that be done with the EIF fund of funds?

Anonymous participant: You mean funds?

I01 : For example, Velasquez in Axon was one of the beneficiaries of the program and it has lots of insights but we talked about it very often whenever we met. I can give you this contact if you want.Very often we rely on these expertise very, very periodically because he's had the experience of building this fund of fund initiative. And he can tell you a lot about the difficulties that he faced doing it.

Anonymous participant: That would be great.

I01 : If you're very much interested in knowing how you can do it, it has quite a lot to say. And this has been quite a subject that is very willing to try to find a solution at the level of the EIF. Even if I don't know what the thinking has recently evolved on that. But what happened after the venture EU program is that they were not of the opinion that it would be necessarily a very good idea to renew it in the current context. That may have evolved now in the meantime, but for the moment, what they got out of it was that of course we had great difficulties and to implement it. It didn't turn out exactly as we expected. So we had to reduce the ambition of the program. And it was implemented. Isomer is another example. But at the end of the day, we had more ambition about this program. The program and maybe this is always the problem with Europe: but we added a lot of other objectives which were out of London, more geographical distribution, helping the countries to the east of the European Union. If you apply these type of policy objectives, it becomes very complex to implement because I mean the world of investment in particular, you can pursue one rabbits and you pretty much sure to catch it but if you pursue three or five or five rabbits at the same time, usually you end up empty handed because it's very difficult. So at the end of the day, often we make the mistake of trying to be too comprehensive in our approach. And that is not necessarily to the best of these types of initiatives. But I mean, at a national level, we have, I would say, less of these types of constraints. Even if you do have them in another more political type of objectives, you have less of these constraints on ensuring equal distribution between member states and so on, which is often a big problem at European level, a problem and of course a positive thing as well. But this is a constraint that we cannot really do away with.

Anonymous participant: Yes, it is. Professor Tinbergen Classical problem. No, you cannot pursue two policy objectives with one policy instrument.

I01 : But it's true from the concrete implementation and the problem in Europe is that we tend often to pursue not only two but three, four or five, and it makes it extremely muddled at the end because then you don't know whether the relationship between the instrument and the means that you have put and the actual fulfilling of the policy objectives. It becomes very difficult to identify truly what has caused what. And at the end of the day, it doesn't really make for very good policy. But anyway, my ranting about the overall policy context in which we operate is over.

Anonymous participant: And no, we fully understand it. It's not easy to design a good policy, but good intentions are already the first important point.

Interview with I02
Constantin Gehring: And that is, we're trying to test out a bit here where these startups could be relevant, and along with that, the question of in which areas do you see the greatest potential for positive change in society through hardware or climate startups?

I02: Yes, so I think I can say that we can approach the issue from two sides. One is the general start-up activity and innovation of the national economy in general. That's what we've been looking at since the early 2000s in 2005 we launched the X Fund here in federal government together with KfW back then. I think that has always been with us. That was basically a diagnostic approach, so not specific to certain technologies and certain business models at all, but really across the board. And that simply follows the idea that startups, which are different from other startups, are simply very important for the economy and technological change because of their scaling potential and disruptiveness. In addition, I think there is now also a very, very strong focus on certain sectors that can be recognized as scales for transformation, over and above the agnostic approach. The term "transformation" always refers to this double transformation. Digitization, of course. Everything that can be digitized will be digitized, and we have to face up to that.
But I think the issue of climate change is even more urgent. The fact is that we will not only end up with an additional two degrees on the path we are now on, but it will go in the direction of four degrees if we do not bring about a change. And that's the change that needs to be prevented, just ultimately by stumbling away from CO2 emissions is clear, there you can make times restrictions, you can make appointments, laws, international standards, etc. to get out of CO2. But I think it's quite clear that, in addition to the change of direction, we also have to put somewhere, that is, we need technological innovation, and there is already a lot that can be scaled up. These are technologies that now really need market access and expansion. That will then orient their business model. But there is also a lot that is still really new that we need. So examples can one gladly call, what I, what the Photovoltaik as a standard element for roofs for the building of houses there have models to support, which are really scaled. Every new building basically has photovoltaics as part with the tile that you put on the roof. That would be one of those examples. Or if you give now in the area of really disruptive technologies as such, what do I know what, what a lot of green hydrogen as fuel for maritime shipping.
So, and these are of course the things so and that there is actually very much there or until shortly before the development towards market maturity. And there is a great need to recognize these technologies or business models in both directions, I believe, and then to invest money very specifically in the start-up phase and in scaling.

Constantin Gehrig: Now that you said there are these startups, they are relevant. Whether they have described this the success of these startups less, endangered by insufficient funding.

I02: Yes, I see. There's a lot going on right now. But I think it will take a really, really broad development. And that's why I think there will be cases here where there won't be enough capital if we don't act now and, above all, provide growth capital.
It is coupled, I would say, perhaps one would have to differentiate again. Namely, it is a question: is there basically no money? And the second question is: Where does the money come from? Well, I think there is quite a lot of capital available worldwide. Germany is, of course, one of the leading modern technology and science locations. There is no question that we have the best universities and also the best research institutes, such as Fraunhofer, Max Planck, and so on. But the problem is, of course, that we basically have a strong influx of international capital, especially when it comes to scaling. And in this respect, it is a fundamental economic question whether the innovations that are developed here will stay here. So in addition to the logical component of sustainability, it is also a question of economic strategy to remain in control and to keep value creation in the country.

Constantin Gehrig: Would they say there aren't enough national flows that promote national companies?
I02: Exactly, although I wouldn't use the term national alone so much now, but I always have the European perspective. That is, for me it's all about Europe. Germany in Europe. You know that with the funds of the EAP Special Fund, which we manage here, we not only have the great cooperation with KfW, with the funds of the rather special assets in KfW, but also and actually longer than with KfW since 2005 with the European Investment Fund. There we have a so-called EIB fund of funds, where we always bring together heavy financing in practice. The EIB is our mandatary there and provides 50% of the financing. And we then provide funds from the federal government via the ERP Special Fund and now increasingly also from the Future Fund. So I'm talking about this because I think it's very, very important to always think of Germany in terms of Europe, and I've always been against it when the Ministry of Finance and the Chancellor's Office always come out with such a terrible narrow view. Yes, does every euro that we channel into financing really flow to Germany? Yes, I think that's important, too. In fact, when we give money to the fund, much, much more goes to Germany than we put into it. But to be honest, I also think it's extremely important that there is also innovation in Portugal or innovation in France or Austria or Slovakia. So it's very important that we take a European perspective from the German side. That's why it's about strengthening start-up and growth financing in Germany and Europe. That must be our goal.

Anonymous participant:
We're interested in a bit of your assessment. Where in the financing chain do you see the biggest financing gap? And you know the chain. We have divided that once by technology levels. TRL 3 to 8 and then on the other hand by different financing instruments starting with funding instruments over funding loans, over equity financing in the early stage, over then slowly venture debt bank financing up to scaleup, IPO, exit or trade sell. And if you can imagine this mentally, where do you see the greatest levers or gaps in the German financing sector or in Europe?

I02: Well, I would say that in Germany we already have a very clear picture here with the funding chain for which I am responsible. I think that right at the front with the Exist programs is a grant program that, if you add the European funds from the European Social Fund, we are almost at 120 million per year. I think we are very, very well positioned. That the founding

teams in the spin-offs from science will find money. There are four complementary programs, also in the Ministry of Research, but the flagship instrument is the Exist program. I believe it has a very high quality standard. I don't have the figures at hand. But we have had it evaluated several times and the retention rate of the start-up teams is extremely good. That shows that quality really is being selected. We have the start-up scholarship and we have the business research transfer, which are the more demanding projects. So I think we have quite good coverage there. Then, of course, in the early-stage area, we have a public-private instrument in the form of the High Tech Gründerfonds. But it has to be said that the public funds have increasingly entered this early phase in recent years, when the market has developed very, very well. Now, under the last crisis, which has set in with the geopolitical situation, where now a year ago, we have resulted in a bit of a tightening of the financing situation again, although we are still clearly above the level before Corona, one must say.
So we have a stable development overall. I would say that the early-stage area is actually very good. I think what we need now in the early-stage area is a stronger focus with a sectoral emphasis. I think there are a lot of funds coming in now. Just had the phase first closing and approaching the panel closing. Planet A World Fund examples that we are promoting with KfW Capital. So for Planet A, I think it's only Capital so far. With World Funds, I think there will be money coming from both sides. Tomorrow we have the state of the Climate Fund, so that the two managing directors determined. And that is that for a fund that is just similar to X and also a co investment vehicle and always together with private investors in the targets reingeht. And is also supposed to cover tech and related topics in particular. So I think there's a lot coming and that's good.
You asked about the bottlenecks. I think that in the rectoral area, I think that more needs to be done and where I still see a clear deficit is in the scaling. I think you can say that the limit is about 10 million and then up to the triple-digit range. Thereby is increasingly what in the market and because they it just so far very, very, very much I say times capital inflow from abroad what one always also to the Exit pay that has the GF see can I me of the chairman of the investor advisory board. to 90% of the Exit of the HTGF go abroad and that is not always bad. Yes, so an example the exit of NEXT power plant excellent startup in Cologne. Voltage balancing grids when you feed renewable energy into the grids. That is so to speak then topic is after UK there are still in Cologne and they continue to grow well so from there, that is now not per se bad. Nevertheless, I would say that one would wish that the German electricity suppliers could have looked at this investment target. After all, this issue of how much renewables we bring to the market in Germany is a key issue for us. But it is the central issue worldwide. It has to be, now it is, and the fact that it's not included is somehow a mystery to me. But please, if it develops well, then it is also good that I am the friend of investment openness. But that shows just a little bit, if the after what there the scaling that is as super super important and that is very much foreign money on the way that is per se not bad, I will say. But I believe that we still have a lot of catching up to do on the German side. And that is also one of the reasons why we set up the Future Fund and are now structuring it.

Constantin Gehrig: Okay. Wonderful. So what do you think is the reason that this funding gap exists there? So, why is the money missing in the place that you mentioned? Why is there no money in that phase?

I02: No money from Germany and too little money from Europe It's money, that's where it is. We have seen a very, very large exit and it is just very international money. And the critics say, the international partners from the USA and Asia also see German engineering. TU Darmstadt TU Munich, you name it. Also in the area of universities of applied sciences. There is also very, very and very solid work and research and development. And of course, the international

partners see that and the valuation has often been lower compared to the U.S. and that makes it attractive, of course, and that's why the influx of international capital. so, what's the reason? You can see that very clearly. Of course, it has something to do with the positioning of the large capital collection points, with the institutional investors, which in turn, of course, also feeds back into the social system. But it's not just the problem, it simply has something to do with the fact that our institutional investors have been extremely risk-averse up to now, because although they have invested in venture capital in the private equity asset class, they have done so very significantly only in the USA or in Asia. And that in turn has to do with the fact that the market there is already more developed and the fund is structured more strongly. And that of course makes it easier for investors who are so ponderous and risk-averse, such as institutional investors, to advertise their money there. But I therefore believe that this is a very, very large market development order, which we have also accepted very, very actively here in the region. We are still analyzing the problem. But at the problem analysis level, it's certainly the issue that the institutionals have not put enough money into this innovative area. And I have to be precise about this, because we have really looked at this very closely. Then it's always easy to say, well, that's just because of Solvency II and regulations that are imposed on insurance companies, for example. And that is simply not true. It is simply not true, because if you look at the amounts involved, they are of course in the billions. But they are not triple-digit billions either. So we had in Germany, what I had in this top year, was at 18 billion VC area so and there the institutionals were not greatly represented. So we say that if a few billion were added from the institutional sector, that would make a huge difference. And they have the air. We looked at this because they are active in this segment, which is quite simple to say, because according to Solvency II private equity and VC is practically used as an asset class, and in the private equity area, which relates to financial companies, i.e., above innovative financing in the SME sector, etc. They are also active in this area. That's where they are active. So that's simply not true, I find it really outrageous how the institutional investors then simply claim about top league. Well, we can't, we are prevented by Solvency II from investing in VC. We have investigated it, we have also hardly communicated it. That's not true. You can do a lot more there. If you look at the investment volumes, the part of the large insurance companies, then of course there would be considerably more in it. And one really wonders Yes, there is also something like a responsibility of institutional investors and self-interest an interest in the. European economy of the German economy. In any case, the regulatory framework is not the financial factor. In my opinion, there is more to be done in the medium and long-term self-interest of institutional investors.

Anonymous participant: Perhaps I can step in very briefly, although I am actually a silent observer. You have already outlined some parts of the solution, such as the growth fund I mentioned. Personally, I would be very interested to know more about this, as it is being reflected quite strongly in the market right now against the backdrop of the growth fund. How do you see or how does your house see the role of a private and independent fund of fund ecosystem? Well, I'm thinking of players like Equation in Munich. As we know, this is much more pronounced in the U.S. than in Europe, where we have much more public concentration in this area. And I'll say it provocatively, that parts of the growth fund from these private independent funds of funds are not currently making it easier to raise institutional money. Is there a tension there?

I02: So it's not clear to me that there's a bit of wrangling. But I have been following this process with the institutional investors very closely since 2018. We had a round table here in the House with Minister Altmaier in November 2018. And that was a tragedy, you could say. After a while, the insurance industry was ready to acknowledge that perhaps a few images of the oh-

so-dangerous asset class were being projected and that nothing could be done about it here in Germany. And Europe? That was quite shocking, because the figures were basically quite respectable and by far not worse than in the UK from the USA. I think that was a very important step. A very tough process was started, which was of course slowed down a bit by the Corona period. For a long time, I was pulling on my own. Even here in the team, not everyone was always enthusiastic. That was really tedious. Even GDV, which is not always the most innovative association, basically recognized this and supported me a lot and brought people to the table again and again. So that's why I'm telling you this. That was, that was a hard piece of work. And yes, when they then set up such an instrument publicly, so to speak, then of course you first have to get it over the line.
We have now had the first closing, which was really a very, very respectable success. And we will see the final closing in Q2 or 3 and then we will be over 1 billion. I actually assume that we will achieve that, and I think that is an important step. I think that can definitely have a signal effect. And I want to answer your question very clearly. Of course, I would like to see the market organize itself. And of course I think it would be ideal if private funds of funds were formed and an ecosystem developed. But I would not want to somehow position one against the other, just as I would never see the Gründerfonds or now the Tech Climate Fund as somehow opposing the private market. We want to broaden the market. That's actually always been our approach. We want to make the market. And that's why I think, yes, I can imagine that: If private initiatives are now fundraising in parallel to the growth forms, that can also sometimes lead to friction. But to a certain extent, I would then consider it a productive phase and also rely on it. Is the goal to necessarily set generation upon generation permanently with the growth of Germany? I believe that if we see the private market take off and develop in this direction, then we will leave the space there again.
Perhaps this is also a combination, because in times when markets are contracting, it's not bad to have the state as an actor here. That may be, but that's my philosophy.

Anonymous participant: Yes, perhaps I may just make one comment. I believe that the EIF had a mandate from the Commission for many years in order to promote the fund of funds market in Europe at the time, and has helped to build up various funds of funds, among other things really located in London. And I think Mr. Polygram was the first to say that the EIF should, under certain circumstances, act with the function of abolishing itself. But that is just saying. I think the devil is in the details and in the conditions that you then go to the market with, whether you create the market or make the market more difficult. Okay, but maybe a quick logistical question at this point. Katrin, you have, I think, a hard stop at 2:30, right? Then maybe we should segue to you now.

Constantin Gehrig: Exactly then again now that the problems have pointed out, what do you think are funding measures, by the way, to close this funding gap or to close the funding gap.

I02: Yes, I think we have a very broad agenda and these are always pilots that we run, where you always have a phase where you check things out, but then also act and create instruments. I would like to mention a few things that are in the area of financing, but I would also like to add another thing that concerns cluster formation in Germany. On the financing side. Tomorrow, the Technology Climate Fund will be launched with a volume of one billion euros. The federal government will finance it from the special fund and from the Future Fund and should then finance 1 billion over ten years. So that's where it becomes the investment vehicle and so it always goes together with private individuals. The ideal is basically that we have good funds that recognize the targets and then the small fund can also go into the targets in a broader way, which will also be able to invest 30 million per target - that's quite a lot and I think that's

also important because we are now really, I would say that we need scaling very quickly in climate-relevant technologies and then in the area of fund of funds instruments I have already mentioned Growth Fund Germany, the volume of 1 billion that we will also achieve, mobilization of institutional investor capital is there then investment advisor and it will then come to parallel investments with KfW Capital.
I think that is important, and then what we have already structured in practice and also have these instruments on the market. These are the opportunities for KfW Capital and AIF to support larger fund bonds in fundraising. Before the Future Fund, KfW Capital could invest up to 25 million in funds. Now it can invest up to 75, which means that larger funds can be raised. I think that is also very important, and we have also done that in parallel with the AIF and the instruments that we have there, i.e. the growth facility. Then is an instrument that is now announced in February. I would like to mention that as well. It will be a so-called City European Tech Champion Initiative. This will be an initiative of the European Investment Bank, France, Germany and Spain. Germany will contribute invitations from the Future Fund. And that is again basically to even bigger funds in Europe, so scaling. So, it is simply, I say, larger, because I myself have now made a provision that we want to associate 20% of the funds of funds in the IAB area in the area of climate technology. I think that is very important. We will now enter into a process with KfW Capital. The kick-off is on February 6, so very soon together with the BFF. We want to sharpen KfW Capital's market development mission again, broken down into various topics. This includes, if you have certain sectors where we believe it is particularly important to position Capital, we want to identify that, then we have an Emerging Manager Facility. That simply relates to the fact that we need more funds and also smaller funds, more first time funds, more women, managed funds, because women come into money a little bit later often simply through the employment biographies. So that's why I think that's there. And we also have the issue of impact on it, on the agenda. I think that is also very important, because it is so to speak again such a qualitative sector-specific component market on behalf of KfW Capital is active. We should also take a closer look at how Capital can add the most value. If I may, I would also like to address the topic of cluster formation in Germany, because I think we have a very, very important initiative going on right now that concerns a very central topic. If you look at why Munich has become such a great location for start-ups and scaling, it's because a cluster has formed there from the Technical University of Munich, from entrepreneurship, from funds, from old industry and old industrial money, and from the founding spirit of young people and research scientists who then take the step of starting up a company.
It's such a cluster, and tomorrow evening we'll have a dinner with Habeck, with Klatten and Co. A series of billionaires that we basically want to spread even more after the first one by Susanne Klatten, who practically lived it in Munich. And we have set up such a process, which dates back to Altmaier's time, which Helmut Schönberger and I started a bit in the background, I would say. And Habeck, like others, has jumped on the idea that we should set up such a process, old industrial money, because ultimately it is money that has been collected in the family offices from the old growth in Germany, flanged there, so to speak, in initiatives, at universities and where there are clusters, to expand this even further. I believe that we can do much better in this area in Germany and that there is a lot of movement and I also see a lot of potential. That's why I'm making these qualitative points, because I believe it's not just money and scaling, but also has a lot to do with it. It also has a lot to do with contacts, it has to do with networking. We should also, if we here in is advisory board, I know that, but there we also have the financing component is a super central so that is very very important state on the part of private will, but we must also bring it together even more in the direction of cluster formation. I would like to have made that as a point as well. And the process that I mentioned. We then have a workshop. Where then, so to speak, the Family Office comes together with the world and we together with Bosch and also again Schönberger and then want to continue this. Then

we are in October November we want to be then probably at the Council Group in Heilbronn. So we are also looking for these clusters and trying to strengthen them. And we also offer a lot of things where you can practically cooperate with our instruments. That is, I think, a bit of the point. And if the private sector then responds even more strongly, I think the shoe will drop.

Constantin Gehrig: Thank you very much. That's actually already one question aside. Do you often have any comments or facts that you think are relevant to the topic but you haven't kind of specifically asked about and you still want to get rid of?

I02: Yes, I basically have two priorities that I would also like to set. I think if you ask yourself, what do I have to do more in Germany? Then I think there are two bottlenecks. One is the issue of IPOs. I think we really need to do better here.
And now we have had quite good stock market activity. That was all quite okay. But I think more needs to happen, otherwise there will be too much migration to the U.S., to the Nasdaq, or also seen, but also in terms of our portfolio here, that is, to develop and I think that we should no longer necessarily only see the Nasdaq as a point of comparison, but sometimes the European comparison is not so bad. Why is Sweden doing better? Or maybe some things are better in Italy? And France. I think the stock exchange location as an exit channel is super important, or it's not about exits at all. The stock exchange listing keeps the control practically in the company. I think that's a very important point and the second important point. That's basically the issue of trade sales. Why is it so important? Because it is ultimately aimed at achieving this, as I made clear earlier in a nutshell using the example of Next Kraftwerk. We need a strong willingness on the part of the large state-owned companies to buy the highly innovative startups, to incorporate them, not in order to take them out of the market, but to learn about them themselves, to build up a new business field. And that is super important of course for everything that comes up, but that then creates the ecosystem and again money of course flushes back to the founders and so on, who are then in turn also activated with it very often. I think it simply has something to do with how the companies can then develop further. There the answers IPO are naturally very strong in the BMF. For our part, we are very excited about what Mr. Lindner is now presenting with the Future Financing Act, which has been announced. As far as companies are concerned, I think it's also a question of raising awareness. A process of rethinking has to begin. You don't necessarily have to go to Silicon Valley to find innovative startups. They are also very strongly represented here. We've already had some delicious examples of a major German company and a German startup finding each other in Silicon Valley. Perhaps we could have looked again in the region. Well, maybe that's also a task for us, to promote it even more. But I think these are very, very important levers. IPO and trade sales, and then the responsibility of the existing companies to get involved by taking on or cooperating with startups.

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Interview with I03

Constantin Gehring: First question, in which area do you see the greatest potential for positive change in society through Hardware and Climate Startups see or read the texts?

I03: Well, I'll say that the fact that deep tech is a solution to this whole transformation question is something we all share. I don't think we need to resolve that in detail. The special challenge that exists and if we now start with the startup side in the first block, then the special feature of deep tech, at least as I understand it, is that you are basically operating in two risk dimensions that are somewhat less typical than what you might normally have. I'll say so classically B2C Saas, that's completely different. There are two dimensions of risk. One is risk of technological development and the other is risk of the market. Relatively clear because in many areas we don't

even have a market yet. So quantum computers are such an issue. There is no market for quantum computing yet, so to speak, and we will develop it when we are ready with the investments. If we assume that this is the case and say that we need technologies to solve the sustainability issue, which extends from energy generation technologies to storage technologies, from rail networks to recycling issues and much, much more. Then you are relatively often close to this deep-tech area or already in the middle of it. In other words, we are obviously looking for companies that are willing to take these risks, that often come from the scientific community, that have completely different needs than what has perhaps classically been done in the venture capital scene over the last 20 years. If you look at the German scene, I think we actually only have a handful of genuine deep-tech financiers in Germany. Now comes a very important aspect. This doesn't just apply to the late phase, as we usually assume. We always say that Germany is good at the front, but not so good in the big financing rounds. Unfortunately, that's also true, but deep tech is also lacking at the front. This is an aspect that I don't think has yet been fully recognized everywhere, including by the German government. That's why it's good to pick up where the government can be picked up. The Future Fund has many components that attempt to address this issue. The question of growth financing with the Growth Fund, which we now have to give a chance and see how it works. Are the institutional investors really going for it? What does all of that look like? Let's take a pillar. If you look at the deep tech area in particular, there is supposed to be this Deep-Tech Climate Fund. It would basically be predestined to at least address the size problem in the deep-tech sector in the early phase. The risk that I see there at the moment, or the weak point, is that although it has been recognized that one would like to invest in the long term, in terms of capital, explicitly VCs, one does not envisage co-investors in this fund. I think that is a huge strategic problem, because the question is, who should be the co-investor from the market? So of course we feel addressed as a family office and I also understand that foundations are addressed. But I ask myself, who should actually make the selection of these deep tech startups? The keyword is smart money. These companies with their corresponding needs, which are different from a B2C SaaS, which can be handled according to the playbook. Who is supposed to make companies big with, please? If this issue of CO Investments is not solved, this fund may go nowhere. I think that's one aspect that can be pointed out again. If we now stay on the capital side, we will of course have these unglamorous perennial issues such as strengthening the capital market. But these are simply the issues that, if the channel to the back is simply narrow, so to speak, it becomes difficult in the feedback to the front. That means we have to continue talking about these issues, including funded pensions, stronger capital markets, and so on. Now, this is probably not the core topic of the Advisory Board, but making the link is also relevant for this topic. That seems to me to be very important, right up to the point that we must remain open to foreign investors despite all the discussions, including discussions about technological sovereignty. On the one hand, this sounds banal, but on the other hand, we are currently seeing how various things have recently gotten stuck in the federal government's investment review. If, in the long term, the perception is created abroad that you don't want to have investments in the technology sector, or that you can't get out of the investment afterwards, then under certain circumstances this could be
become a problem.
I think an important part is, of course, the whole issue of research funding. Basically, we're not bad at this, but it is of course a very decisive component for deep tech. I think we have to pay particular attention to two things here. One question is, can we already take into account in research funding that we want commercialization at some point? I'm not talking about basic research, which we really have to take to its own level and uncouple from benefits, considerations and so on. That's a whole other block. But if I'm already involved in mission-oriented research or applied research, I have to somehow bridge the gap to commercialization,

including the whole discussion about IP in the case of spin-offs. That's where the relevant considerations are. I guess Rafael Laguna said a few words about that as well. This is simply an essential topic, otherwise we simply won't be able to move from good research to sensible commercialization.

Constantin Gehring: You see deep tech companies in particular as the relevant players for social transformation?

I03: There are always two ways of looking at it. We'll come back to the second later, where the question is rather how do we actually help established companies with the transformation? For me, that's part two. The first part is the question of where the new impetus comes from. My guess is that if we're talking about really new technologies and not about the further development of existing technologies, then of course we're in the start-up area, in deep tech and in the area of spin-offs from science. That's sort of the reason why I'm looking at this. But because these are technologically very demanding topics and because we don't have an established market for some things, they actually meet the definition of deep tech. This also requires a different treatment in the funding system, but also how private investors can support or whether they want to invest in the first place.
Constantin Gehring: Do you see the success of these deep tech startups being jeopardized by insufficient funding?

I03: I see three things. The first question is, how do we get to these foundations in the first place? First of all, this is a pure quantity issue plus a quality issue. So the first question is: how do we enable our research institutions, universities, non-university research institutes, institutions, if we have the bright minds, to get into spin-offs? The second part is: How do we manage to get investors close to this spin-off at a very early stage? In the beginning, of course, that might be government funds or government-backed funds. They are, of course, business angels and family offices. But the third question is: How do we manage to bring institutional investors, i.e. VCs, to this topic relatively quickly? After all, they are the ones who have to help the company to grow in the end or even to establish itself as a company in the first place. In order to scale up in the third stage, when it really comes to the very high capital requirements, and that will very often be the case in this context because you have a lot of hardware, we simply have hardly any capital in Europe. What we know from research is that the more foreign capital there is in these companies, the higher the probability that these companies will ultimately generate their value added abroad. That's not to argue against foreign capital. But call the question again: What can we do in Germany to get more involved in this issue under our own steam?

Constantin Gehring: Here's a diagram, in which phases do you see the problems?

I03: I'll put it this way, at every level we would find points where we could improve. In the case of spin-offs: the number, but the question: how do we handle IP in spin-offs from research institutes? Then there is the question: How do we manage to gain faster access to private investors? How do we get a quick business focus into the companies that actually come from science, that tick completely differently than the classic B2C start-ups that we might know, until the next financing round. The topic of growth financing from the end thought. So if you're here now, at the back end is the IPO. That means we're with all the capital market-strong systems, with funded pensions, and then in between there are then points like that that you would find, if you say, for example, there's not only external financing, but also still internal financing of the companies. So the question is, can the state act as a customer, especially in the

area of deep tech, whether it's new space or in the energy sector, because there it's even more obvious. I could imagine mobility, so there are three ways of saying that the state as a customer is simply a very decisive lever, firstly to help the startups with financing, the keyword being internal financing, but of course also to prepare the market relatively quickly or to prepare what can later actually be a private market. We know that the state as a client is not the easiest partner and the closer it acts to the market, as we can see from the state programs that are distributed, the stronger and more attractive it becomes for start ups to participate in these things. Another model is DARPA, a form of public procurement. At its core, it's not just about equity participation, but about buying in research contracts in the first place, bridging this valley of death in order to come up with solutions that can later be financed and absorbed by the private sector. This, too, can be found very early on, so to speak, and the SPRIN-D finally needs to be freed from its shackles, keyword freedom law, etc. It is imperative that it be included in this discussion, because the issue is simply already anchored. There is a political will. We basically all know how it works. We also know that the model works. But now we basically have to enable it so that it can show what it can do.

Constantin Gehring: The financing gap exists because the state does not act close enough to the market?

I03: If it were only a matter of market action, one would always say that the state should stay out of it. But now we assume that there is a market failure at some point and thus a justification for government action, because there are coordination failures and the classic arguments that are usually used. So if the government decides to use public procurement to promote innovation, I think it can do that particularly well if it actually procures these solutions according to the most commercial logic possible, according to a logic that is as close to the market as possible, knowing that it is not a real market player....
The participation of foreign investors is also an issue where the state sometimes reacts very hesitantly, and I'm not necessarily talking about China, but countries that tend to be friends, also in the economic sense, so that the concerns start relatively quickly. Is this a company that can actually invest in the area of key technologies, and I'm not talking about Defence here, but in the area of key technologies. In other words, we need to act closer to the market, so to speak, and in other areas where the market does not provide a solution on its own, we need to use very clever methods, such as the DARPA model, to build a bridge so that the market can basically take over at a later point in time. Then, however, private investors must also enter into the continuing risk and then the chain must basically continue to run until the exit capital market, etc. In other words, we need to be close to the market in terms of procurement, so to speak, with targeted, clever instruments, but in the areas where the market is just failing.

Constantin Gehring: Are there any cultural or systemic factors that contribute to this end to end principle not working yet? So you said there are problems in the individual phases, but are there any overarching factors that you could name?

I03: These cultural questions and the questions of how to assess risks in different societies, and so on. There are, after all, 100,000 analyses and I suspect that all of them are correct. I just wonder what do we do with them? Because a changed culture is often the result of something, but not something where I have a very simple tool to do something immediately. That's why I always find that a very flowery discussion, which I honestly wouldn't dwell on at all. It's more about what instruments could be copied from abroad. I'm not talking about the question: How do we copy Silicon Valley? That doesn't work. And I don't think we have to. The question is rather: Are there instruments that we should think about in addition to those that we already

have and that we should improve? For example, DARPA, growth funds, deep tech funds, capital markets. What are new instruments that we can look at?

Constantin Gehring: I have to interrupt there, let's talk about risks and problems first.

I03: Then I would look at the things that basically make up Germany as an economic innovation and finance location, even if I'm not primarily talking about sustainable finance. This can be tax issues, it can be the question of what is happening with tax-based research and development funding, which is not primarily related to systemic finance or transformation, but was originally intended as an innovation funding instrument. But we know that there are huge problems in the implementation. So these are. These are, so to speak, four questions that you can ask yourself, because they are operationally tangible, and you can make immediate changes to them, so to speak, if you want to do so politically. Whereas the only way to see whether we have become a more innovative and open society is to look at the results of this cultural question. But nothing that we can do now, with three discussion groups or any special programs. That's why I would like to move away a bit from this culture and these overarching questions, but rather focus more on what actually makes up our innovation system. Are we strong enough? But breaking this down into aspects that need to be taken care of, including the huge issue of a shortage of skilled workers, training and other issues.

Constantin Gehring: Where do you see the biggest challenges for investors in Europe, for these startups?

I03: Well, if you look specifically at the deep-tech area, then from the investor's point of view it is of course clear that if he deals with quantum computers or energy storage, technologies or nuclear fusion or similar things, it is much more difficult for him to make an assessment of the technology than if he says what does a food trading platform look like or what does a scooter platform look like or similar, where you say that you have already seen this three or four or five or ten times. I then also recognize what the eleventh company's potential is, what kind of technical risks it's exposed to, and what the market access is like. I don't usually have that in the deep-tech area, right up to the point that as an investor I first have to find people in my own ranks or in my environment who are able to give me at least a rough orientation. Whether the team I have in front of me is on the right track, so to speak, with the technology it wants to bring up there, and whether they are viable. It's also simply a question of talent, how many people can you find who actually know their way around this area? And with the market... I mean, in the end, it's the case that in many areas we simply don't have a market at all yet, and it's also difficult to assess market potential. We can form expectations and you can look at the reports of the consulting groups. But in the end, it's a crystal ball and a correspondingly high risk for the investor. That is, as long as an investor can still playbook, he may do so. Those who are then new to the market and say we want to do deep tech will, I suspect, have a relatively long phase in which they first learn painfully how these investments work. In Germany, I think there are a handful of funds that are really very serious about it, that are not just investing in deep tech, but have people in their own ranks that can actually evaluate deep tech. This is an industry that I think is just starting to grow. The more success stories, successful startups, good exits with well-known companies there are, the more successful these funds will become. But that will take two or three generations, then probably more people will follow, who go into these funds, make their own funds and then this scene will also grow. That would be the hope that one could have for this.

Constantin Gehring: So we are simply still at the beginning of the growth phase?

I03: You'll probably always find some historical landmarks. But I'll say this, the breakthrough moments are going to be in the public perception when actual times well-known companies emerge. Also Biontech has basically given a certain push for certain things. There is a greater perception on this topic. My impression is also that both politicians and the business press reading public are more engaged with the topic of deep tech than they were three or four years ago. Exactly what that's due to, I don't know. My impression is that this can be seen in the first stories from companies. People are dealing with topics that come from science and are trying to commercialize them. So that there is more reporting on it and that there is greater recognition that we have not actually exhausted the potential of scientific excellence in the direction of commercialization. From these narratives, the perception is growing on these very issues. The more the established industry makes use of these solutions from the startups in the medium and long term, the more of an issue that's likely to become in the mainstream. It will become a really recognizable field of its own, so to speak, maybe not as its own asset class or anything like that, but at least as its own field with its own requirements, its own needs, its own logics, its own people who are out there actually discovering.

Constantin Gehring: You said that awareness in society has already increased, how do you assess that on a political level?

I03: My perception is that the topic is recognized as such when I talk to Mr. Müller, for example. If you look at the administrative side, I have the impression that there are some people in the Ministry of Economics who have a very clear conceptual understanding of the topic. They have ideas on how to approach this topic specifically. What do I have to do in AI? What do I have to do in the area of climate technology? What do I have to do in the field of quantum computing? This is mirrored in part, so to speak, in the BMWF, although this is more on the research side. So I believe that there, too, the understanding and ideas are growing as to what instruments we need in order to actually make progress in these fields. I think this is growing, but it is still a niche topic.

Constantin Gehring: Okay, now we come to the exciting part, namely the possible funding measures and recommendations for the German government. Here I usually ask how the three concrete measures that the German government can take in hand to close funding gaps. But I would like to ask you right now how you would structure that. So would you structure it along the TRLs or for how? How do you think the structure makes sense to make recommendations?

I03: Basically, of course, you can see it in the chain that you had inserted before. Conceptually, it's not easy, but you can at least try to follow a bit of a company history and see where the fields are that you need to tie in with.

I03: And I'm still now in the area where we're not yet talking about blended finance and so on, but really about the very classic things. Basically, what can be done to support venture capital financing? I would rely very heavily on the instruments that are already there, especially growth funds, especially deep-tech funds, and especially funded pension plans. Because they are already there, and the question is: How do we make the instruments that are already conceptually prepared and backed with money effective? That would be a topic that I would take up. The second thing I would do is: How do we link the topic of research funding even more strongly with the perspective of commercialization, especially against the backdrop of IP? The third focal point would be the whole issue of the state as a customer of deep tech, and there in brackets to this with, as far as possible, acting as a market player, so to speak, i.e. with

as few hurdles as possible that make it very difficult for startups to participate in such tenders. This relates in particular to IP and liability rules. A fourth topic would be new instruments, that concerns the whole DARPA story and that may model and then of course SPRIN-D in particular. Again, I would start exactly on the existing system or the existing instrument because it is a very good one. I myself helped to build up the Federal Cyber Agency as head of strategy. That is why I am familiar with it, from both painful and good experience. What I know from this time, so to speak, is that this instrument works 100%. It is possible to learn something from America and adapt it for Germany. It works well, but you have to make it work in the sense of the inventor. That is not yet the case today. But that is precisely the lever that politicians actually have in their hands.

Constantin Gehring: Can I just jump in? Where is the lever that is not working? So what exactly is not working there?

I03: At the most abstract level, the two models in Germany work, or both models in Germany suffer from what all other countries that have tried to copy this model so far also suffer from. They are always political and bureaucratic interventions that any long-suffering person can recite to them. So that means the instruments work when they have scientific and entrepreneurial freedom. If they don't have that, in other words, if they have to discuss every day, every little detail with people in the administration, then it doesn't work. That's sort of the most abstract short version. I guess Rafael Luna would elaborate on that. There are also governance issues that are still there right now with the creation of the people-owned enterprises that have to do with the DARPA model. Those are, in effect, people-owned enterprises, as of today. They bracket history too much. So I don't think the Advisory Council can save SPRIN-D now. But if it were to work on its own to say that the SPRIN-D Freedom Act should come into being and then make the appropriate contribution, which is what we actually all want here, that would be valuable enough.

Constantin Gehring: Coming back to the commercialization of programs in universities. Do you know of a tool or a concrete measure that you can recommend?

I03: Yes, so I would look very strongly at the IP question in this whole topic. As it stands today, every university, every non-university research institute basically has its own regulations on how to deal with IP. Of course, there are 100,000 explanations for this, all of which are good and correct. But the question is, how can we standardize and simplify more, and ideally make the whole thing even more founder-friendly? What do I mean by that? As things stand today, it is often assumed that we are using state money to support people who become entrepreneurs and then get rich. We want our share of that. I'm exaggerating that a bit. But we have to get away from this and say that we are enabling something from which society as a whole benefits enormously. And if this entrepreneur becomes rich afterwards, that's no harm, so to speak. On the contrary, then it's like this, then we've even done everything right and he'll still remember us later and bring parts of it back into the system. That is perhaps more the American logic. A really concrete recommendation is faster, simpler, standardized processes for handling IP on spin-off. I think that's what it's all about and a suggestion that has been made. In a working group around Rafael Luna, this story is IP for virtual shares. I don't know whether that's the right approach or not, but I think it's a very, very good one. I also think it's good that the top ten 20 institutions have already joined forces to say we want to try this out. That's actually exactly the way to go.

Constantin Gehring: Thank you very much. The fifth point she was just getting at was?

I03: The fifth point among the new instruments is green bonds, which now have a history of almost 20 years, at least internationally. As far as I know, they have extended to other areas at the moment. It's not just sustainability in the environmental sense, but other issues as well. Interestingly, this same discussion as with green bonds is going on right now in the life science area, with the keyword biobonds in the US. That's a very interesting model, which is basically based explicitly on the green bond discussion. It explicitly focuses on this topic of INAUDIBLE capital and explicitly addresses needs, saying: How do we actually treat diseases that are very rare and therefore perhaps have poor commercialization, in quotation marks? That brings us to the second block, what do we actually do if the risk-return-profit is not as we classically have it in markets? That's basically where these bio-bonds come in and the assumed need that companies need not only debt capital not only equity capital, but the life science sector, under certain circumstances, could perhaps even use debt capital very well. And how can that be supported? I think that's a very interesting discussion. As far as I know, it's currently in Congress in the USA. You'd have to take a look at what that looks like. A second instrument that I find very interesting, and now again is on the equity side: In China, there are so-called guiding funds at the city and provincial level. I don't know them from my own experience, but only from reading about them. The state invests in funds, in VC funds as LP, so as a very classical LP. If investments from the fund fail, it bears the risk, does not take the risk away from the other investors, but does something else, namely it capped its own upside and distributes that to other investors afterwards. In other words, while we follow the logic of making venture capital investments attractive to risk-averse investor groups by taking risk away, they do exactly the opposite. They do exactly the opposite. They simply say we leave the risk as it is but increase the upside. Now, of course, this is connected to the previous question about the culture in Germany. I could imagine that this might be a clash. But if we want to think about new things, I think it's at least interesting. Whether it really works, I don't know, but I find the idea very, very, very charming.

Anonymous Participant: That means he takes first loss piece or all risks? Or does it work on a mechanic that he says I'll take what the first 20%?

I03: As far as risk is concerned, he is just like any other investor. Let's say the thing somehow makes five x now, but then he might only take a few percent of that and sort of give all the rest to the other LPs. Okay, but that's high. That's just the reverse logic. I think that's highly interesting. I would bring it up. Maybe another model before we get to these hybrid stories afterwards. In the UK, there is a long-term commitment from Ubadala for life science. That is, the United Arab Emirates sovereign wealth fund has made a commitment, over £800 million for life science investment, which is then matched again, so to speak, from government funds to come up to 1 billion, but handled by UK authorities or at least under that. I find this idea quite interesting to say: Are we actually doing everything to possibly get large institutional investors from abroad behind our interesting topics? So that KfW or the Sächsische Aufbaubank don't have to do everything.

Constantin Gehring: We're at the end here. Is there anything else from your side?

I03: What actually happens when we talk about projects or technologies where the risk-return profile is perhaps unfortunate? But which would be socially desirable. Let's say we had something for nuclear fusion now, but somehow the risk-return profile is not such that everybody wants to jump in there right away to finance the story. What I find very interesting are, these blended finance stories, which to my knowledge are not yet so insanely widespread

in Europe. So the only model that I've seen, although only from the outside, but once, is this theme Break Through Energy Catalyst in the U.S., triggered by Bill Gates or at least so. They basically put 1.5 billion in the showcase, what they raised from philanthropists, from foundations, but from institutional or even government investors in the US, Europe and UK. With the goal of leveraging or mobilizing private funds for clean tech. That's the idea, basically, to couple philanthropic money, meaning after-the-fact donations or grants, with equity investments and government purchase guarantees for products. That's back to the issue of internal financing, and there seems to be an effort that if I have a technology that's a little bit more expensive, but it serves the purpose of being more sustainable, it's going to be financed. And that even though the market is not willing to pay for it. Then that is, so to speak, the tranche that goes in philanthropically at the end. In this way, we are trying to free up the market for technologies that would not normally be able to enter it. To bring down this issue of green premium. I don't know whether that works. I've only heard that it exists. I think it's a very interesting instrument, and we're also discussing the question in Germany: How can we get more foundations involved in innovation financing?
That was one of the topics discussed at the Future Council at Scholz. There was also some discussion of the question of how foundations can be enabled to invest more from their own endowment capital in things that are in line with the foundation's purpose. These are program-related investments that are already established in the U.S., but are not yet very well known in Germany. So I think it would be very interesting to think about things like that, because it really does integrate the market logic and the market players quite explicitly and only addresses the small delta again, where we say that this is the premium that we want to try to keep as small as possible from a social perspective, so that we can somehow bring the solutions that are close to the market or that already exist and those that we want to have in the future up to par.

I03: One more point just came to mind, because you asked earlier about the structuring of the risk-return profile. You could of course ask again: What exactly does this delta look like structurally? Are we talking about a temporal delta? Then you are more likely to ask: Are we still in a technological development that is so early that no one private can go into it at the moment and then you are in the valley of death, etc.? Then you're at the DARPA model or biobonds. If you say these are persistent things and the green premium is basically not going away, then you would basically have to go much more heavily still on this philanthropic theme. The third, of course, is more when it comes to externalities. So any reasonable Co2 pricing regime of course indirectly solves that issue as well. There, as I said, I'm a big friend of that, because that just indirectly compensates, so to speak, the momentary disadvantage of green technologies basically. So that means thinking about such things, especially coupled with instruments that we have already had for a long time, and making sure that they really work.I think that helps such a discussion enormously.

Anonymous Participant: Maybe a quick question. How do you see the role of corporates in this change? Also in the promotion of these technologies? So, what kind of responsibility do corporates have for the changes in these places?

Anecdotal

I03: Of course, this is a topic that can fill an entire evening. It has several levels. On the abstract level: Is there a moral responsibility on the part of companies to act in the service of society? I'm always more in favor of saying that an entrepreneur or a company already fulfills a social purpose per se, even if it doesn't say, "We're doing this to make the world a better place. Because as a systemically relevant element, that's what you're already doing per se. Then, of course, it

does so ideally under certain framework conditions. That's, that's clear. So if we say we have a certain CO2 budget that we can't exceed in the long term, then we need a framework for that. The companies then orient themselves accordingly and are ideally subject to the same framework.
What other responsibilities do you have? I believe, of course, that within the scope of one's own influence, one should keep the consequences of one's own actions as well under control as possible. The negative consequences, that this is possible, are also about the whole issue of pollution, about the question of how much water do I actually use? How much land do I use? The issue of noise plays a huge role, also in the whole issue of sustainability reporting. This is something I don't have an overview of at all, something I simply have a great deal of respect for. It's incredibly complex, big and difficult. But companies will increasingly have to deal with these things. That is to say, to get clear about these consequences as well. And the third thing is, I think, you have a responsibility at the end of the day to participate in the social debate. Not in a moralizing sense, but simply in the sense of "What can we as an industry do that makes sense in order to achieve the best possible arrangement between what we want privately as private companies and what society basically wants? And if we want to focus even more on the business side. So I think it is our hope that deep tech will work precisely when it comes to the start-ups that emerge from the university landscape or the research institutions, that they will be picked up relatively quickly by the industrial networks, both in the sense of industry as a customer and industry as a potential buyer of these companies.

I03: And then you have the whole ecosystem issue, and that's the great hope, that we move towards each other from two sides and that it works. If you now such a corporate policy area. I don't know enough about that, it also seems to be very individual. Whether that works well or not, I don't know exactly. But this ecosystem logic, if we could somehow manage it, that would be very, very good. And then, of course, the companies, the corporations, have to do something themselves. So I think that we need to recognize that we don't always have to do everything ourselves, but we also need to look at those who can really change something in the system and support them and then also participate in these actions. The adoption rates for new technologies in Europe are much lower than in the U.S., and so is the openness. And it's always this investment here at the moment forward, which is a big problem in my view and that's why so. Yeah okay, but I think I don't want to hijack this now. I actually just want to.

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Interview with I03 23rd of January 2023
Constantin Gehring: Wonderful. The first question would be, in what area do you see the greatest potential for positive change for society through hardware and climate tech startups?

I03: In energy production and alternative processes, away from fossil fuels. The third would be to replace conflict minerals and rare materials. Those are the three big issues. The fourth is the removal of environmental damage that we have already caused. Carbon capture is one of them, and it is a topic that is seeing a lot of money right now. But also banalities like removing microplastics from water and cleaning up industrial waste and so on. There's a lot to do there as well.

Constantin Gehring: Where do you see it working well in Germany?

I03: The whole environmental issue, that is to say generation close to becoming cleaner, we do that well in international comparison. We are, of course, because we are an industrialized nation, we are able to scale large-scale processes. To bring things really big onto the road. We

can do that. Unfortunately, things are looking worse at the moment, especially in the field of renewable energy production, solar and wind energy, which we cannot maintain. We have scaled up very well and are still doing quite well in wind power with large companies in Germany and Europe. But they are not doing well. We are lousy at energy production. We are not going in any comprehensible direction. We have goals that are in conflict with each other and we have to resolve that. We have just seen that in the last Council. This is the manifestation of the conflict of goals. If you don't want to deindustrialise, you need energy. You have to take an undogmatic approach and ask what produces green energy? We don't do that, and that leads to prohibitions on thinking, action and wrong decisions. This is an incredibly difficult social and political issue. But I believe we have no choice but to deal with it. And that leads to some uncomfortable decisions having to be made. But the way we are doing it now, no way.

Constantin Gehring: Maybe if we first take a step away from this conflict of goals, but talk about the fact that startups can solve these social problems in these areas. Would you say that there is a positive trend there and what is going well in Germany right now?

I03: Yes, first of all there is the positive trend that there are quite a lot of startups. This seems to be a topic that moves young people in particular. It's being a purpose-driven entrepreneur and I think that's great. It can be financed quite well in the early phases, if it doesn't require too much investment.
So seed rounds and Series A. However, real deep tech Series A that are larger than 2-5 million are more difficult. Everything below that can be financed well in the early phases. There are also instruments before that with public programmes like Exist. With SPRIND, there is now also something for the very large inventions that I can use in the early phase, even with large sums of money. It has to be said that we are pioneers in Europe. Even the Americans are looking at us because their instruments are a bit dusty. Sure, they do things like that with Breaktrough Energy, which sometimes rests on private and sometimes on public things that are new. It's also great that the SPRIND was invented. So that you can invest in the later stages with big expensive hardware start-ups. I actually always say deep tech or IP heavy. That actually always involves hardware. If it works now, the European Innovation Council is also a good instrument. However, they had big teething problems. But now they should really start spending money. That's a bit better, because they make up to 200 million grand and 15 million equity. 15 million is already a figure, that's quite respectable. But I would say that it stops at 15-20 million. So if a company like Marvel Fusion actually needs 300 million in Series B or C, then you can't get that together here.

Constantin Gehring: Do you see the success of these start ups that we just talked about really being threatened by insufficient funding?

I03: Absolutely yes. First of all, they have to spend way too much time looking for the capital and secondly, of course, that slows down the speed. Thirdly, the most promising ones are then bought away from outside Europe. With environmental issues, that may not matter, the main thing is that it works, no matter where in the world. But it is then no longer subject to the control of our cultural sphere and that can be a problem. We have this microplastic project that someone wanted to buy and put in cruise ships so he could do all the purification of water on the cruise ship. That would have done zero to improve the world and we were able to make sure that he didn't do that, but that we used the technology to get microplastics out of the ocean and out of the rivers. That's what I mean by that. So, if you lose control of a company, then it might not go in the right direction at all.

Constantin Gehring: In which phases do you see the biggest problems?

I03: The chart would actually start with basic research, then you go into applied research. But you're still researching, but you've researched the physics, chemistry and biology and you think this could work. You've built a demonstrator and now you need to build a first pilot, then you're at TRL 4-5 and then you need to show that you can build a product that you can industrially produce and scale, then you're at 6-7. After that you need the manufacturers, you're at 8 and at 9 you go to market. The problem starts with the spin-offs. We are well funded in basic research but we don't give directions. There is no mission-driven basic research, but it is good in itself. When it comes to the applied part, it's already difficult to spin off from universities, to take the IP out and bring it into the company. If a start-up is one that doesn't have the good financing conditions that we've just mentioned, then you have a problem scaling it up, that's where it really starts. When you scale up, there's just nothing. If you do real scale-ups, then you have to have a strategist or get money from abroad, because there is no European scale-up fund.
Now, hardware heavy or deep tech companies already have a higher capital requirement in the earlier stages. These can be described as first commercial contracts and early commercialisation. But that does not describe it sufficiently.
What you are actually doing is the second iteration of your product, which you are commercialising. At the same time, you build the product in such a way that you can manufacture it industrially, i.e. you can scale it up, and to do that you have to build the manufacturing plant. After the first prototype, there are two hard steps. For the last one you may need 1 billion. But even the second step, building a demo factory, can cost between 20 and 200 million, or even 300 million, and even there it looks meagre. If you can do it cheaper, you'll be fine. So if you can build your demo factory for 5 million or ten, then you get the money. If you're above that, you don't.

Constantin Gehring : Where do you want to set the limit? Around 20 million?

I03: Yeah, I think a total funding round of 50 million upwards is insanely difficult because the tickets that individual VCs make stop somewhere around 20-25. Now you could still say that if the lead investor does 20-25, then you can get five small ones in. But of course such consortia are also really exhausting. They're not fast or anything, we saw that with Aerospace, for example, and with Marvel Fusion. They did a 35 million round and that was a huge thing. It was really difficult to get the money together.

Constantin Gehring: Why is it that this capital is not there at these different stages?

I03: The funding is a cycle that has to run. If only one part is interrupted, then there is nothing going on. That's because investors need exits at different stages. That means that if the cycle is interrupted somewhere, there are investors who no longer see this exit. Then they become very reluctant to invest in the market. Then they might disappear, and then they will go bankrupt before that. We saw this in Germany in particular, but also in Europe with the collapse of the Neuer Markt in 2001. That was when we first started to build up a certain equity culture, and the big stock market crash was very negative for that. Other, more experienced markets, such as in the USA, recovered after 3-5 years. Not us. We still have Dax and so on, but even that didn't do well compared to the big American indices. But a tech stock exchange, a start-up stock exchange, we haven't managed that in the last 20 years. This means that the IPO as an exit for everyone is closed and, if you think backwards, the cycle is interrupted. That's why we have less late-stage financing or no money at all, because they ultimately need IPOs or very large

trades. There have been company takeovers like Suse Linux, which was taken over for two and a half billion by a large Swedish private equity company and then floated on the stock market. But those are the big ones, which is not a solution for most start-ups. That was an IPO worth seven, eight, nine billion. That is huge. What we need are IPOs of 100 200 million valuations, so that we can bring such start-ups as we have just described relatively early into this exit channel. So no IPO, therefore little late stage capital. Further back it gets better because these Series A and seed funding have a good exit channel in the form of trade sales when they are not even in scale-up. 85% of exits from high-tech start-up funds go outside Europe. This means that in the phase before scale-up, when there is no financing here, they are sold, which is of course bad for the economy as a whole.

Constantin Gehring: In a nutshell, the exit is closed, that's why scale-ups are so difficult to create and everything is therefore sold beforehand?

I03: Exactly, I say the exit that makes economic sense, the IPO is closed. Although you create liquidity for everybody and the company stays here. It's unfortunately only available to very large companies, like now Biontech or Suse and so on. Only a handful or two hands full, they did it. But they were all bigger than 5 billion and many of them did the IPO in the US, on Nasdaq. Simply because this exit channel does not exist, there is very little late-stage financing and only if there is, then only for the really big ones and not for the scale-ups. That's why they looked for another exit channel, which is trade sales, but that's also led to what's there working.

Constantin : Is the IPO channel just culturally closed? So, is there no corresponding equity culture here or is the market not mature enough?

i03 : It's easy to forget that the new market, until it collapsed, was actually a success. So a lot of capital was activated, which flowed into the new market between 1990 and 2001. So it worked well at first, but the impact was so hard that the market never recovered from it. Of course, this is also a result of various political decisions. So it's a cultural issue, if you want to change culture, then you have to move something socially and make sure that a process of change takes place. For that you need a political process, and that has never existed. No one has ever taken that on. The topic also touches on things like the equity-linked pension, the current assets of many trillions of euros that are lying around passively could be used to at least partially activate such a market. It makes economic sense to also steer state-owned investments in this direction. But none of that has happened, and of course you would activate enough capital if you did that with a few countries in Europe. Of course, it could only be a European stock exchange, then it would work. But no one has set their sights on that.

Constantin Gehring: Is there no awareness in politics that you have to support these start-ups?

I03: They say that it's clear to everyone and that some instruments have been created, such as the Deep Climate Fund. It won't solve the problem, but it shows that there is awareness and that instruments are being created. No one has tackled the issue of the stock market yet. It is simply too far out there. I am very concerned that if we don't do this systemically at the same time and don't close the loop, the other activities won't work either. As long as you put large amounts of government money into it, it might work. But you don't start a machine with it and you keep bleeding. You have to see that the other issue is being played with, but many would then say, calmly take one step at a time. The stock market issue is the elephant in the room, so to speak. We have to do it pan-European. It will be another ten years before we get something done. So let's do the obvious thing. That's not so bad, but I would like to see more discussion.

Constantin Gehring: Where do you see the biggest challenges for investors in Europe?

I03: All the private sector instruments don't trust the politically motivated processes. Now when we talk about energy transition and so on, it's a politically motivated process and it's not reliable. If you're a money investor and you think in 30-year time frames, then you need reliability. I would say the first big issue is the reliability of the policy, because in retrospect, unfortunately, that has not been given. The second issue is consistency, that you can logically deduce what should come. This is also true because many issues are not logically consistent but dogmatic. You don't like that as a rational investor because it's just hard to predict what reaction X to situation Y would be. But that's exactly what you do when you do risk analyses. When politics comes in and there are random decisions that seem to be thrown at you. You have no idea what the outcome will be. They certainly don't like that. The third thing is to have an understandable and comprehensive strategy on a topic. For example, China 2025 or France 2030, it says what the government's focus areas are and what is being done and so on. You can orientate yourself on that. There is nothing like that for us. There is a fragmentary strategy, a start-up strategy, a strategy for the future and other things like that. All well-intentioned, but there is not one piece that says: How do we achieve the energy transition in the next ten years? What are the steps? Just to give an example: Do we invest in issue X or not? If we don't, what is the substitute and how much do we invest? With which instruments do we invest? Just to perhaps illustrate what this means and where it has worked.
When the Americans realised that they were behind the Russians in the Space Race 1958-57, Sputnik came along. That's when they said, okay, obviously the instruments we're using are not suitable for getting into space because the existing instruments only manage the status quo but don't create anything new. So they created two agencies, DARPA, and NASA with the mandate to change that now. And not by a long shot. You took on the societal communication of telling the people that you're now spending up to 8% of GDP and that was really big bucks. Everyone knows the Kennedy speech. "Before the end of the decade we chose to go to the moon", so rock n roll and all that. That was a package. Then you knew that's what's going to be done now until we landed on the moon, and then you could align yourself with that. The industries that emerged, including Silicon Valley and the whole thing around it, are now history. They have done that too. That's what I mean by having a consistent strategy that is also communicated and socially accepted. That's what we lack with these issues and that's not good. Investors don't like that at all, and it's not particularly good overall. Last but not least: as long as there are alternatives, they will give their money to the Americans and because they have a stock exchange, late-stage financing and often a mission.
Like this huge fund that Biden has now set up. Basically, it's "we're building hardware again". Basically, that's it and that's a mission. There's a number and that's what they do. Even if the president changes, they go through with it. They're not perfect, but they're better than us. Of course there are investors who give money.

Constantin Gehring: What would be measures to close these financing gaps?

I03: When we create instruments like SPRIN-D or the Deep Tech Climate Fund, we have to give them the freedom to act sensibly. That is the biggest problem. We do this with great momentum, but then put the chains back on, which means that if you want to enable successful agile action, you have to allow it. The structuring of these instruments is still far too strong. They have the same chains on as the ministries and project management agencies and are then supposed to run around freely outside and build something new. That doesn't work. With every new centre for digital sovereignty, and I could rattle them off now, even the economic stimulus

programmes we have made, quantum computers, AI and so on, we have set them all up wrong. The SPRIN-D too, by the way. For the past three years, I have been working 50% on getting it right so that we can do it sensibly. So structurally we have to set up these instruments differently, much more freely.

Constantin Gehring: Too many bureaucratic hurdles prevent a successful operation in the private sector?

I03: In the environment, but also with the environment. You just asked what they actually want. Of course they want to have partners with whom they can act freely. Since Sprint or the Deep Tech Climate Fund is set up like a public authority, with all the restrictions that come along with it, it can't do that at all and thus becomes an unattractive partner. Therefore, it then doesn't work the way it could. Even if you have to react quickly to a given situation, you have to have a certain flexibility in the structure. You can't deliver a personnel plan for the next five years. That is simply nonsense. If you want to finance unpredictable things, as we and many others do, e.g. the whole science funding, you have to be able to react flexibly to what is learned along the way. But you can't do that if you have to draw up five-year plans. That's rubbish, rubbish. That encourages exactly the opposite behaviour, which leads to a solidification of the systems. Take science, for example: there was even a Nature paper recently about the fact that the number of impactful papers, i.e. the papers that are really important, is decreasing in comparison to the money that is flowing in. Why is that? Because we need to know so much in advance and want to know what scientists want to research so that they can no longer take any risks. But that is a paradox. If you know everything beforehand, then it's not research. Then it has already happened. That's what I mean by saying that in order to have a really big impact, you have to give freedom to the projects that are funded. The second thing is that we have many instruments that we don't even use to promote innovation. The federal and state governments in Germany redistribute over 50% of the gross national product. That means that the purchasing power of the federal government and the Länder is 50% of our economic output. However, this is processed according to certain criteria, which lead to decisions that are often not comprehensible and do not produce good quality. So major projects, something like Berlin Airport or something, shitty motorway bridge somewhere or a building site is all, all junk. Or, as a Cologne resident, we can't build an underground and the archives are about to collapse and so on, that's typical. It's almost normal, with a few laudable exceptions. That's because we don't buy strategically, neither strategically in the sense of promoting innovation nor strategically in the sense of maintaining competition, so that the best solutions really do compete with each other, even during the construction period, and purchasing also serves as a strategic instrument to point the way. So if we now want to expand renewables, why doesn't the federal government say that we will now buy 100 gigawatt hours of fully renewable energy that we want to have stored and ready for use? Then we would also have an electricity price brake in the form of direct market intervention with electricity production. Then you say, what is a gigawatt hour worth to us? Then you say okay, the megawatt hour is worth €9,000 to us or something like that. That would be €0.09 per kilowatt hour, if I've calculated it correctly. The market will align itself with this and take advantage of the opportunity. The federal government offers to buy it for ten years. The spreadsheet is then relatively simple on the revenue side. Now you just have to think about what you're going to build and bang will come an enormous pool of renewable energy that we can then provide with other instruments. This means that government procurement as a strategic tool in the management of such processes is completely underexposed here. We hardly ever do it, and no one dares because it is so ritualised. I mean, the Bundeswehr has 13,000 employees who do procurement, you know. It's completely crazy. Or the special assets of the Bundeswehr. How much is innovation going? 0.0. It's not being

intensified at all. If you are already making 200 billion double bums trallala package, then at least 30 % must go into innovative procurement, because you want to get out of the misery in the long term. So, unfortunately, we are also underexposed in that respect. So the structures are in new and existing instruments. We don't even use many of the funds and think we have to take even more money out of the tax sack. That is not true at all. We redistribute so much that we could use what we redistribute much more strategically.

Constantin Gehring: Are there instruments that are used abroad that are not used in Germany but could be helpful?

I03: For me, market commitment, so what I just described. To say you're going to buy so and so many gigawatt hours of electricity, or you're going to buy antivirals for the next virus. They just have to be broad-spectrum. So NASA says, I'll buy two space capsules that can transport people, whoever wants them, and then it became Boeing and SpaceX. There was no product there yet. That's Advanced Market Commitment or Pre Commercial Procurement. We even have that. The PCP instrument, which was created by the EU in 2008, is only used in Germany outside of SPRIN-D by no one. We have made challenges and have become a role model, because people see that it works. But I ask myself, why has it been lying around for over ten years and why hasn't anyone done it? PCP is when you order a product that does not yet exist, that is not fully developed, but where you do the pre-commercial phase. That's why it's called pre-commercial procurement. Advanced Market Commitment is that you buy a product that doesn't exist yet, but that you want to have delivered. So, the two instruments are there, but they are used far too little and by others, of course, see NASA, very much so and very comprehensively. We don't do that with Ariane6. There, the contracts are haggled over to the existing industrial groups, which have no competition at all and create 0.0 race between start ups and established industrial companies. There is basically a backroom money distribution in the space programme, with bad success, as we can easily see.

Constantin Gehring: I wanted to ask if you have anything on your mind?

I03: Yes, I think we have already packed everything. So if you, if you have the issues of tightening up the instruments in terms of guns greater freedoms still on your mind. That's a bit abstract but it applies to both the established innovation systems and the new ones. There really needs to be a jolt. So that's just a bummer. There's still a lot of small stuff, of course, but that's what the others will tell you. As for the whole regulation for start-ups themselves, so here employee share ownership programmes and stuff like that.

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Interview with I05 12th of January 2023

Olivia Suchy: Where do you see the greatest potential in German society from investing in such hardware projects, hardware start ups?

I05: I already decided four or five years ago to adopt a vegan lifestyle and give up various things. And that was a longer process that we dealt with. Be it ethical reasons, but also reasons of climate protection, which played a role by us, because we said, the way we live as humans now, it can not continue, because we are simply a very destructive part, as far as the preservation of our planet is concerned. But what you notice is that above all the generation that grew up directly after the war, of course, had completely different concerns and this topic was perhaps

not so present at the time. And that this openness to deal with these issues has increased in recent years, but is still far from where it needs to be in order for us to be able to talk about a sustainable change in the behavior of each individual. And I think there are many things where we need innovation in Germany. So we in Germany are still very good at developing patents, for example. I read yesterday, for example, that we are supposed to be the leader in the field of hydrogen patents, ahead of Japan. So if you believe this study or this article. None of this is being implemented. And I think our main problem is that we are not providing this innovation that we need with the right incentives. That the ordinary citizen or even the politician has an incentive to implement these things in the short term and that we then also don't offer holistic solutions in the context.

I05: So I don't know if you know the example of the hydrogen trains in Frankfurt. It's a very classic example. In the area on a line in the Taunus, they wanted to use hydrogen-powered trains, and out of ten trains, only three came. And then the manufacturer says: Well, when the tank is one-third empty, you have to get off, because otherwise it's too dangerous to keep going. The only difference is that the nearest gas station for this is not in the Taunus, but somewhere near Frankfurt, and accordingly these three trains cannot go into operation at all and instead diesel locomotives are repeated, for which, however, the train drivers are lacking and accordingly rail replacement service is currently being operated, because nothing is happening at all. And I believe that we need more courage to put these holistic things on the track, even if they are perhaps unpopular, but in the end they are profitable, also economically profitable. And that this innovation is urgently needed to make our economy fit for the future. Because if our economy is not fit for the future, then in the end our citizens will also suffer because we will lose jobs. Irrespective of the ecological costs, which are presumably more likely to be felt in the long term and therefore only partially by the citizen, and our experience shows that our decision-making horizon currently plays a rather subordinate role. For the most part, I think it's important to create a stronger environment to drive hardware innovation so that we become future-proof. I think you have to sell that more strongly. This aspect, too, that it has an economic component, that you can profit from it, and for that we have to create the right framework in Germany, also in terms of the financing environment. And we are still experiencing a conservative mindset here.

Olivia Suchy: That is, basically agreeing with the hypothesis that the success of these so-called hardware start ups is jeopardized by lack of funding.

I05: So whether there is a lack of funding? That is very individual. And it also always depends very much on which financing round we're talking about there. I would at least agree with the part in general that a lot of things fail because the willingness to deal with venture capital, for example, is not there, unlike in other countries.

Olivia Suchy: In which phase of financing do you see the biggest challenges for startups?

Elisabeth: Perhaps I could also briefly add one more thing. I think that you also deal a lot with commercial banks. I think what we are particularly interested in and where I think we can also use this interview: Where do you see the challenge for commercial banks in particular, in order to enable more subsidies and financing, i.e. also from the point of view of the regulatory framework?

I05: Yes, so what I'm going to say now can't be put in the minutes, I can only give it to you on the soundtrack. The last lessons from the financial crisis was yes, we have to make banks more

stable. And I can do that in two ways. I can make them better capitalized, both in terms of equity and liquidity. And at the same time, I can make sure that they understand risks better and don't take them in the first place. And the various regulations that have been in place since 2007 are also effective in the sense that the banks are well equipped, but their ability to take risks is very limited. And the tenor that we hear across the board is that early-stage financing by banks is not possible from a regulatory point of view. And that's something where there's a political trade off between do I want banks to do that? So it could, in theory, be done by others. Security. And the realization that is slowly but surely perhaps also coming to politicians. And Christian Lindner commented on securitization in the Börsenzeitung at the end of the year. I can't want absolute security on the one hand, and on the other hand want high-risk projects to be financed. So somewhere you have to decide what you want. And I personally see relatively little incentive to roll back bank regulation in this area. So I would say that financing, early-stage financing of funds, startups in general via banks, where we're talking about large volumes, where you have to scale very quickly - that's generally difficult, but I would say hardly feasible with banks.

Olivia Suchy: Anything else you want to add to the question?

Elisabeth: We have seen, in venture capital, that even commercial banks that were not active in the market so far have started to develop products in the direction of venture debt, mezzanine financing for their little later-stage start-ups, so to speak - now in the primary software market. Deutsche Bank for example, Commerzbank also a little bit, but Deutsche Bank had a relatively strong presence there. I suspect that this has now decreased quite a bit. Of course, there is also the shadow banking market, and by that I mean the debt funds, which, just like the venture funds, have grown strongly in the last decade. In the American part of the market, for example, these private venture funds are a very regular and important part of the financing of startups, especially hardware startups. Yes, according to some estimates somewhere between ten and 20%. Every deeptech company in America is funded by venture debt. And yes, depending on who you talk to, there is also the hypothesis that these private lead funds in Europe have by no means exhausted their potential. If you now make a comparison with other markets. But so far, it has not developed as strongly as in America. So that is perhaps just the observation that I have made.

I05: There are an incredible number of offers to finance start-ups in Germany. But first I'm talking about, let's say, low-volume targets. Then you can ask yourself, and we have discussed this intensively, for example with FinnConnect in North Rhine-Westphalia. The question, why does North Rhine-Westphalia, for example, not have a Unicorn? And then there are various soft aspects: many people leave North Rhine-Westphalia and go to Munich or Berlin or somewhere else. There are people who say we have a good idea. When they get it, it's immediately bought up by the big companies that are in the Ruhr region. Because of the shortage of skilled workers in Germany, many good people have no incentive to become self-employed, not least because of the high level of social security. And that's one aspect where, if you transfer that to the banking landscape, there's a realization that we also need equity instruments with this kind of financing, for example. The question - and this is a major structural problem in the German economy - of who needs this and where the demand will come from and when it will come from is difficult to forecast, because we also come from a time when companies had a lot of liquidity in equity and investments in new technologies were mainly financed internally. And of course that's changing now once through inflation and the recession when it comes. Plus the corona crisis, which has also cost many companies a lot of equity and we still have the interest rate rise and so the question is, when do I take this step? So I think the realization is already there. What I can say from my discussions with them in general is that they say we already

know that the financing will come from the transformation, and we're talking about that now, regardless of which phase we're moving through or whether we're talking about established companies, that they say we're not at all sure whether we have enough equity as a bank to be able to handle what's coming our way. In this context, the topic of securitization is always very strongly mentioned. But we as banks are quite active in setting up funds to support early-stage financing, to collect money for it. But we can't do that ourselves.
So, and then the question is why is there more financing in America and not here? And it's often the case, even when we talk to larger insurance companies, for example, that they say, venture, that's quite costly and that's also gambling, and if so, then at most private equity, because they're already more established. What do I get out of it? If at all, then please let Sekoia or whatever in London manage it for me, but I won't do it myself. That is very unfortunate because it also takes away the opportunity to build up expertise. And I have visited very many sovereign wealth funds around the world. And if you talk to the teachers pension funds in California, for example, it's not gambling for them, they say, okay, if I finance ten things, then seven fail, two are break-even and one takes off totally. And that secures my return on investment. And I've been doing that for years.
And I see myself as a financier of innovation, as a financier of locations, so that my location remains attractive. For me, that's the most basic task of a long-term investor who manages the state's pension assets. And many other funds do similar things. Denmark, for example. Canada alone, I think, has 1/4 of its pension fund (we're talking over $100 billion Canadian) in infrastructure investments spread across the board. And they alone have 60 employees who only deal with the topic of infrastructure, but who have this supported externally by Blackrock, where there is a very clear strategy behind it. And that's what I miss in Germany, that in principle this political strategy should be pursued, that this should be taken out of the mud corner, in quotation marks, and that it's not gambling, but simply necessary. And the return figures that are there also speak for themselves. And accordingly, I have also suggested to the Ministry of Finance, for example, that a venture capital component should be included in the issue of equity pensions, so that a certain sentiment is created and a certain expectation is linked to it. Personally, I'm not a fan of fixed quotas that say you have to invest this or that amount in something. I personally think that's the wrong way to go. But we urgently need to work on the sentiment and then there will also be more, more investments in this area, I believe.

Olivia Suchy: Are there any other concrete measures that come to your mind that could be taken in Germany? So besides, for example, this political measure that you just mentioned.

I05: Then we always hear that there are mainly problems in the financing, in the area of the pre-IPO phase and that the money there does not come from Germany. But we can only verify that to a limited extent, because we know that most of the large asset managers invest their money in Germany again via American funds. But not the direct focus, they just give them the money. When I talk to foreign investors, we often see that there is a great willingness to place significantly more money in Germany, but that the money does not find its way. This is also a question of location policy. Someone once told me that if I go to Boston and New York, I can meet 100 different companies within a few days. And if I go to Germany, I don't even know where to go. And then, I have to go somewhere in the back of beyond to visit some medium-sized company. And where do I even find them? And that is also an allocation problem. Initiatives have already been launched, but I believe that much more could be done. And I believe that more incentives, more platforms simply have to be offered to promote these technologies, perhaps also with government guarantees, under certain circumstances to lower inhibition thresholds. But that's not the concrete solution right now. We need product X because we don't believe that it's the one instrument that will get us out of this situation, but we believe

that we need a general change and that we need to support this with targeted measures to attract investors. So that's a bit of ordoliberal help for self-help, which is what we would like to achieve, yes, and not so much to say that we need the state here exclusively.
Elisabeth: On the one hand, as far as guarantees are concerned: I know that the Commission regularly does this with the EIB in order to make it possible to take on higher risk, for example, in the case of climate-related, i.e. climate-themed financial products, with a 95, 100 % guarantee in the background. Would that also be an option for German banks? Or do the regulatory capital requirements stand in the way, so to speak? In the sense that even if you had a high guarantee now, it would perhaps not be divided into thirds in practice, because the credit risk department still tends to think in terms of conservative and risky acquisitions.

I05: So the main problem is that there is actually only one institution that can issue this guarantee. That is the KfW and their possibilities are also limited in quotation marks. So besides the Corona Hilfen and Unipa and others - that's getting bigger and bigger, more and more. So the question is, where does it come from? But in principle, something like that would have to come from KfW if it's a 100% guarantee, which is at conditional irrevocable pay at first demand. In other words, not when the whole insolvency procedure has been completed. We once had such a guarantee in the Eurosystem on a bond and it related to the insolvency of some Austrian bank that went bust. And the guarantee looked like the state would pay if the entire insolvency proceedings were completed after 40 years. And of course I don't need such a guarantee, because it doesn't help me, but then you really have to be out of the country by leaf and there is that. So that is definitely a possibility. We ourselves have launched a major initiative to finance the transformation of existing companies. The German Securitization Platform Expert Group. And there, it's basically about answering a similar question. So an established medium-sized company needs money to renew its machinery and wants debt capital to do it. And they go to his savings bank. And the savings bank may tell him in a few years: "I can't support you because I don't have enough equity capital. The equity capital cannot be provided by the municipalities, so there is no credit because etc.. What is the solution? The solution is to securitize the loans. According to the new securitization regulations etc. and pass them on to the capital market. And we do it in such a way that the risks are also transferred to the capital market, so that the bank can release the equity to grant new loans for the transformation. And that works either by selling all the dreams to the capital market. That is often the first lost piece, or by partially adding a 100% guarantee from a public institution such as the EIB or the KfW on top of it, then that works and is often the only way to introduce investors to these products. We have already seen such transactions, which are also accompanied by the AIF. And if the investors then become familiar with, can assess the risks, the refinancing costs also go down significantly. And then it becomes interesting for more people, because more people do it. And that's another question of sentiment. You need a few pioneers. Yes, that will still be a drag, but in principle it's quite conceivable. Then there must be the marching orders from Berlin to KfW and say do it, because otherwise relatively little happens there.

Olivia Suchy: We talked earlier about best practices from other countries, whether you can think of any others, especially in international comparison, that Germany might still be missing or that Germany could promote.

I05: Instruments. It's one of the main keys that sovereign wealth funds in many countries are driving this role of venture capital financier significantly, in the U.S. the pension funds. But we also see this in other countries like Netherlands. Australia, with its two funds, the Superfund and the Future Fund, has also started large, investment projects in the venture area and also in

the infrastructure area. I don't know which of the two funds in Australia, for example, has also proposed to think about rebuilding this allocation 60 40 and 40 30 30, that always a 30% share is also desirable from a return point of view for alternative investments in the sense of infrastructure and venture capital. And I believe that this is something where we, when we talk to institutional investors in Germany, in products, securitizations, venture, etc., we have to think about alternative investments. Infrastructure, yes, so you have to carry those to chase in some cases. So if there is no real need there, then you don't like to develop in that direction. And that brings me back to the topic of mindset. I think we simply have to do a lot more to address this issue.

Olivia Suchy: Okay, with a look at the time. Elisabeth, do you have any outstanding questions right now?

Elisabeth: Yes, I would like to ask you one more question that is bothering me a bit, where X you know much more than I do. 80% of German companies are primarily bank-financed from banks and often also with rolling loans that are simply renewed again and again in a certain amount, but also sometimes another bank comes in etc.. Wouldn't it be a great lever if more banks turned these loans into green bonds, so to speak, or at least provided them with a green touch, so that the companies would have an incentive to invest in innovation projects with an ecological impact, either in their own companies or through the purchase of start-up technology, even more than they perhaps should have now from their business model, if they are smart.

I05: I think that the thing where we have to be very careful, I think, at the moment is to say we absolutely need green. I'm rather progressive on that issue. So not one who somehow denies this issue or pushes it off the agenda. We are currently seeing various lawsuits in the USA. They are in the form of accusations that managers of investment funds, for example, have neglected their return targets because they have deliberately focused on sustainable assets. So I think we have to succeed in showing that, in the medium term, the return on green bonds makes much more sense economically than temporarily foregoing returns for moral and ethical reasons, because I think that would simply involve various legal difficulties. Personally, I also think this is the wrong approach. Unfortunately, I think this issue will be resolved sooner or later anyway, because if we break more temperature records with El Nino, then the damage will materialize much more strongly and then I think it will also be reflected much more strongly in the company figures and risk models. The second question is then, what is actually green? And I'm not a fan of saying that only the wind farm is green, but rather that where we still have to go is to say that I have a company, a classic company. It has recognized the need that in order to continue to exist in the future, it has to transform. Digital, sustainable, whatever. But it has to change and we have to finance this transformation. And that part, we also have to keep a very, very strong eye on. And there are so many different approaches that I personally, for example, partially understand and partially don't understand. I don't know if you've heard of the Green Asset Ratio, which is currently being discussed among banks. The idea is to make it mandatory for banks to hold so many green assets in their loan books.

Anonymous participant: This is an initiative of the ECB.

I05: The EU Commission. When they then talk to the banks, some of them say completely stupidly. Where am I supposed to conjure up all the green stuff, because they have fixed corporate customers in the portfolio? I can not now, if I, let's say the German economy, let's say here is and I need them but there then I can not prescribe. Where am I supposed to get that from? Because then I automatically cut off the others who are willing to transform themselves

under certain circumstances. So they took note of that and then said: Well, that only applies to large companies, i.e. those that are large according to the EU definition of medium-sized companies. Okay, well, that still misses the mark a bit for me, because that's a moral and ethical component where we say that's where we have to go and that's all we have to finance in normative terms. But we don't really want to finance the way there. So how can we get around that now? In the case of securitizations, for example, we discussed for a very, very long time with the EBA within the framework of the EU Green Bond Act whether the asset pool that is securitized, for example in the case of Volkswagen cars, has to be red green, i.e. electric. And then Volkswagen says to us, well, then we don't issue any more assets, because our asset share that we currently have in electric is 20%. So if we would then make these emissions, then it would be obvious that it's greenwashing. But if we then only have green electric cars at some point and say when we're above the 50% mark and so on, what do we still do with the combustibles because they'll be brown. And then we won't get them financed at all, even though we're also doing that. So we completely do without the instrument then. So that's not necessarily conducive either. What did we say? We said, okay, it would be a good idea to base it more on the so-called use of proceeds. That means that the funds that come out of this thing must be demonstrably used for green projects. So, for example, they have to be used to make the production line green, etc., etc. And I think this part should also be emphasized in the Sustainable Finance Advisory Board, that we say that what we want to do must also be rewarded, so to speak, so that this journey to "I'm going green" is also financed and rewarded. And we can see that there is a lot going on, let's say, but that the political discussion is often very black and white. How green really means exclusively new technologies, How I get there, that is actually rather then not quite wanted and that is always the question, then also the definition and the taxonomy. The question is, what is actually green at that moment? This is also an issue for the banks in particular, where there is a great deal of uncertainty at the moment, where they do not know exactly what can or cannot be financed. Because the queries that have been made so far by the Bundesbank and BaFin on the subject also ask the question "Who has granted green loans? Yes what? What is a green loan? So it's the craftsman who renovates his building because he wants to save energy costs.

Is that already green, or do they say that's transformation financing? We actually think that's necessary, but it's not green, so we can't sell it. I can't think of a suitable example right now, but I think we also have to say how we get from A to B, and I think we have to reward that more. And this part, if you spin it a little bit further, you can definitely say, for this, and not only for the normative reasons, is completely decisive for me become alone. But also, because we believe that the economy has no future in Germany without transformation, we also reward this part, and more could be done there. My last point is that if you look at the figures at the moment, for example, the question of whether green bonds can be submitted as collateral to the Eurosystem for refinancing operations and lower risk weights can be applied there, then you simply have to say at the moment that this is not materializing in the risks.

Based purely on numbers, green projects are not preferred at the moment, rather the opposite, because we are still early stage in many areas it is even riskier. So it's then a political process that has to get going, because to tell a bank regulator like that, you have to take the lower risk weights for green because it's supposed to be promoted and the bank then grants more loans under certain circumstances because it's more favorable for them. But if that can't be reflected in the numbers, then it doesn't work. Then I'm back to the point of guarantees, where I can say that if I want to achieve certain transformation goals, then I'll just promote the transformation. Kind of like how they said if you need a solar system on your roof, then you get a cheap KfW loan for it. Then there is an incentive mechanism that people also pull and use. And I think this component has to be expanded much more, extended to many more instruments also in the area of all states. One last point. Well, what I also don't understand, for example, is when you talk

to representatives of the authorities in some cases. Then the consistency argument is always very strongly coined. If something applies to everything, for example capital gains tax, then I can't exclude product X, because then the whole thing is no longer legally consistent. But why don't I go there, for example? And there are the first funds in Germany, so along the lines of invest €100,000 in a venture fund. And that was one of the first opportunities in Germany last year, where you could go directly there privately, where then money was asked for 7 to 10 years, let's say and gone. For that you also get return X, Y, what venture investments are. But then why don't you do something like that as a retirement model in Germany. That one says, the people who can afford it in quotes. You can talk about the limit, but if you're allowed to invest in it, they'll get such investments tax-free if they hold them until they're 65. No capital gains tax on them, then they expire. How much money would go in all at once, how many funds would shoot out of the corner all at once to finance ventures. I don't give this economic incentive, then nothing will happen. And that's how you get the shift in the mainstream. Because if you look at the people in Denmark before Corona they bought Copenhagen Airport and then Corona came and nobody flew anymore. And then the auditor in Denmark says to the Danish pension fund: Yes, say hello, how do you actually rate Copenhagen Airport now? And was it such a good idea to invest in it, etc.? And then they said, well, we have to go through it now, two years. But so in the medium term, people are flying, there's business there, etc. So that was a good investment, I can't evaluate the Market now for two years, but so be it, we have to get through it.

So when you talk to German institutional investors, they cross themselves, drama and the devil's stuff and just not. And they don't understand that in other countries. So, as I already mentioned with California, for them it is quite logical that a pension fund finances ventures in Germany, when you talk to them, there is a complete disproportion between opportunity, return, risk. Where do we want to go, that it is also a task, perhaps a social one, to reinvent ourselves in general, also in Europe. That is not seen there. So I believe that incentives can be set in the entire allocation criteria, because I can tell you one thing from the discussions I have had with the savings banks and Volksbanks on the subject of securitization. Some of them don't really know what green is, but it's clear that you have to transform yourself. And they are very, very aware that they themselves don't know how to finance this, that alternative instruments are needed. And it's not as if they're now saying we wouldn't invest in early stage, but they can't because of the framework conditions. You don't have to change that by means of risk weights, but you can use these incentives, models, guarantees, returns, tax exemption, etc. to help them help themselves in this area. From a political point of view, we are in a discussion where we are at the very beginning, if not more. I am also involved in the project, but when we talk about the topic of pensions, for example, 10 billion is a start.

Yes, but what asset classes are we talking about then? Why doesn't anyone go and say people, we need several 100 billion, that's the goal. I mean, good, that's what Christian Lindner said. Fair way, however, and we also have to finance venture. And then it belongs but also politically. And that unfortunately requires the transformation that you also have to endure risks sometimes. The Danish pension fund made a loss of 37% in the first half of last year. Press conference says Yes, we have now lost 37%. In the first half of the year over the last five years, we still made an average gain of 20%. Yes, so what if you then do the math, €100 billion profit in five years and you just have to get through that. Just think what would happen in Germany. Bild Zeitung will immediately headline: Finance minister destroys Germany's pension house and then you see some old granny standing in the soup kitchen etc. and so on. So there it needs, I think, also in politics a big change. We need more reality and truth there. And we simply have to be more courageous. Exactly. Maybe they transcribe the transcript so that I don't get hung afterwards, but I'm always a friend of frank words. And yes, I hope you can start with that.

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Interview with I06

Olivia Suchy: The first question I would have is. Where do you see the greatest potential for positive change in German society? By funding hardware start-ups. At the moment.

I06: For society, to increase the adaptability of the whole economy?

Olivia Suchy: Are there any particular sectors that stand out to you or that you would particularly emphasise?

I06: No. In general, I have the established companies and when I then have young, technology-oriented companies and I have a functioning ecosystem there and thereby enable them to grow faster, I don't know where the challenges will come from in the future, but for me that is first of all the overriding goal and the overriding benefit.

Olivia Suchy: Okay, before we get into the challenges, are there any particular tools that are working well or being used well right now for funding hardware startups that you can think of?

I06: I think the whole topic of venture capital is on the rise. If you look at the market development over the last seven years, the investments of venture capital companies in Germany and in Europe as a whole have increased by 25% on average every year. Now let's leave out 2021 as an outlier, a positive outlier. But this trend is unbroken and I believe it will continue to increase. Or that must be our goal, because first of all it enables companies to tap into this source of capital, where debt financing does not yet work at all. Yes, that is a learning curve. The ecosystem has to develop further and that starts with the corresponding lawyers and ends with the mindset of the investors. It has to be anchored in the investment plans of the respective investors. At the moment, it's not so firmly anchored there. But we can talk about that later.

Olivia Suchy: Okay. Yes, perfect. We can address that briefly in the challenges. The next point would also be to ask, first of all, do you agree at all that the success of hardware start-ups is endangered by a lack of funding?

I06: Yes, I would say so.

Olivia Suchy: Can you go into more detail about how and why?

I06: Yes, it's or two-part. I think what we have seen now was in. So it always comes in waves like that. In 2021, the investment volume was driven up massively, essentially also capital that spilled over from the USA to Europe. I believe that 40% of the total investments ultimately came from the USA. And that is capital that flowed in very quickly and is now also flowing out again very quickly. But that is incredibly unhealthy for such an ecosystem. And I think the goal is rather to enter into such a stable development and to have the commitment of the investors in the longer term. And that's why I would say financing is still an issue. Okay, even though I didn't have an issue in 2021, everyone who could somehow write their name straight got money. But that's also incredibly dangerous. So they had the issue at the beginning of the 2000s and then the ice age. And we want to avoid such a situation at all costs. And now the trick is to make sure that we don't slip back into it and systematically develop the market step by step with stable players. But the topic of financing is still an issue.

Olivia Suchy: Okay, we'll come back to the players later. I would, when we talk about the issue, I'm tired of being prepared, maybe we can talk about that briefly. We did touch on briefly earlier, VC's. You can see the screen here.

I06: Yeah, I need to get a little bit bigger there.

Olivia Suchy: So we have different phases of start ups in development here. And my question would be about this. Where do you see the biggest challenges for the financing of start-ups, perhaps also challenges from the investment side? Exactly.

I06: I think especially in the. When I enter this growth phase, I am the first in the seed phase or Series A, I have established players, I actually have quite good money, I have my business angels, I have my HTGF, that is stable, that is good and I also need manageable amounts, that works. It gets more interesting when I really enter the growth phase, i.e. Series B to D, where I need larger amounts. And then I sometimes think there is a danger that I, as an entrepreneur, lose influence on my company or get players on board with a different mindset who are short-term oriented. These are now the US players or I bring in corporates and I don't yet have any debt capital as a financing instrument, that doesn't fly yet. And I think that is the point where special attention should be paid in this growth phase. So I think it's relatively relaxed at the very beginning, we're already well positioned, we used to have an issue ten years ago.

Olivia Suchy: Okay, that means the first two phases, the Greens say they are okay. And then from the technology validation, first commercialisation, those are then the...

I06: Yes, Technology Validation First Pilot. So if I'm not exactly a biotechnology company with some long clinical research topics, but I think this first piloting, that is, I don't need so much capital yet. But especially when I look at the scale-up phase, so now I'm really taking an example, I'm now somehow active in e-commerce and now I'm making my prototype, I for my business, I can do that with relatively manageable capital. But if I want to expand across Europe and really scale up or expand my value chain vertically in areas where I might have regulatory issues and then need a completely different mindset, a completely different skillset, different manpower or a high marketing budget. So now to give an example, I need the money and I'm not cash flow positive yet. And then I burn money and I need people with deep pockets and good nerves to finance it for me.

Olivia Suchy: And also especially in terms of hardware start-ups, that's probably much more expensive than...

I06: Sure, first I have a small production line. I'll build a prototype. But I don't earn any money with it yet. And then I go into series production and build up my sales. Also in the hardware sector. And that's where I really need capital.

Olivia Suchy: Okay, that means you only see the biggest problem of the financing gap from this phase on. Yes, build up. Okay. And if we maybe. It's not always easy to talk about this suffering, but I wanted to show them. We have different risks for your capital providers. And it would be interesting to see what you think which risks have the most value when it comes to hardware startups. Which ones cause the biggest problems when it comes to investing. There are of course other risks than the ones that are just listed here.

I06: Yes. Yes, I think the technology risk is less the case. I would say the change in management, in the leadership team. I'll take an extreme example: I have a founder from the university who has developed a great product and is also a great inventor and knows the technology inside out. And the prototype also works and the customers like it with a hook on it. But all of a sudden I need a completely different set of skills in the company, which I have to put alongside it. I need the marketing experts I need all of a sudden. I need the whole business skillset and sensible management on top of it. I have to build up HR and scale it all up so that it works and doesn't fly apart, because I can't run the company the way I ran my 3,4,5 man business. That's where I see the real risk, not so much in the technological area. And then, of course, it always depends on what kind of product it is. If I have something now, that's a competition risk. Of course, other players also see my product if it's something I can copy relatively easily. Then a business model can collapse again. So those are the two issues that I find most difficult. I'm probably looking at the first one, which is to subsume founder risk.
Yes, I think distribution risk. It's all a bit related to that. It probably means that I am now somehow building up a reasonable distribution. Yes, but that's all under me. Yes, the new management team and the founder. I don't want to push him out, but he can't have these skills and I have to give him congenial partners to work with.

Olivia Suchy: Okay, I understand.

I06: And by the way, that is also a very big, very big task, a very big issue for the investors, if they are really good. And I have some here who are familiar with the market and with the custom, that's something. It's not just about providing capital to finance these start-ups, but also about bringing in this know-how, these management skills, that's something that an investor also brings along in the best case. So if I get a good VC in front of me, he will also help me with these issues.

Olivia Suchy: Absolutely. Besides the risks that we just looked at, there are certainly other reasons that are responsible for this funding gap. And I'd like to go back to the cultural and systemic factors, if you can think of any, as to why this funding gap exists.

I06: Yes. That's kind of when I play through the investors. They are. Many of them are quite conservative. So who comes into question as a potential investor? As a rule, they don't invest directly in start-ups. I'm now mentally going down the path of VC funds, and there I have insurance companies, pension funds, pension funds, foundations, family offices as potential investors. If I simplify it, all these players have now gradually moved closer to alternative investments in the low-interest phase. In other words, I have my public markets, where I simply buy bonds to invest my capital. Or I go and invest in any listed companies. Hooks on it. That's the traditional approach. And then in the alternatives, you can imagine it like a staircase, then I start and usually these investors start to invest first in infrastructure and any housing issues, any office buildings. That's easy. You can grab that. I can assess the risk well. Then I go further. Then I have private debt, where I might finance some infrastructure projects, some wind farms. That is also an issue. They are usually quite flat-chested. These alternative investment teams at these institutional investors, if they have entire teams at all, they only have the really big players and then at some point we come to private equity, they invest in it and only when they are through there do they approach the asset class of venture capital as the very last thing. And if I run through this food chain, there are not so many of these investors left who are familiar with the asset class venture capital. And I think that's an issue, to raise awareness and to attract these potential investors to the German market, where there is an enormous amount of capital, but it

tends to flow more towards infrastructure projects or private equity in the USA or Asia than towards venture capital in Europe.

Olivia Suchy: So it's the mentality of the investors in this case, so to speak.

I06: Yes, that's for sure. I first have to have the desire and the courage to create a pocket in my asset allocation for venture as an additional asset class. And if I have made quite good returns so far and perhaps my return expectations are not so overambitious, then I say that's human, why should I make life difficult for myself and take on the stress and I don't have the people, then I'll just do what I've always done and not try anything new. That's quite a large group of people who think like that.

Olivia Suchy: Yes, and how do you assess that in comparison to investments abroad? We have often heard that Germany invests differently than America, for example. Do you see any notable differences, especially with regard to hardware investments?

I06: If I think about institutional investors, they tick quite differently in the USA, for example. There they invest much more in alternative assets and then again much more in venture. The asset class is more developed there, it is even more professional, but the investors know it better and therefore much more capital flows into it.

Olivia Suchy: Okay, and then in addition. Now we have talked a lot about the investors themselves in terms of politics. Do you think that politicians understand that there is a need for more hardware start-ups and that software start-ups are no longer sufficient as they have been invested in until now? Is the awareness there at that level?

I06: I think so. I think, yes, they already have. Even when I have my conversations with the departments, they already have it on their radar and try to push the issue. I think that's always dangerous, isn't it? It's a double-edged sword. I know, the restaurants, it's also good. They are very much there to do something afterwards. I just have to be careful not to become too active as a state. Let me put it this way: if I now feed the venture capital funds, for example, and thus indirectly also the companies, for the most part with state investors, then this is not really a self-sustaining ecosystem. And to find the measure and the middle ground, i.e. how much state do I take in to create reliability and at the same time still be attractive for private investors? I think that is the art. And I personally see a huge potential that can be developed in a stable way in the long term. If we succeed in attracting the large number of investors that exist here in Germany and Europe to this asset class. That is the real lever. And then I see the state more as a state, now as an investor, that it then pushes certain topics more strongly, drives them forward, develops them, but less now in the broad area. The broad area. This must be supported by mobilising private capital. And then I can say, now I'm making a tech fund here and maybe I can set up special funds there to push female yuppies. These are the accents, this direction that I can steer in order to get something moving in the first place. I think direct state investment is very good for this. But the firepower of the state and the appetite of the state will never be enough to push the entire market into these spheres, which would be necessary. But the state has also understood that. So both the Federal Ministry of Finance and the Federal Ministry of Economics and Technology as well as the Chancellery have this on their radar.

Olivia Suchy: Okay, that means that we are actually moving perfectly into the possible funding measures, very smoothly. And that's where my next question would be very broad. We have already addressed the possible solutions from the government side, but what concrete measures

could be taken in Europe in general to close this financing gap and to support hardware start-ups more. Or do we refer to Germany? Maybe that's better.

I06: Yes, I think these are always such topics. Then I have the management fee and the VAT issue, where I say I simply have structural disadvantages. But every VC fund can probably sing a much better song about that than I can now. These are the standard disadvantages where I have better conditions in the UK or sometimes also in France, and I think these are hygiene points that the state should simply adapt so that the tax framework here is competitive. Full stop. Of course, if you ask the scene, everyone always says that everything should be free of charge, with three bonuses and whatnot. So you have to make sure you don't overdo it. But I think Germany can still do something about that.

Olivia Suchy: Okay, so in your opinion the three most important actors for this transformation.

I06: So transformation now for the hardware start-ups?

Olivia Suchy: Exactly for the sustainable transformation and thus above all taking into account the hardware start-ups.

I06: Yes, so what I don't know about now is the tax framework for start-ups. But I think I come from the capital side and from the venture sector, and I think it is very important to advance the venture ecosystem and make it stable, and what do I mean by that? There are so many different topics involved. I need to mobilise capital, which I already mentioned, because there is a lot of money. Basically, it needs to create the necessary trust and a certain credibility so that the asset manager dares to enter this asset class for the first time. Because the poor guy, if he sinks the money, he gets his head ripped off and then he kind of, he can't really win anything. So I have to build him this bridge to lead him to it. And that's what KfW Capital is doing now. I need a serious player, active as a funder, who has the know-how, who is serious and says you can rely on it if you try it out with me. Maybe you'll get three more basis points from another player. But with me you know that nothing burns, the risks are out.
So now that somehow the compliance is not right in the fund, etc., all these issues, and then I have a fund of funds, that is, I spread my capital as an investor over many VC funds and then I say, okay, then I'll try that out and then he likes it and then he sees a lot of other VC funds with us and can take a look at them. And that's what we want. And then he says, look, cool, that's good and the return was good. Then he goes back to his superiors and says, "I invested 25 million last time. That works. I have a better feeling now. Now I'll take the next step". There was something about VC Fund X and now I'm putting money directly into it. So we say, "Well, that's great. Or he says, "No, I'm going to make a follow-up fund with KfW again, but we can already put in 50 million. That seems to be a sure thing. I understand that now. Or he gets an RTD approved internally and suddenly has an expert who then also wants to specialise in the asset class of venture capital. So that's the set-up, that the, let's say the ecosystem, then I also want to make the VC funds more stable in terms of professionalisation. Let's take the example of ESG, where there is also a bit of a danger.
Now I have this whole SFDR debate, article six, article eight, article nine, and then many funds write and we see some that say Oh come on, I'm an eighth, but actually they're not an eighth, that's crap, that's crap for the market, because I'm gambling with trust. And that's where we see a task, again as a large investor, to try to improve governance in the funds and to say, look, there's the issue of ESG, take it seriously, we'll help you develop tools so that you become even better, so that it's easier for you as a VC fund to attract capital again or reporting requirements. So that's what I meant by market development and then next. What emerges in an evolutionary

way are all the service providers. I then have all at once and it takes time to develop that. I then have capital management companies that specialise in managing the VC asset class. I have law firms that in turn build up know-how and staff for the topic of due diligence for VC funds for investors. And then the whole thing keeps growing. And that's the part where I see this huge potential. So it's not just a matter of the government saying, "Oh, cool, next year I'll make the following fashion trend or I'll put 500 million into it," but rather something that has to continue to grow every year.

Olivia Suchy: These are already best practices, so to speak, that are slowly becoming established, but still need to be promoted, if I understand correctly.

I06: Exactly.

Olivia Suchy: Yes, okay.

I06: There's an incredible amount happening, especially in a positive sense.

Olivia Suchy: And besides these best practices that we just mentioned, are there any other measures that should be taken by other actors or by the same ones that we have already discussed that just come to their mind?

I06: Yes, I still have, let's say, product innovations. So what can I do again. Now I, I go back to my investor. Now I first said, how can I get more money into the asset class of venture capital. Of course there is another trick I can do. I can pump money into the asset class venture capital without him having to mark money in his asset allocation for venture capital. So what do I mean by that? For example, I can set up a fund where I issue bearer bonds. This is also done with the growth fund and with these bearer bonds there is then conditional interest and fixed interest. And suddenly the investor is no longer a limited partner in a fund of funds in the asset class venture capital, but buys an investment-rated bond, a bearer bond, and then the capital for the insurance does not come from the budget pot venture capital, which is much smaller, but from the budget pot fixed income. And all of a sudden this player says cool, actually I could have only done a 20 million ticket, but with fixed income you get 100 million. On the other hand, I have to build the counterpart, so to speak, which is even riskier capital. Then again, I have players who say, I'm actually quite familiar with the asset class of venture capital, and now you've built me something leveraged, which I find totally exciting. Then I'll do it, because I still have a yield kicker in it. These are rather savvy family offices and they can really boost their returns with it and that. That these two interests then come together again. These investor interests generate new capital, which flows into the market. And if these models also work on the market, then I have completely new opportunities again.

Olivia Suchy: In other words, this is also a bit about either I take a higher risk, i.e. that the risks we also wrote about and discussed earlier are with hardware, or I don't take this higher risk and then expect lower returns. And what you just mentioned would be a way for an investor to balance it out exactly, so to speak.

I06: Exactly. He simply buys, he somehow gets a 5% preferred return, so he gets 5% interest on an investment grade bond, he puts his capital into it and then I have the counterpart, so to speak, some other investor who takes a lot of risk to finance this fund. And both together finance the fund. The fund can then have more money to invest in hardware start-ups. So I can't really understand the interests of the investors, aslo where do they come from? What is their mindset?

and I can play with that, there are different currents, but you can't do it like this, like that, like that, that also has to develop, that's the, that's pretty high ramp-up costs, pretty high fixed costs. Everything has to be clean in terms of tax law, clean in terms of regulation, and it has to function sustainably. I have to understand what makes the various investors tick, what their regulatory requirements are. That's a different kind of fundraising than saying, "Hey, cool, I have a VC fund here, give me some money and I'll invest in the following companies in the following sector. That is much more complicated and you need a much bigger team. But if you manage to do that as a fund of funds, the money also goes out into VC funds and then back into the companies.

Olivia Suchy: Okay, is that understandable. Those were, those were all the interview questions that I had prepared, maybe from my perspective. With the background that I have. I am simply a younger generation that sometimes looks at the state. And I think, okay, we don't have that much time anymore, why is it all so slow? And I understand that this is a slow development and that something like this needs time. And that's why we also conduct these interviews, to understand what, what we can pass on in our publication as promotional measures, to really improve something in the end and to accelerate something. But it was definitely super exciting and I thank you again for your willingness. I don't know if there is anything else you would like to add from your side that I might not have asked.

I06: Yes, I have still left out one instrument completely, but of course I could build it up and then I would be in completely new spheres. That is that I would move from a purely pay-as-you-go pension system towards a funded approach, and then I would build something like what other countries already have. I could then have a sovereign wealth fund. Christian Lindner has these 10 billion. I think the Bundesbank is managing it now, so I would be careful. It doesn't matter who does it, but if I now say okay, I'll take a certain amount X, which I'll invest smartly today to dampen the pension contributions of the future, and then I'll look for professional investors who will manage this fund, so to speak, just as I have these large sovereign wealth funds in the Middle East, I have Singapore, I have Norway, there are dozens of examples, and that works, too, and then I can set the thing up seriously. And then, of course, I have completely different capital in the market, a fraction of this money would then flow in the direction of venture capital. Of course, the majority will not go in the direction of venture capital. That would not be serious, because the risks would simply be too high. But I can take the income from that to cushion future increases in contributions. That would be a real hammer. So in summary, I would successively develop the market as it is, try to mobilise the capital that is already there, that is, in Germany and Europe, in the direction of venture capital. For VC funds, I would simply look at what I can improve tax-wise. Of course, at the portfolio company level I also have to look at that. That is this. And then, of course, I could also look at a funded or sovereign wealth fund, which would allow me to enter completely new spheres via the pension system. That would be particularly exciting for you.

Olivia Suchy: Yes, definitely. Super, super exciting. And that was definitely a completely new insight. I learned a lot. Thank you.

I06: Last comment. Please, please, please no actionism and not too much state acting alone. Always the feedback. So the worst thing I can do is that every year or with every legislative term. I say that, because I've been in the political business for a few years now, and now the new minister wants to announce a 10 billion fund and then some crap is written down that the poor ministers have to pay for. Köhler is then the one who suffers. You already had him in the interview. And then there's always something together that perhaps still misses the market. And

somehow, three years later, it's cold coffee and I think up something new. That's sort of how it would be badly done.

Olivia Suchy: Yes, that's certainly a good, good contribution to the measures for that. Do's and don'ts that if we definitely take in. It could be that if you have any other questions, feel very free to get in touch with me. Anytime. We'll evaluate the interviews and maybe we'll have some more demand like we, we'll kind of email it if that's okay with you. Yes, and otherwise, thank you for now for the interview.

I06: The draft. Is it an anonymised elaboration or is it not anonymised? Or how does it look on the timeline and with your report? I would find that exciting again, or how does it work then?

Olivia Suchy: [00:48:02] Well, we have our first 15 interviews now and we will evaluate them. Now, in the next three weeks. First of all anonymous. If it should be something personalised, Friedel and Elisabeth will definitely consult again and from that we will decide whether we will do more interviews or not, whether we will go more specifically into certain directions. And we want to have the publication ready by the end of May. And if there are statements etc. that should or could possibly be used, we will definitely ask again and ask for consent.

I06: And who does the publication go to then?

Olivia Suchy: To the federal government. We will then make it public with anonymised interviews. It is not yet completely planned how exactly the strategy will be, because it really depends on what kind of picture we get from all the interviews and what comes out in the end. But it is planned that the publication will be made public on the Sustainable Finance Committee. On the website you can also find the old publications. Exactly.

I06: Okay, great. And then one last question do you want to send them to me as well? Interesting, when it's done.

Olivia Suchy: Of course to all interview partners.

I06: And did my statement that would still be exciting coincide with the previous ones or did you find any deviations? That would be interesting again.

Olivia Suchy: Partly, partly. So we interview different participants of the ecosystem and also startups and VCs and that.
The perspectives are very different and the same question can lead to very different answers. I didn't expect that at the beginning either when we created the interview questions. But in fact it is the case that everyone naturally relates more to their own sector and knows best about it. That's why it's not so often that they completely overlap. We already had from certain interview partners the statements that the state does not have enough awareness. Then we had statements from other interview partners, such as yourself, that the state definitely has the awareness and is already acting, but that it takes a little time. So there are very different statements, but in principle it is in any case the case. What is consistent is the statement in the interviews so far. I have to evaluate it again and really determine with codes at the end whether what I'm saying is true. But the basic statement was that the state has to act, but rather through this push of money and not through concrete interventions. And exactly, also the phases agree very often, so the teams where hardware, startups have the biggest problems have funding.

I06: I have another highlight, it just occurred to me. What about the don'ts. There was once a passage in the start-up strategy and you read it again and again. Where it says: Yes, the large private capital collection agencies and investors should now invest a certain percentage in the direction of venture or something. That is, of course, an absolute no-go in my eyes, in terms of regulatory policy. It sounds good in the short term, maybe it's populist, but of course I'm scaring off the investors. They also resent that, because I want the opposite. I want trust. But the Federal Government has understood that, and there are also different currents. But I think they are doing it quite cleverly now.

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Interview with I07

I07

Constantin Gehring: In which three sectors and technologies do you see the biggest potential for change through climate tech startups?

I07: All areas where energy can be saved, CO2 reduction, energy reduction, energy efficiency, that's a huge, huge area.

Constantin Gehring: Where would you say the transformation is working well at the moment? What is an important driver?

I07: That's a bit of a cliché: in every crisis there is also an opportunity. But we can already see that due to the climate crisis, many start-ups are now on the move in the fields. According to the Start-up Monitor, almost 50% of start-ups belong to the green economy. Certainly not all of them are. HelloFresh, for example, says it makes the world sustainable because it shortens distances. But that's debatable. Overall, I do think that the climate crisis is a driver because startups act as problem solvers. In this respect, it may sound a bit paradoxical, the crisis itself is a certain driver for solutions to problems that exist acutely, but for which there is currently no solution.

Constantin Gehring: Do you see the success of these start-ups endangered by insufficient funding?

I07: That's exactly the core question. I find it quite difficult to answer that in such an abstract way. I do believe that the situation in 2023 is different from what it was in 2021. That was an absolute record year in venture capital investments, which were very, very large. Compared to 2020, almost a threefold increase. So there was a lot of money in the market that was also raised by VCs. Now there is a war in Ukraine and an overall uncertain economic situation. Some stock markets are collapsing, including in the US. This means that exit channels are currently more uncertain. Rising inflation, rising interest rates, these are all circumstances that tend to show that this record year will not necessarily be repeated. That's why we have to look very, very carefully to see whether this normalisation leads to companies that are aiming to be part of the solution to the problem falling through. I don't think there is a completely uniform answer to that question at the moment. I can see that there is a certain danger that they will fail. On the other hand, I see that these kinds of VC funds, which are now fundraising or have been fundraising, have been able to raise more money. Which also means that the start-ups with this orientation should have an even easier time than in the past. In this respect, I think there are two developments that are not contradictory, but that have to be seen in the overall picture. The more VCs there are that are aligned like Planet A, the less need there will be to actually add to

this. That is a pretty crucial point. It is probably also the case here that the crisis is and can be a major driver. That's why I find it a bit difficult to make a definitive judgement at the moment. I think you have to observe very, very closely how it behaves. Whether VC companies that don't have this orientation per se will still go into such projects, even though they are a bit more risky and don't correspond to their normal investment structure.

Constantin Gehring: Would you say that the growing number is helpful for female founders in the scene, in clean tech startups and high tech startups?

I07: I think impact and deep tech are harder to get money for, because you have longer development phases, much higher technical effort and big uncertainties. These are all points that are not so sexy for normal venture capitalists. So, to exaggerate a bit, you could say that this is changing now. But in the past, venture capitalists themselves were often relatively risk-averse. I think this problem is particularly evident in the area of impact in connection with tech. Often it is precisely the special innovations, i.e. the classic deep tech, that leads to these problems. The focus in the past of normal VCs was purely agnostic, that they just couldn't map that. I think that's changing now because the opportunities are much bigger now and the need for it is much more palpable. The risk-reward profile has improved significantly for the impact tech sector in favour of that of the startups.

Tino: Would you make a clear distinction between hardware and deep tech? So would you say, so about problems that you have talked about, we can also talk in the hardware area? Or is deep tech special again?

I07: I would see it already further than now pure hardware, but probably it's essentially now it's about that.

Constantin Gehring: From now on, please name when you refer specifically to deep tech. In which phases do you see the biggest problems?

I07: So on the issues of deep tech and venture capital as a whole. There was for a long time and that's also changing, the assumption to say a venture capital fund closes after ten, twelve years. If a development cycle is much longer, then that doesn't fit at all. What critics describe as the pig cycle from the private equity sector. That doesn't fit. With these closed-end funds and the clear maturities, I always have investment phases. If I come out of this construction, I don't even manage to finance these really driving innovations, because this long-term development doesn't fit with this medium-term financing. That was one of the reasons why this Deep Future Fund was founded. I don't think there is such a problem because, as on the slide, the phases interlock. We have said for years in Germany that growth financing is a challenge. Especially as far as European investors are concerned. But it's another question where the capital comes from. In the meantime, financing bottlenecks in the growth phase have been minimised by non-European capital. That is certainly a fact. In this respect, there were difficulties in growth financing for a long time. But that was also due to the extent to which the ecosystem is growing. It is positive when this demand arises, because it shows that something is developing here. But I also come back to the fact that there are still difficulties in the early stages in the real deep tech area. Which is related to the focus of the VCs.

Constantin Gehring: So phase 1-3 are the problem?

I07: Yes, exactly. Besides the general picture that we have a problem in the growth phase. But if you look more closely at the early stage in deep tech, there are challenges. That includes hardware. As this whole area is still in its early stages, we may soon see the funding problems we see now in the early stages in the later stages as well.

Constantin Gehring: Okay, you say the market is not mature yet. But as it matures, it will continue to move backwards until it doesn't exist anymore.

I07: Yeah. That's at least a phenomenon that we've seen now for the normal area of so.

Constantin Gehring: How do you assess awareness on a political level? How is the relevance and uniqueness of hardware and deep tech startups seen there?
Well, I think there is awareness. You can also see how the new traffic light government is leading the BMWK. You can see changes there. So that is already the perception that the idea of impact is currently more in the foreground than it was in the past. I believe that because of the Greens, the focus is also more on impact. That's where you find the debate, Unicorn vs. Zebra. If they are non-exit driven, then many instruments don't fit at all.

Constantin Gehring: What is a zebra?

I07: Zebras are profit-oriented, but don't aim for a valuation in the billions.

Constantin Gehring: What would you say are two factors that prevent money from getting to start-ups?

I07: Well, I actually think that the lack of expertise on the venture capital side is an important point. Really having that expertise as well and that means a different focus. That is also changing. The risk-reward profile is changing in favour of the companies and thus the VCs are changing. Moreover, as I said, the long development cycles don't fit so well with the current system. As I said, you can make it fit. But in the case of nuclear fusion, for example, where development cycles are really very, very long, a normal VC will tend to hold back. They are geared to a certain holding period in order to achieve returns.

Constantin Gehring: Why isn't the know-how flowing into this area?

I07: I think that investors are often not technology-driven enough, but rather finance-driven. This is not the case with Deep-Squared or others, who are much more involved in this deep tech area with their know-how. Earlybird is now making a fund for spin-offs from universities and research institutes. This is a phenomenon that didn't even exist a few years ago. But that presupposes that I have expertise myself. Of course, I can always buy it in. But if I don't have the focus at all, because my investment also has a different focus, then I won't get there. It has to do with the expertise of VC. The personal backgrounds, the education and so on.

Constantin Gehring: What do you see as the biggest challenges for investors, banks and corporate VCs?

I07: The topic as a whole is daunting and the lack of expertise. It's important to be able to assess whether this will be the next big thing. The risk-reward profile doesn't seem attractive enough.

Constantin Gehring: Where would you like to see the state take a more active role to promote the markets?

I07: There are really a lot of instruments. Personally, I always have an ambivalent relationship to them, because on the one hand I see that these things need to be promoted more. On the other hand, however, there is the question of whether such instruments are really needed or whether this is not already happening. There is an incredibly wide range, from HTGF to KfW Kapital's fund of funds, where investments are made in venture capital funds. It's not as if impact is excluded from this. The question is whether these disadvantages or supposed disadvantages that we have just discussed are so special that you have to create an extra vehicle for them. The Deep Future Fund went in that direction but now requires product development. You can no longer do what you actually wanted to do with it. A Deep Tech Fund would have to be the first to invest in nuclear fusion. But that didn't work out at all for them. The question I come back to is whether we need new things or need to create more awareness in existing vehicles? It's a bold comparison, but we see it with diversity. The question, how do we want to promote women founders more? Some say we absolutely need that. I count as well to say that if we have more female investors, we will have more female founders. In a way, that is the right starting point. I just wonder if we need to do the same with the impact area or if the programmes will achieve the same result by raising awareness more.

Constantin Gehring: What do you think would be three very concrete measures to close this funding gap?

I07: This has already been hinted at a bit, but creating awareness is one. Because it can create a lot of demand, I think it's a very important factor. I'm a bit reluctant to have my own funding instruments for impact. I'm really not against it. But I ask myself whether it has to be this way. It would be a good idea to see how we can align the existing ones so that no one falls through the rust and gets funding.

Constantin Gehring: Good to hear that not everything is going badly. So creating awareness?

I07: Exactly, but we also have the focus on climate. I think this focus is really important and it is also necessary because of the climate crisis. But conversely, I would say that a start-up that doesn't go in this direction should not be treated disadvantageously. Making banking easier and more customer-friendly, for example, is also a good thing. I see a certain danger of dividing too much into good and bad.

Constantin Gehring: Maybe to ask specifically, what would be a means that the Sustainable Finance Advisory Council could give to the government? So that the focus is set?

I07: No, I think you have to set clear criteria that a company has to fulfil, like in the area of diversity. You can do that much more easily. But it would be worth considering transferring this somehow analogously. We have to find criteria for the area of impact that we don't really have in our hands and that we still have to develop. The art of developing these criteria is to set them so precisely that they achieve the desired funding effect. On the other hand, not so sharp that too few companies qualify.

Constantin Gehring: How do you see the investments in these start-ups in the EU compared to the US?

I07: There are still huge differences, but we see a strong development. To create lasting value in Germany, we need these large-volume financing rounds, also from a geostrategic point of view. We are no longer chasing the USA like we used to.

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Interview with I08

Olivia Suchy: So the first question that I would like to ask you is in which area do you see the greatest potential for positive change in society when it comes to hardware innovation?

I08: So I think first and foremost, I'm a little bit biased in the sense that this is transport logistics which we're working within. Right. But there's no doubt that if you look through the lens of especially transportation, then this is a huge emitter as a single group one way or the other. So depending on when you put aviation shipping and sort of land transportation on top of each other, about 20% of total emissions - and it's all hardware driven emissions - is coming out from there. You can argue maybe it's hard to debate but at the same time actual solution are not sufficient competitive. We'll get back to that during the interview, I'm pretty sure. But there are solutions to turn a car electric, you just change the emissions essentially to zero. There are other things which are more difficult to do. I think that the change for aviation is so difficult that it's not one that I would personally put too much hope for because it's just very difficult. But it's very clearly a big link on transportation and also at the hardwares where we can actually go from 100% to zero. There are other hardware components where the scale of the needs, if you think about concrete, metal and steel, it's a lot more difficult to go to zero. So I think the high impact where you can go to zero, that's what you should be focusing on because that's going to have a much faster potential impact rather than be a gradient sort of reduction, which is very hard because we're not going to stop building stuff. So I do think transportation is. But again, I'm ever so slightly biased because that's where I have my 25 years of upbringing in that industry.

Olivia Suchy: So currently there are already some innovations going on in hardware. So which instruments are being used for that finance or transforming sustainable transformation right now? And what's already available in Europe to just understand the current status of it? And on the political level also? What's your opinion on that?

I08: So there's technically a lot of solutions available already. I mean, if you look at a hydrogen car: that's been an engine that's been around for decades - it's never really taken off. If you look at private vehicles, then the most progressive nation in Europe is Norway - the coldest place in Europe. It's the one with the highest degree of electrification. It makes absolutely zero sense, right? I mean, you can't run electrical cars at -50. They will drain the battery in 2 minutes, but they've done it. So just because the government took a decision to drive this transformation. So if you drive around Norway, you will see more charging stations that you see filling stations. They are there at every 50 kilometers. I mean, it's seriously the most ridiculous country to electrify. But they did it because they wanted to. Right. They made a decision. And the willpower when you made that decision, essentially like a pendulum swings to the other side is phenomenal. When you have technologies in place which you have for that example. So I think what's important is that governments have to go in. They have to in no way subsidize it. Right. But it's a change thing because the the ownership of the infrastructure is very fragmented. If you look at how many firms have three trucks, how many have this and that, even the the

personal vehicles is incredibly fragmented in ownership from a usage perspective. And that means it's very difficult to drive a transformation without a large scale incentive of sorts. I don't think the Inflation Reduction Act from the US, I don't think that will ever fly in Europe just from the way we make decisions, EU and so forth. The fact is that in the last six months they've been transforming more than we have probably in Europe the last five years because of that.It's just a catchup effect. It has some misfires, for sure. But that's that's how it is. So I think the government needs to be in there. They need to inspire this. Then big firms like ourselves, those who actually has the money, those who have the ability to make big swinging movements, they have to do it. I think our best example is in the US where we have ordered 400 export trucks. We don't actually want to own 400 electrical trucks. We want to basically have someone move all those trucks and move them around for us. But we couldn't get our hands on carbon neutral transportation without going in and taking active ownership of these fleets. It's the same thing with: we bought a lot of ships for methanol fuel. There's no methanol around. So now we've actually launched a parallel initiative with at government levels Spain, Egypt and a few other places where we'll go in and co-finance the establishment of production lines. We don't want to be an energy company. We're shipping logistics company, but we need to pay partake in co-investing because we have the ability. Infrastructure funds where all our pension money goes into on a monthly basis. They need to lower the return requirements. We have to accept lower returns. Maybe a little bit difficult as inflation is going up. But there are some very, very big pools of money. And they have to step up and take responsibility. It has to be nourished by governmental and various regulations. But it has to be nourished. You have to put it in slightly different. You need to take the choice away from the individuals. I should not have a choice between do I want a black or a green because I will always vote with my wallet. So don't give me the choice. Take the choice away from the individuals.

Olivia Suchy: But just to confirm, do you see the success of these hardware startups right now threatened by insufficient funding in general?

I08: Yes. So and now I'm going to be offending. I'm sure, half the world or something like that. But let me take you on a slight little trip back in the let's say, mid-nineties to late ninties. So in 2000, the investment firm, so VCs had some very, very challenging decisions to do when they looked at software. This was before in reason said software will lead the world. So the VC firms was filled with technical people who actually understood this. They made very, very detailed due diligence. Over the years, software became easier to understand and so forth, and all the investment firms they now have different types of people. They don't actually have the same kind of technical folks as you actually have, for instance, in Planet A, Right? And a lot of those have now transformed into being climate tech investors, but they're software analysts and they don't actually have the technical capabilities of diligence in a lot of these investments. And then as the computer says, no, right. If you don't understand it, you're going to shy away from it. And that's why we see a lot of investments going into software over hardware. So there's an upgrade of capability needed in the investment sphere. So there are more climate funds out there than there are climate investors out there from a capability perspective. You have to look at the hardware differently. Right? There's no revenue. I mean, I just closed two investments yesterday, personal best 280. But there are no revenue projections in the next 2 to 3 years of cash flow. What no revenue, really? But how does this work? How do you scale it? The dependency hardware is quite often dependent on if you are developing a battery, let's say that you're dependent on somebody, you're buying your battery. You also have to move it around. It has to be injected into a vehicle or whatever. So the interdependencies on this, let's call it supply chains or whatever before you end with a final product is very difficult to comprehend versus, you know, 20 folders in a basement. And there's a beta version, right? You can't do beta

versions in hardware. It either works or doesn't, right? If you send something to Maersk and we try to buy it and it doesn't work - you might get one shot of repairing it, but after that, I'm sorry. I mean, we're going to move on. And then I think the other part for hardware is that the sales process and this is where also investors are a bit concerned: you have to have a pretty big impact because the implementation of the hardware, the integration of the hardware, you might need to change processes and other bits and pieces. It's not something that industrial buyers can actually easily do. If your impact is 2 to 3% improvement on something, I'm not doing it. It's simply too little. The standard variation of it is too complex and too uncertain. So I need probably about, let's say, 10% improvements on emission reductions or whatever it might be. There has to be room for this. You can never test hardware in a large scale, right? I can't send out my hardware to 1000 coders that looks at my Alpha version before. It's just not possible. So, I mean, it's a very different type of investment profile. But we used to do that when software was in its infancy. There you had to look at this in the same way as you now have to look at hardware. It's just that the majority of investors weren't around when we used to do that.

Olivia Suchy: So staying with the investors, what would you say are the biggest challenges for them with financing hardware start ups, like you already mentioned a few factors. Is there anything you would like to add?

I08: So I think there's very little experience in general with hardware. I think that's just how it is. You cannot suddenly come up with experience to be fair. And what you need to try to do is you need to try to onboard resources from other places and maybe say someone who's been working in the oil industry for 15 years. So energy, essentially - they are probably chemical engineers and so forth. They might not never looked at investments. But what you actually need is them to look at the tech. It's not about investments. You need tech assessment capabilities and you should look for that in various industries and not within the financial industry necessarily in that way. Then you have to and we don't run a fund, right? So I think future will know more about how difficult is this. You have to have some conversations with your LPs for sure, about what this is, right? It's longer. Certainly. You might have to have a longer investment period before you actually start seeing some things you might have to go to - maybe these are 12 year funds versus ten years funds. And I like to believe you can make the returns on hardware as fast as you can. Ultimately you're behind, but you will catch up. But at the same time, there has to be an initial patience. Corporate investors - Partner with them. Get access to them. I have a tech team out here of decarbonisation people coincidentally in the same building as us. So they're right next to me. And they have 100 years plus of experience between them and looking at catalyst production methods, chemical engineering, structural engineering, mechanical engineering, all this. You know what you get, you get complete free access to that resource. I'm not charging you for it. But it's a partnership. We don't want to be the lead investors. We want to partner with folks. But we have resources. We have people. So you can bring your corporate partners in a much more collaborative way than you need for software, for instance. There's a lot of resource you need access to. And firms cannot hire because you cannot replace the investment discipline. That's really at the core of it still. The amount of people that we can throw at something to assess a tech, there's no way no VC firm will ever have that. It is not possible. It would be the wrong processes and resources and you don't get enough management fees to pay for it either. So you have to find the right partnerships. Again, I guess I'm sort of arguing a little bit in my own case here because this is how we like to get involved. But we do throw resources at it as part of the partnerships.

Olivia Suchy: What do you think are the biggest challenges for entrepreneurs? For the startups themselves and which trials and which sort of faces do you think they are most challenged in that situation?

I08: So I think it comes in a range of first, the typical entrepreneur in this space is not a business person and for good reasons, because they're probably pretty bad at business, but pretty clever at doing some engineering stuff. So you need to fairly early on probably try to get a business person on board. So if you imagine sort of a little bit of two by two, but really system one by one almost: one access you have TRL and the other access you have MRL as a market readiness level, right? So a Stanford graduate runs from 0 to 9 on market readiness level but doesn't really necessarily build it. The engineer runs from 7 to 9 on the TRL but has no way of actually marketing it. So what you need is someone who can help you doing that sort of 45 degree, ideally development. Planet A portfolio company 'Carbon one' is a wonderful example of mixing a bunch of propeller heads with a very highly skilled entrepreneur or business person in the form of the CEO. And I think this is important. The other part is that they will tend to look for grants because this is a way of getting access to money and it's cheap money. There's a lot of grants out there. What grants does is two things. It might complicate what you do because you will have to do it in partnership with eight others. Just keeping track actually of who's working on what project. But the other part is grants slows you down and slows you down because you don't have an investor who's really tough on you. So the combo of grants and investment. So take the dilution early on, accept it in combo with grants and then I think it's you have to really spend the time on understanding your investors. The investors needs to be very clearly expressing a understanding of "this is about development priority, So R&D approach, it's not about a revenue policy". Because the minute if an investor comes in and looks at a piece of hardware and says when am I going to sell 100 of these babies? If that's the first question, you should run away because revenue cannot be in driver seat early on. In the same way as investors are diligent in companies, entrepreneurs need to diligence they investors. It's just really important and it's totally binary. Unfortunately, we have one example. It was not really in the climate space. We did an investment back in 18 and we let ourselves be sort of distracted a bit by revenue focus of the previous two two investors, seed investors that was in there. And that company never had a fighting chance because it was actually an R&D company. It should have stayed in R&D for two or three years. Putting its revenue pressure on them meant that they had to do short cuts,they send out beta versions almost and so forth. And the demise of the company was: we actually drove it into the ground, not the entrepreneurs. You need to get investors in early on. You need to get some grants and then find a business person. I have another investment that I want to close in January, and they've been smart. It's some young guys, but they have a they have a business person who maybe if you think through it, is if you look at the priority, what you need to do as a company, technology development wise, that business person is really self hardly maybe half time job, but it means the conversations we are having, they're thinking into business models, they're thinking about other bits and pieces, some of that lingo, right? So that normal people understands what they're saying rather than talking in numbers. And let us add it together, it's a very, very strong proposition.

Olivia Suchy: So following up on that, what do you think is the risk return expectations of investors for the transformation capital provided?

I08: So there's no reason why the return requirements and desires and goals and so forth should be any different in principle. There's the timing of it, right, that you will hopefully still get to as a fund 3 to 4 x, whatever, ten x and one investment or whatever. But rather than being sort of maybe a bit more linear or even sort of, you know, you know, heavy growth in the beginning,

I think this is going to be a slightly more exponential profile. But there's no reason why you can't get to the same same returns. I'm slightly biased because we are a business that needs to make profits. As an investor should forget about green premiums. Green premiums is not something which is sustainable for business world. So you have to look at your investments through the lens. Is this competitive without thinking about green premium? And if not, what can we do to drive that down? The ultimately you can say that it's oversimplified, but the cost of energy that is green, it will ultimately have to be able to compete with your long term fossil equivalent parity, which will be whatever price plus tax is or whatever it is and the world does not have enough money. And just right now we're actually seeing exactly that unfold in front of our eyes. People are switching away from organic and switching away from brand names. They're buying less. They're doing this because of inflation. That is just really back to my point about don't leave it to people. Take away the choice. But as an investor you can get the returns but you have to target a non green premium business proposition and then there's no reason why you can't make. This is going to be business models like any other business models, right? So in the last hundred years of industrialization, we've made nice returns in hardware as well. It's just been a little bit easier to get excited on a Silicon Valley level about software for getting conveniently how much money has been lost in software as well by the way.

Olivia Suchy: That's, I think, super interesting regarding investors and now going deeper into the reasoning behind why this funding gap really exists. What are, in your opinion, cultural factors, systemic factors that led us to this point?

I08: I normally say that the track is that you start making something in your kitchen, right? It's just you in a pot of something and you can get it to do something. Thenn the next level up, you're actually sort of getting your friends and families and now you can cook something for 12 people. The next level up is that you have to entertain an entire beer tent at Oktoberfest. And this is where it goes wrong, right? Because that scaling part is absolutely impossible to model. And it's not linear. It's sort of kitchen family dinner shit and there's no way of doing it in a financially viable way. You can't test it in gradually increasing scale. I think that's why we have a love for modular technologies where we just know that we don't have to actually build something that's ten times the size because we can just put ten of these on top of each other and we'll be good. And I think that's probably where you will get more uptake from investors modularity, which goes against the principles within fuels and other chemical industries in general. If you just go to the Wall Street and see what these big machines are looking like. And so I think it's this you can get comfortable with a couple of people in lab coats going from the kitchen to the family dinner. After that, you have to have a very different kind of faith. We're right now completing a trial plan for fossil fuel investments in the Netherlands. It's €3 million we put into the ground. And in CapEx on a trial plan that we probably don't need two years from now. And we're trying to raise some non-dilutive funding for our behalf. But nonetheless, we had to make the decision as investors to take €3 million of equity. Hammer into the ground, hoping that that machine would then show us what we're hoping it would show that we made in a small lab scale kind of thing. Because that's then the commercial validation kind of thing. So the faith that you have to do is a very substantial amount of money. You can't do it halfway. You can't be half pregnant and you can't stop shit, 2 million years later. No, you have to finish it because it has no value. So I think it's very difficult for a lot of investors to relate to that piece. And then it's back to the point before, if you then have a team that did not think sufficiently about market readiness level and that business component of it, then you suddenly having some very slightly geeky types that is asking people to give them 15, €20 million to put into the ground to prove that what they think works, works. If it doesn't work, by the way, those 2015, €20 million are pretty much worthless. And that's a very difficult gap there. I mean, this valley

of death that we've been talking about for years in general, it's a really, really big valley and it's within hardware. But yeah, I'm coming at this from having spent my entire life in hardware. I've built ports and machinery and stuff over the years. And so I'm just very comfortable with hardware, right. Understanding it, what it goes through, how difficult it is. But I'm sure someone coming completely cold into it is going to have a lot of issues. So this is seriously series A gap. Major series A gap because when you have to go from the the family dinner to the beer tent that's very substantial amount of money.

Olivia Suchy: And how do you assess the political awareness on this and the current governmental support that hardware startups can get at the moment, and especially the awareness?

I08: I think environment is one element of any governments. You know, there is inflation right now, unemployment is going to increase, there's refugees coming, there's a war going on. So I think we should not fool ourselves and think that this is the top priority on any any given day. And politicians are a temporary blips. They change and so forth. You have to rely on the civil servants underneath. And some of those, again, big corporates and big people they could do this. And so I think the awareness is there to some degree. I don't think the attention span is sufficiently anchored so that that you will have a continuously: "Wow. Four or five years later we've had the same environmental minister and they're doing this and that and so forth". In that sense, there's a lot of money being allocated, are sending grants and so forth. But I have the slight fear. And now I'm also unfortunately probably discouraging a fair amount of startups. If you cannot show me a way, a path to real impact, then I'm sorry, you're not part of solving the next 20 years that needs to be solved. And if we still need to, as we hopefully get to something in 2050, that's a continuation because emissions will increase, populations increase and so forth. So there's maintenance level but you cutting a few hundred kilos here and a few hundred kilos. It's the same as, you know, only flushing every second time you go to the toilet. It seriously has absolutely no impact at the end of the day on that next emission cap that we have towards 20, 30, 40 and 50. If there's a prioritization that ideally should happen of these funds that are available out there through grants and so forth. But I don't think any public institution or governments that needs to be re-elected and so forth dare to make that decision. So we are making the decisions as investors. But there's a lot of money available that doesn't have the same protestation to it. And it means that we're going to put money into something which even if successful, is completely, utterly irrelevant. Unfortunately, not making it worse or make it worse. I really think this is about a big impact. And there's some funds. I mean, there's breakthrough energy ventures that potentially has to be half a gigaton annually, right? Low carbon capital is Chris Sacca and all his merry men is saying one gigaton. And so I have no clue how they calculate. This is complete fucking bogus in my mind. But it's the notion, It's the mentality around it, right? And that's also what startups needs to be able to do. And that's why I always ask show me your impact. It might be five, six, seven years down the road. That's perfectly fine, but show me what you can, how that can have a substantial impact so that anyone will buy your product of those who can actually make the changes. And it's again the three of us in our daily behavior, we are not going to make the change. Not in a substantial way that helps us. Ultimately, we'll get smarter and better and friendly and so forth.

Olivia Suchy: In the last few minutes of our interviews, I would really like to use it to go into possible solutions that we could have to solve it. And so my next question would be: how can projects be funded that have a positive contribution to transformation but are not profitable according to conventional profitability requirements? And maybe adding on that question also,

what are, in your opinion, concrete measures that can be put in place in Europe to to close this funding gap?

I08: There's a lot of folks who says that we have all the technologies available out there to achieve it. We just don't have the money allocated in the right way. I would tend to agree in principle, but I think the technologies we have are too expensive and therefore they're not efficient enough. The energy consumption to produce a different kind of energy is too high. We let ourselves get carried away with a lot of windmills. But at the end of the day some of it is a little bit more window dressing, perhaps. So first and foremost, legislation wise, I think we do have to step up legislation. We want we support legislation as MAERSK as well, as long as it keeps a decent distance where we're keeping encouraged. We want to have CO2 taxes and so forth. But there's always a flipside. It's a little bit like the Inflation Reduction Act, right? They got a lot of good stuff and then I just seen some ventures that are just essentially doubling their profits because they're now selling a piece of equipment that they can get 25,000 of subsidies to. And it goes straight to their bottom line and doesn't really help anything because it transformation what's going to happen anyway but definitely legislation is something which needs to be there. And the other part is I think the government needs to stop thinking about this as a as a symbolic way. Our government insist on having carbon neutral domestic flights between Copenhagen and other parts of Denmark by 2030. And you know what? It makes absolutely bugger all difference. I mean, it's really completely, utterly irrelevant. But they're making that a external policy, which means people are looking at it and thinking about it and would like to be part of it. And it really makes no difference. There's a hesitancy Agriculture. It's a huge, huge emitter. You got to have to do something about it. And it cannot be a gradual 20 year kind of thing and save the farmers and so forth and all that. You just have to do something in that sense.I don't think the politicians are bold enough, and I think that's a little bit the fundamental problem. So where I think politicians could be bolder and I think they will, is put this onto the corporates. It's perfectly fine to put this on our shoulders. We technically have the money or we have the possibility of transferring it to the customers. We're not going to be able to transfer all expenses to our customers. So we have to find a way of becoming smarter because otherwise our profits will disappear. So this is quite a line from an incentive perspective to do that. But legislation is a necessary part of it.Just repeat the so those three points of your questions?

Olivia Suchy: So my question the first time was how projects can be funded that have a positive contribution to transformation but are not profitable according to profitability requirements at the moment.

I08: I think this goes a little bit back to if it's not ultimately profitable, you might have to adjust your payback period a bit and some other bits and pieces. But it's fundamentally transformation requires a very different profitability, acceptance and 20 year paybacks or whatever and so forth. It's not going to work. I don't think you should fund things that has a necessity to be looked at very, very differently because it's ultimately not going to work. And a lot of the funds available out there are people's money, right? It's either tax money that I've paid or it's my pension and so forth, and I'd like to save the world. But if my annual pension increases were 2% returns because I'm funding something that has just not going to work. I think ultimately you should not fund things that's not going to work. You have to look through this in the same way as we're doing now with some flexibility and nuances, accepting that we are early days because we are. Three years ago, nobody asked for a lot of what we're asking for right now. And we are in a situation right now where corporate governments or big institutions are asking, demanding, willing to pay for solutions that has not yet been invented, essentially. And this is

a very different set up than it has been before. All the ventures, entrepreneurs and so forth have been bringing things to us over the years, saying: look, you have a problem, this is what you need. And we said: No, we don't need it. You haven't understood anything. Two years later, shit, we need it because entrepreneurs are better at identifying pains, problems and solutions, period. Here we actually are desperate now because this has come around like a pendulum to pay, to invest, to do this. If you have the solution right. I'm desperately needing emissions data to look at my scope three. The reality is nobody has cracked emission data yet from a primary data understanding perspective and so forth because it's early days. So I think that's quite important. I think there's money there because there's actually a demand there that has already been identified. So if you can plug into that, then it's brilliant. It's not the same challenge as you coming up with the first CRM system ever in the 2000 but I do think it's important that we don't look at this to handicapping in a way of saying you have to accept lower returns if you want to transform, because ultimately it's not going to work. But I think you have to train folks to be accepting different profiles, but ultimately it has to offer a better return. I mean, LPs are not going to accept one and one half X returns just because you're doing impact. Our customers is ultimately not going to pay a premium because we're green. Because if you're not green, my friend, we're going to use you. So I just think it's important if you deploy that two years ago people were presenting ventures as green because green was a proposition. I don't think green has ever really been a proposition. It's ultimately what are you getting out of it? If you're then presenting something now we're saying if it is green, but you must be prepared therefore to accept a little bit lower returns. That's not quite a proposition that works at the end of the day. And we risk putting money, especially public funds, into that concept and money will be wasted. That is a long, roundabout way of answering that question.

Olivia Suchy: What are the most important actors and stakeholders that can really influence the transformation and which instruments are the most effective ones that need to be used in Europe? Maybe instruments that are already being used in other places that we surely need to adapt.

I08: As I said early on, I think the Inflation Reduction Act - there has to be a stronger communication around. But it's hardware that's going to decarbonize the world. It's not software. And software is part of it, but it's still hardware that's going to do it in the same way it's hardware who screwed up environment to start with. And I think signaling that possibly over allocating funds for hardware development, I think would be really important. And then in Denmark unfortunately, we're very bad at spinning out or taking intervention from our universities out. And and there's a lot of very smart people who's been researching for years in these areas. And we just don't have very big access to it so better than others. The US, again, is absolutely phenomenal in doing these things. And I think there's definitely things, I can only speak on in relation to Denmark, but here we are very, very poor at getting our very clever people commercialised. Then there has to be legislation. Unfortunately again, we are 27 countries. There's very big difference between the northern parts of Denmark and the southern parts of Italy in terms of what is needed and not what is not needed. Concerns and how it impacts people and so forth. But legislation is necessary and an aligned legislation instead of what we've seen so far. A little bit of banning of some plastics here and a little bit here. It's really super fragmented how it's done. We've stopped burning. Garbage is not the most clever thing, but that's what we're doing. And then somebody else is picking up our garbage and burning it. So it's kind totally circular. It makes absolutely no difference. It looks great. And our carbon accounting in Denmark, but fundamentally, it's a zero sum game that makes no sense. And we can be more aggressive on legislation. The only thing, if you think about ETS, for instance, the idea is that obviously these funds gets returned to fund these green initiatives

so that it doesn't become just an income to pay for other stuff. And I'm not super convinced that that in an EU structure is done in a very efficient manner. Back to how do you prioritize it? It's the money is going to the people who are the best at writing Horizon 2020 applications or whatever it is. So there is definitely something. Again, put it on the wider shoulders. Make sure that you focus this on those who at least have the potential and the standing in the environment, in business environment, to drive this. I find the absence of oil majors with all the money they have in the transformation, absolutely staggering. They have billions and billions and billions. They're printing money right now because we still need fossil for years and the US company is completely absent. The European ones have set up a few ventures here and there and so forth, the shell ventures and so forth. But they're not proportionately to their money and their own influence on the environment active in this. And yeah, so I think that's something that should be done. I mean right now implementing this special tax rate on energy companies because they're making too much money and it's hitting people but this is what they're doing as a counteract to inflation. Why can't it do something similar as a counteract to emissions?

Olivia Suchy: Okay. Thank you. Is there anything that you would like to add on on that? Any question that I didn't ask you anything important that you think is.

I08: I think my main messaging here is that you need to put it on the wider shoulders. There's a lot of corporates that has the might and the ability to drive change. To do that, you need to put legislation in. That obviously means that we can't really sort of shy away from it. You also need for ventures and for the entrepreneurs then to think about if it's the widest and bigger shoulders that are picking this up, you have to show impact of a scale where we are prepared to pick it up. Otherwise you would be deselected. And then I think we have to find a way of channeling the available capital in a smart way towards where we have the biggest impact. And as long as you channel it through investors, VC firms, PE, then you have a natural selection. But I mean, there are billions being handed out every year in grants with not a lot of scrutiny. They have to hand out the money. So essentially, if you just look the best out of the ten submitted an application, then you'll get it right. They have to hand it out. There's no way they can't. So, we are ready to pay. And then the last part I think is this piece about that, corporate and VC investors can combine to a much more effective development support of these hardware ventures, in particular. Finding the right balance. And you need some that are agile and smart. With that I mean the corporates but there's a bigger, stronger symbiotic relationship when it comes to hardware and when it comes to software.

Olivia Suchy: Amazing. Thank you so much.

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Interview with I08

Olivia Suchy: So the first question that I would like to ask you is in which area do you see the greatest potential for positive change in society when it comes to hardware innovation?

I08: So I think first and foremost, I'm a little bit biased in the sense that this is transport logistics which we're working within. Right. But there's no doubt that if you look through the lens of especially transportation, then this is a huge emitter as a single group one way or the other. So depending on when you put aviation shipping and sort of land transportation on top of each other, about 20% of total emissions - and it's all hardware driven emissions - is coming out from there. You can argue maybe it's hard to debate but at the same time actual solution are not sufficient competitive. We'll get back to that during the interview, I'm pretty sure. But there are solutions to turn a car electric, you just change the emissions essentially to zero. There are other

things which are more difficult to do. I think that the change for aviation is so difficult that it's not one that I would personally put too much hope for because it's just very difficult. But it's very clearly a big link on transportation and also at the hardwares where we can actually go from 100% to zero. There are other hardware components where the scale of the needs, if you think about concrete, metal and steel, it's a lot more difficult to go to zero. So I think the high impact where you can go to zero, that's what you should be focusing on because that's going to have a much faster potential impact rather than be a gradient sort of reduction, which is very hard because we're not going to stop building stuff. So I do think transportation is. But again, I'm ever so slightly biased because that's where I have my 25 years of upbringing in that industry.

Olivia Suchy: So currently there are already some innovations going on in hardware. So which instruments are being used for that finance or transforming sustainable transformation right now? And what's already available in Europe to just understand the current status of it? And on the political level also? What's your opinion on that?

I08: So there's technically a lot of solutions available already. I mean, if you look at a hydrogen car: that's been an engine that's been around for decades - it's never really taken off. If you look at private vehicles, then the most progressive nation in Europe is Norway - the coldest place in Europe. It's the one with the highest degree of electrification. It makes absolutely zero sense, right? I mean, you can't run electrical cars at -50. They will drain the battery in 2 minutes, but they've done it. So just because the government took a decision to drive this transformation. So if you drive around Norway, you will see more charging stations that you see filling stations. They are there at every 50 kilometers. I mean, it's seriously the most ridiculous country to electrify. But they did it because they wanted to. Right. They made a decision. And the willpower when you made that decision, essentially like a pendulum swings to the other side is phenomenal. When you have technologies in place which you have for that example. So I think what's important is that governments have to go in. They have to in no way subsidize it. Right. But it's a change thing because the the ownership of the infrastructure is very fragmented. If you look at how many firms have three trucks, how many have this and that, even the the personal vehicles is incredibly fragmented in ownership from a usage perspective. And that means it's very difficult to drive a transformation without a large scale incentive of sorts. I don't think the Inflation Reduction Act from the US, I don't think that will ever fly in Europe just from the way we make decisions, EU and so forth. The fact is that in the last six months they've been transforming more than we have probably in Europe the last five years because of that.It's just a catchup effect. It has some misfires, for sure. But that's that's how it is. So I think the government needs to be in there. They need to inspire this. Then big firms like ourselves, those who actually has the money, those who have the ability to make big swinging movements, they have to do it. I think our best example is in the US where we have ordered 400 export trucks. We don't actually want to own 400 electrical trucks. We want to basically have someone move all those trucks and move them around for us. But we couldn't get our hands on carbon neutral transportation without going in and taking active ownership of these fleets. It's the same thing with: we bought a lot of ships for methanol fuel. There's no methanol around. So now we've actually launched a parallel initiative with at government levels Spain, Egypt and a few other places where we'll go in and co-finance the establishment of production lines. We don't want to be an energy company. We're shipping logistics company, but we need to pay partake in co-investing because we have the ability. Infrastructure funds where all our pension money goes into on a monthly basis. They need to lower the return requirements. We have to accept lower returns. Maybe a little bit difficult as inflation is going up. But there are some very, very big pools of money. And they have to step up and take responsibility. It has to be nourished by

governmental and various regulations. But it has to be nourished. You have to put it in slightly different. You need to take the choice away from the individuals. I should not have a choice between do I want a black or a green because I will always vote with my wallet. So don't give me the choice. Take the choice away from the individuals.

Olivia Suchy: But just to confirm, do you see the success of these hardware startups right now threatened by insufficient funding in general?

I08: Yes. So and now I'm going to be offending. I'm sure, half the world or something like that. But let me take you on a slight little trip back in the let's say, mid-nineties to late ninties. So in 2000, the investment firm, so VCs had some very, very challenging decisions to do when they looked at software. This was before in reason said software will lead the world. So the VC firms was filled with technical people who actually understood this. They made very, very detailed due diligence. Over the years, software became easier to understand and so forth, and all the investment firms they now have different types of people. They don't actually have the same kind of technical folks as you actually have, for instance, in Planet A, Right? And a lot of those have now transformed into being climate tech investors, but they're software analysts and they don't actually have the technical capabilities of diligence in a lot of these investments. And then as the computer says, no, right. If you don't understand it, you're going to shy away from it. And that's why we see a lot of investments going into software over hardware. So there's an upgrade of capability needed in the investment sphere. So there are more climate funds out there than there are climate investors out there from a capability perspective. You have to look at the hardware differently. Right? There's no revenue. I mean, I just closed two investments yesterday, personal best 280. But there are no revenue projections in the next 2 to 3 years of cash flow. What no revenue, really? But how does this work? How do you scale it? The dependency hardware is quite often dependent on if you are developing a battery, let's say that you're dependent on somebody, you're buying your battery. You also have to move it around. It has to be injected into a vehicle or whatever. So the interdependencies on this, let's call it supply chains or whatever before you end with a final product is very difficult to comprehend versus, you know, 20 folders in a basement. And there's a beta version, right? You can't do beta versions in hardware. It either works or doesn't, right? If you send something to Maersk and we try to buy it and it doesn't work - you might get one shot of repairing it, but after that, I'm sorry. I mean, we're going to move on. And then I think the other part for hardware is that the sales process and this is where also investors are a bit concerned: you have to have a pretty big impact because the implementation of the hardware, the integration of the hardware, you might need to change processes and other bits and pieces. It's not something that industrial buyers can actually easily do. If your impact is 2 to 3% improvement on something, I'm not doing it. It's simply too little. The standard variation of it is too complex and too uncertain. So I need probably about, let's say, 10% improvements on emission reductions or whatever it might be. There has to be room for this. You can never test hardware in a large scale, right? I can't send out my hardware to 1000 coders that looks at my Alpha version before. It's just not possible. So, I mean, it's a very different type of investment profile. But we used to do that when software was in its infancy. There you had to look at this in the same way as you now have to look at hardware. It's just that the majority of investors weren't around when we used to do that.

Olivia Suchy: So staying with the investors, what would you say are the biggest challenges for them with financing hardware start ups, like you already mentioned a few factors. Is there anything you would like to add?

I08: So I think there's very little experience in general with hardware. I think that's just how it is. You cannot suddenly come up with experience to be fair. And what you need to try to do is you need to try to onboard resources from other places and maybe say someone who's been working in the oil industry for 15 years. So energy, essentially - they are probably chemical engineers and so forth. They might not never looked at investments. But what you actually need is them to look at the tech. It's not about investments. You need tech assessment capabilities and you should look for that in various industries and not within the financial industry necessarily in that way. Then you have to and we don't run a fund, right? So I think future will know more about how difficult is this. You have to have some conversations with your LPs for sure, about what this is, right? It's longer. Certainly. You might have to have a longer investment period before you actually start seeing some things you might have to go to - maybe these are 12 year funds versus ten years funds. And I like to believe you can make the returns on hardware as fast as you can. Ultimately you're behind, but you will catch up. But at the same time, there has to be an initial patience. Corporate investors - Partner with them. Get access to them. I have a tech team out here of decarbonisation people coincidentally in the same building as us. So they're right next to me. And they have 100 years plus of experience between them and looking at catalyst production methods, chemical engineering, structural engineering, mechanical engineering, all this. You know what you get, you get complete free access to that resource. I'm not charging you for it. But it's a partnership. We don't want to be the lead investors. We want to partner with folks. But we have resources. We have people. So you can bring your corporate partners in a much more collaborative way than you need for software, for instance. There's a lot of resource you need access to. And firms cannot hire because you cannot replace the investment discipline. That's really at the core of it still. The amount of people that we can throw at something to assess a tech, there's no way no VC firm will ever have that. It is not possible. It would be the wrong processes and resources and you don't get enough management fees to pay for it either. So you have to find the right partnerships. Again, I guess I'm sort of arguing a little bit in my own case here because this is how we like to get involved. But we do throw resources at it as part of the partnerships.

Olivia Suchy: What do you think are the biggest challenges for entrepreneurs? For the startups themselves and which trials and which sort of faces do you think they are most challenged in that situation?

I08: So I think it comes in a range of first, the typical entrepreneur in this space is not a business person and for good reasons, because they're probably pretty bad at business, but pretty clever at doing some engineering stuff. So you need to fairly early on probably try to get a business person on board. So if you imagine sort of a little bit of two by two, but really system one by one almost: one access you have TRL and the other access you have MRL as a market readiness level, right? So a Stanford graduate runs from 0 to 9 on market readiness level but doesn't really necessarily build it. The engineer runs from 7 to 9 on the TRL but has no way of actually marketing it. So what you need is someone who can help you doing that sort of 45 degree, ideally development. Planet A portfolio company 'Carbon one' is a wonderful example of mixing a bunch of propeller heads with a very highly skilled entrepreneur or business person in the form of the CEO. And I think this is important. The other part is that they will tend to look for grants because this is a way of getting access to money and it's cheap money. There's a lot of grants out there. What grants does is two things. It might complicate what you do because you will have to do it in partnership with eight others. Just keeping track actually of who's working on what project. But the other part is grants slows you down and slows you down because you don't have an investor who's really tough on you. So the combo of grants and investment. So take the dilution early on, accept it in combo with grants and then I think

it's you have to really spend the time on understanding your investors. The investors needs to be very clearly expressing a understanding of "this is about development priority, So R&D approach, it's not about a revenue policy". Because the minute if an investor comes in and looks at a piece of hardware and says when am I going to sell 100 of these babies? If that's the first question, you should run away because revenue cannot be in driver seat early on. In the same way as investors are diligent in companies, entrepreneurs need to diligence they investors. It's just really important and it's totally binary. Unfortunately, we have one example. It was not really in the climate space. We did an investment back in 18 and we let ourselves be sort of distracted a bit by revenue focus of the previous two two investors, seed investors that was in there. And that company never had a fighting chance because it was actually an R&D company. It should have stayed in R&D for two or three years. Putting its revenue pressure on them meant that they had to do short cuts,they send out beta versions almost and so forth. And the demise of the company was: we actually drove it into the ground, not the entrepreneurs. You need to get investors in early on. You need to get some grants and then find a business person. I have another investment that I want to close in January, and they've been smart. It's some young guys, but they have a they have a business person who maybe if you think through it, is if you look at the priority, what you need to do as a company, technology development wise, that business person is really self hardly maybe half time job, but it means the conversations we are having, they're thinking into business models, they're thinking about other bits and pieces, some of that lingo, right? So that normal people understands what they're saying rather than talking in numbers. And let us add it together, it's a very, very strong proposition.

Olivia Suchy: So following up on that, what do you think is the risk return expectations of investors for the transformation capital provided?

I08: So there's no reason why the return requirements and desires and goals and so forth should be any different in principle. There's the timing of it, right, that you will hopefully still get to as a fund 3 to 4 x, whatever, ten x and one investment or whatever. But rather than being sort of maybe a bit more linear or even sort of, you know, you know, heavy growth in the beginning, I think this is going to be a slightly more exponential profile. But there's no reason why you can't get to the same same returns. I'm slightly biased because we are a business that needs to make profits. As an investor should forget about green premiums. Green premiums is not something which is sustainable for business world. So you have to look at your investments through the lens. Is this competitive without thinking about green premium? And if not, what can we do to drive that down? The ultimately you can say that it's oversimplified, but the cost of energy that is green, it will ultimately have to be able to compete with your long term fossil equivalent parity, which will be whatever price plus tax is or whatever it is and the world does not have enough money. And just right now we're actually seeing exactly that unfold in front of our eyes. People are switching away from organic and switching away from brand names. They're buying less. They're doing this because of inflation. That is just really back to my point about don't leave it to people. Take away the choice. But as an investor you can get the returns but you have to target a non green premium business proposition and then there's no reason why you can't make. This is going to be business models like any other business models, right? So in the last hundred years of industrialization, we've made nice returns in hardware as well. It's just been a little bit easier to get excited on a Silicon Valley level about software for getting conveniently how much money has been lost in software as well by the way.

Olivia Suchy: That's, I think, super interesting regarding investors and now going deeper into the reasoning behind why this funding gap really exists. What are, in your opinion, cultural factors, systemic factors that led us to this point?

I08: I normally say that the track is that you start making something in your kitchen, right? It's just you in a pot of something and you can get it to do something. Thenn the next level up, you're actually sort of getting your friends and families and now you can cook something for 12 people. The next level up is that you have to entertain an entire beer tent at Oktoberfest. And this is where it goes wrong, right? Because that scaling part is absolutely impossible to model. And it's not linear. It's sort of kitchen family dinner shit and there's no way of doing it in a financially viable way. You can't test it in gradually increasing scale. I think that's why we have a love for modular technologies where we just know that we don't have to actually build something that's ten times the size because we can just put ten of these on top of each other and we'll be good. And I think that's probably where you will get more uptake from investors modularity, which goes against the principles within fuels and other chemical industries in general. If you just go to the Wall Street and see what these big machines are looking like. And so I think it's this you can get comfortable with a couple of people in lab coats going from the kitchen to the family dinner. After that, you have to have a very different kind of faith. We're right now completing a trial plan for fossil fuel investments in the Netherlands. It's €3 million we put into the ground. And in CapEx on a trial plan that we probably don't need two years from now. And we're trying to raise some non-dilutive funding for our behalf. But nonetheless, we had to make the decision as investors to take €3 million of equity. Hammer into the ground, hoping that that machine would then show us what we're hoping it would show that we made in a small lab scale kind of thing. Because that's then the commercial validation kind of thing. So the faith that you have to do is a very substantial amount of money. You can't do it halfway. You can't be half pregnant and you can't stop shit, 2 million years later. No, you have to finish it because it has no value. So I think it's very difficult for a lot of investors to relate to that piece. And then it's back to the point before, if you then have a team that did not think sufficiently about market readiness level and that business component of it, then you suddenly having some very slightly geeky types that is asking people to give them 15, €20 million to put into the ground to prove that what they think works, works. If it doesn't work, by the way, those 2015, €20 million are pretty much worthless. And that's a very difficult gap there. I mean, this valley of death that we've been talking about for years in general, it's a really, really big valley and it's within hardware. But yeah, I'm coming at this from having spent my entire life in hardware. I've built ports and machinery and stuff over the years. And so I'm just very comfortable with hardware, right. Understanding it, what it goes through, how difficult it is. But I'm sure someone coming completely cold into it is going to have a lot of issues. So this is seriously series A gap. Major series A gap because when you have to go from the the family dinner to the beer tent that's very substantial amount of money.

Olivia Suchy: And how do you assess the political awareness on this and the current governmental support that hardware startups can get at the moment, and especially the awareness?

I08: I think environment is one element of any governments. You know, there is inflation right now, unemployment is going to increase, there's refugees coming, there's a war going on. So I think we should not fool ourselves and think that this is the top priority on any any given day. And politicians are a temporary blips. They change and so forth. You have to rely on the civil servants underneath. And some of those, again, big corporates and big people they could do this. And so I think the awareness is there to some degree. I don't think the attention span is sufficiently anchored so that that you will have a continuously: "Wow. Four or five years later we've had the same environmental minister and they're doing this and that and so forth". In that sense, there's a lot of money being allocated, are sending grants and so forth. But I have the

slight fear. And now I'm also unfortunately probably discouraging a fair amount of startups. If you cannot show me a way, a path to real impact, then I'm sorry, you're not part of solving the next 20 years that needs to be solved. And if we still need to, as we hopefully get to something in 2050, that's a continuation because emissions will increase, populations increase and so forth. So there's maintenance level but you cutting a few hundred kilos here and a few hundred kilos. It's the same as, you know, only flushing every second time you go to the toilet. It seriously has absolutely no impact at the end of the day on that next emission cap that we have towards 20, 30, 40 and 50. If there's a prioritization that ideally should happen of these funds that are available out there through grants and so forth. But I don't think any public institution or governments that needs to be re-elected and so forth dare to make that decision. So we are making the decisions as investors. But there's a lot of money available that doesn't have the same protestation to it. And it means that we're going to put money into something which even if successful, is completely, utterly irrelevant. Unfortunately, not making it worse or make it worse. I really think this is about a big impact. And there's some funds. I mean, there's breakthrough energy ventures that potentially has to be half a gigaton annually, right? Low carbon capital is Chris Sacca and all his merry men is saying one gigaton. And so I have no clue how they calculate. This is complete fucking bogus in my mind. But it's the notion, It's the mentality around it, right? And that's also what startups needs to be able to do. And that's why I always ask show me your impact. It might be five, six, seven years down the road. That's perfectly fine, but show me what you can, how that can have a substantial impact so that anyone will buy your product of those who can actually make the changes. And it's again the three of us in our daily behavior, we are not going to make the change. Not in a substantial way that helps us. Ultimately, we'll get smarter and better and friendly and so forth.

Olivia Suchy: In the last few minutes of our interviews, I would really like to use it to go into possible solutions that we could have to solve it. And so my next question would be: how can projects be funded that have a positive contribution to transformation but are not profitable according to conventional profitability requirements? And maybe adding on that question also, what are, in your opinion, concrete measures that can be put in place in Europe to to close this funding gap?

I08: There's a lot of folks who says that we have all the technologies available out there to achieve it. We just don't have the money allocated in the right way. I would tend to agree in principle, but I think the technologies we have are too expensive and therefore they're not efficient enough. The energy consumption to produce a different kind of energy is too high. We let ourselves get carried away with a lot of windmills. But at the end of the day some of it is a little bit more window dressing, perhaps. So first and foremost, legislation wise, I think we do have to step up legislation. We want we support legislation as MAERSK as well, as long as it keeps a decent distance where we're keeping encouraged. We want to have CO2 taxes and so forth. But there's always a flipside. It's a little bit like the Inflation Reduction Act, right? They got a lot of good stuff and then I just seen some ventures that are just essentially doubling their profits because they're now selling a piece of equipment that they can get 25,000 of subsidies to. And it goes straight to their bottom line and doesn't really help anything because it transformation what's going to happen anyway but definitely legislation is something which needs to be there. And the other part is I think the government needs to stop thinking about this as a as a symbolic way. Our government insist on having carbon neutral domestic flights between Copenhagen and other parts of Denmark by 2030. And you know what? It makes absolutely bugger all difference. I mean, it's really completely, utterly irrelevant. But they're making that a external policy, which means people are looking at it and thinking about it and would like to be part of it. And it really makes no difference. There's a hesitancy Agriculture.

It's a huge, huge emitter. You got to have to do something about it. And it cannot be a gradual 20 year kind of thing and save the farmers and so forth and all that. You just have to do something in that sense.I don't think the politicians are bold enough, and I think that's a little bit the fundamental problem. So where I think politicians could be bolder and I think they will, is put this onto the corporates. It's perfectly fine to put this on our shoulders. We technically have the money or we have the possibility of transferring it to the customers. We're not going to be able to transfer all expenses to our customers. So we have to find a way of becoming smarter because otherwise our profits will disappear. So this is quite a line from an incentive perspective to do that. But legislation is a necessary part of it.Just repeat the so those three points of your questions?

Olivia Suchy: So my question the first time was how projects can be funded that have a positive contribution to transformation but are not profitable according to profitability requirements at the moment.

I08: I think this goes a little bit back to if it's not ultimately profitable, you might have to adjust your payback period a bit and some other bits and pieces. But it's fundamentally transformation requires a very different profitability, acceptance and 20 year paybacks or whatever and so forth. It's not going to work. I don't think you should fund things that has a necessity to be looked at very, very differently because it's ultimately not going to work. And a lot of the funds available out there are people's money, right? It's either tax money that I've paid or it's my pension and so forth, and I'd like to save the world. But if my annual pension increases were 2% returns because I'm funding something that has just not going to work. I think ultimately you should not fund things that's not going to work. You have to look through this in the same way as we're doing now with some flexibility and nuances, accepting that we are early days because we are. Three years ago, nobody asked for a lot of what we're asking for right now. And we are in a situation right now where corporate governments or big institutions are asking, demanding, willing to pay for solutions that has not yet been invented, essentially. And this is a very different set up than it has been before. All the ventures, entrepreneurs and so forth have been bringing things to us over the years, saying: look, you have a problem, this is what you need. And we said: No, we don't need it. You haven't understood anything. Two years later, shit, we need it because entrepreneurs are better at identifying pains, problems and solutions, period. Here we actually are desperate now because this has come around like a pendulum to pay, to invest, to do this. If you have the solution right. I'm desperately needing emissions data to look at my scope three. The reality is nobody has cracked emission data yet from a primary data understanding perspective and so forth because it's early days. So I think that's quite important. I think there's money there because there's actually a demand there that has already been identified. So if you can plug into that, then it's brilliant. It's not the same challenge as you coming up with the first CRM system ever in the 2000 but I do think it's important that we don't look at this to handicapping in a way of saying you have to accept lower returns if you want to transform, because ultimately it's not going to work. But I think you have to train folks to be accepting different profiles, but ultimately it has to offer a better return. I mean, LPs are not going to accept one and one half X returns just because you're doing impact. Our customers is ultimately not going to pay a premium because we're green. Because if you're not green, my friend, we're going to use you. So I just think it's important if you deploy that two years ago people were presenting ventures as green because green was a proposition. I don't think green has ever really been a proposition. It's ultimately what are you getting out of it? If you're then presenting something now we're saying if it is green, but you must be prepared therefore to accept a little bit lower returns. That's not quite a proposition that works at the end of the day.

And we risk putting money, especially public funds, into that concept and money will be wasted. That is a long, roundabout way of answering that question.

Olivia Suchy: What are the most important actors and stakeholders that can really influence the transformation and which instruments are the most effective ones that need to be used in Europe? Maybe instruments that are already being used in other places that we surely need to adapt.

I08: As I said early on, I think the Inflation Reduction Act - there has to be a stronger communication around. But it's hardware that's going to decarbonize the world. It's not software. And software is part of it, but it's still hardware that's going to do it in the same way it's hardware who screwed up environment to start with. And I think signaling that possibly over allocating funds for hardware development, I think would be really important. And then in Denmark unfortunately, we're very bad at spinning out or taking intervention from our universities out. And and there's a lot of very smart people who's been researching for years in these areas. And we just don't have very big access to it so better than others. The US, again, is absolutely phenomenal in doing these things. And I think there's definitely things, I can only speak on in relation to Denmark, but here we are very, very poor at getting our very clever people commercialised. Then there has to be legislation. Unfortunately again, we are 27 countries. There's very big difference between the northern parts of Denmark and the southern parts of Italy in terms of what is needed and not what is not needed. Concerns and how it impacts people and so forth. But legislation is necessary and an aligned legislation instead of what we've seen so far. A little bit of banning of some plastics here and a little bit here. It's really super fragmented how it's done. We've stopped burning. Garbage is not the most clever thing, but that's what we're doing. And then somebody else is picking up our garbage and burning it. So it's kind totally circular. It makes absolutely no difference. It looks great. And our carbon accounting in Denmark, but fundamentally, it's a zero sum game that makes no sense. And we can be more aggressive on legislation. The only thing, if you think about ETS, for instance, the idea is that obviously these funds gets returned to fund these green initiatives so that it doesn't become just an income to pay for other stuff. And I'm not super convinced that that in an EU structure is done in a very efficient manner. Back to how do you prioritize it? It's the money is going to the people who are the best at writing Horizon 2020 applications or whatever it is. So there is definitely something. Again, put it on the wider shoulders. Make sure that you focus this on those who at least have the potential and the standing in the environment, in business environment, to drive this. I find the absence of oil majors with all the money they have in the transformation, absolutely staggering. They have billions and billions and billions. They're printing money right now because we still need fossil for years and the US company is completely absent. The European ones have set up a few ventures here and there and so forth, the shell ventures and so forth. But they're not proportionately to their money and their own influence on the environment active in this. And yeah, so I think that's something that should be done. I mean right now implementing this special tax rate on energy companies because they're making too much money and it's hitting people but this is what they're doing as a counteract to inflation. Why can't it do something similar as a counteract to emissions?

Olivia Suchy: Okay. Thank you. Is there anything that you would like to add on on that? Any question that I didn't ask you anything important that you think is.

I08: I think my main messaging here is that you need to put it on the wider shoulders. There's a lot of corporates that has the might and the ability to drive change. To do that, you need to put legislation in. That obviously means that we can't really sort of shy away from it. You also

need for ventures and for the entrepreneurs then to think about if it's the widest and bigger shoulders that are picking this up, you have to show impact of a scale where we are prepared to pick it up. Otherwise you would be deselected. And then I think we have to find a way of channeling the available capital in a smart way towards where we have the biggest impact. And as long as you channel it through investors, VC firms, PE, then you have a natural selection. But I mean, there are billions being handed out every year in grants with not a lot of scrutiny. They have to hand out the money. So essentially, if you just look the best out of the ten submitted an application, then you'll get it right. They have to hand it out. There's no way they can't. So, we are ready to pay. And then the last part I think is this piece about that, corporate and VC investors can combine to a much more effective development support of these hardware ventures, in particular. Finding the right balance. And you need some that are agile and smart. With that I mean the corporates but there's a bigger, stronger symbiotic relationship when it comes to hardware and when it comes to software.

Olivia Suchy: Amazing. Thank you so much.

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Interview with I10
Constantin Gehring: So, to get a sense of relevance, in which sectors and technologies do you see the greatest potential for change through hardware start-ups?

I10: How granular should I go?

Constantin Gehring: So, maybe if you just give an overview of your industry or so just touch on what you think is relevant.

I10: We only invest in the climate tech sector and actually almost only in hardware. At the end of the day, it's about energy, of course, and this can be seen particularly strongly in the Russian crisis. How do I generate energy? Unfortunately, I would say that not all electrons are created equal. Electrons have certain quality criteria. And unfortunately, the quality criteria of the electrons that we get from fossil fuels are the best. There are many quality criteria. I can operate the system 24 hours a day, I can switch it on and off relatively quickly. Patchable is what you call it then. It can also be easily stored. I can also easily store the energy in gas and so on, so those. These are the quality features, and in the end it is of course incredibly much about energy, which can always be seen in two parts. It's not just about electricity generation, it's also very much about heat, I think. Germany in particular has almost 50% of its energy needs in the form of heat, of which industry absorbs a large part. But you mustn't forget to process heat either, not everything can be electrified, some of it could be made from steel or hydrogen. But there are also things that simply need to process heat and more heat than we can generate with electricity. But at the end of the day, of course, it's about energy issues, and we personally look above all at these high-quality electrons and everything they make possible. It has to be said that there are also many players in the grid, i.e. on the electricity generation side. We are looking strongly at BEGs processes, i.e. biomass in any form. Biogas for electricity generation or biogas as biomethane for feeding into the grid. There is still a lot of potential here in terms of efficiency in electricity generation and gasification. That's what we're looking at, and the second major generation process we're looking at is geothermal energy. That is, geothermal energy in any form, either for direct use as heat, when we are in the temperature range of up to 150 degrees, then it is a matter of feeding it into the district heating network. In the high-temperature range, the mixture of heat and electricity generation is also relevant. High temperature means

geothermal, hot deep or medium deep. Other areas are, for example, heat pumps as home applications to heat up and sometimes also generate a little electricity, depending on the size. Of course, this only has a very limited market, it doesn't work everywhere, but in some places it can be done. The big areas are the grid areas, how do I set up a district heating network where renewable energy sources also feed in? How do I convert an electricity grid? Ultimately, you retrofit the existing infrastructure, such as power plants, coal-fired power plants or combined heat and power. These are the big issues in energy generation and energy storage that we are looking at very closely. Heat, however, was also mentioned. What waste heat is used efficiently is also a very important topic. 70 % of the heat generated by humans is wasted, a new one is not used. So there is a very high potential to make smarter use of existing infrastructure. Small fun fact There is also a sense in our heads about the topic of heat. We are currently adding about four Hiroshima bombs per second to the planet Earth, so that the seriousness of the issue is very high. So there we have a big issue now and then thermal storage is just as important. I can often generate waste heat somewhere, but I don't have a consumer on it. How do I store this heat and ideally bring it to the consumer? So-called heat sinks. That is also a very, very big topic where you can do a lot.

These are both topics that naturally only involve infrastructure construction. Basically, there is another area, and it is not a hardware topic at all, but largely a software topic or market regulation. The so-called flex markets, i.e. flexible assets such as wind and solar. How do I use them optimally? Today there are no real platforms where you can auction such things. In addition, there are so-called curtailment processes, where the grid operator says, okay sorry, now I have to take you off the grid because I don't have enough transport capacity. That happens all the time in Germany. Then you can always see from the electricity prices on the stock exchange, which goes down during the day, because that's exactly what would have happened. The grid operator would penalise you if you continued to feed in. That is, if I have a wind farm or a solar plant, then you would have to pay him a penalty, so to speak. If I continued to feed in, and therefore have to shut that down. Larger operators can then go into storage, i.e. produce hydrogen or whatever. But there are software solutions in this area, i.e. in the grid area.

You would have to build a marketplace for flexibility. We have much more installed capacity than we can use during the day. Especially on windy summer days, we have an extremely large amount. When I look from Berlin, the electricity generation is probably zero from renewables because of the low fog. No wind. We have several hundred gigawatts of capacity across Europe that we can't actually use or use better. That can't be optimised infinitely. But I would say that 10-20 % can be achieved through software solutions, which is many gigawatts. On the resilience side, look at the Ukraine crisis, that would be a quick win. Something can be achieved quickly to make us less dependent on gas. These are the three big areas. Then we look at many other areas. For example, in terms of efficient steel and concrete. But we also do a lot of what we call the hydrocarbon value chain, which is about transport at the end of the day. It's about e-fuels, hydrogen and carbon. So how do I get carbon and hydrogen into the system in large quantities in order to then bring so-called CO2 valorisation cases. So it can be e-fuel, but it can also be nano-carbon tubes or something like that. There are different CO2 valorisation streams, how to turn CO2 into a valuable material. Because that's what we actually need, an industry around this CO2, then all this capturing and so on will be worthwhile. It's actually worth it now if you can really make something out of CO2. There will be no case for all the gigatonnes we have already pumped up. That won't work. The big case is too big but at least a part of it to create a ramp-up that leads to a cheaper capture technology. That's also what government officials are saying is definitely there. And then at some point we will have to prove the sour apple and register, but before we want to register it, definitely use it. And the more expensive, the better. Of course. So, those are the parts we are looking at. In the industry sector, we've gone a little bit wide, but it's really a very very wide field. And for each of these sectors I just

mentioned, I can probably think of 20 companies we could look at. We haven't yet talked about issues like green ammonia as the basic building block of the whole agriculture. Green nitrogen and the whole topic of metals and mining, I would say, is also a huge topic, because all the metals for the energy transition represent a very important building block for net zero. They have to come from somewhere, and there's also a whole rat's tail of solutions on how to make it more efficient. So there are a lot of areas.

Anonymous participant: Now we have to discipline ourselves so that we can make progress.

Constantin Gehring: Okay, and then within this whole back story that you mentioned, would you say the success of the hardware start-ups in the fields is threatened by insufficient funding? So do you see a funding gap that specifically jeopardises the success of these start-ups?

I10: Yes, definitely. So for the first time. I've also personally heard it exactly in that area. It's actually almost always about hardware. It's almost exclusively responsible for almost all the pollution on our planet. And that's where you have to start fixing it. First of all, there's a point. And of course financing. That is the reason why we founded this fund, for precisely this reason. We saw that there was no financing. And we did have a nice macroeconomic model in Paris, but I've been investing in the field for a while and I've seen that nothing happens. So there are founders who have an address book that is super small to call anyone. It's just super small. That's why we founded an early-stage fund and a founders' fund. To seed other managers and to build an ecosystem and create opportunities directly. So yes. Answer: Definitely yes.

Constantin Gehring: Okay, then as a follow-up question: In which start-up phases or technology readiness levels do founders have the most difficulties? I'll briefly share a graphic so that we have a common understanding of the phases. So, where do you specifically see the greatest difficulties in financing?

I10: It's actually in the later phases that this early phase is covered entirely by the institutes, universities and so on. Yes, it is in the phase from techno validation/first pilot that it usually becomes more difficult. That is, from the sales pilot to real mass production. We actually say that from TRL 4,5 it becomes difficult for entrepreneurs. You can still get to three or four with grands and co.
Later, too, by the way. From seven to eight, there is no end of capital. Capital is not the problem there. They don't find anything to invest. So if you talk to a Memoral or TPG, they leave earlier and earlier every day because they can't find anything to invest in.

Constantin Gehring: If you clearly say that this shortage exists, let's get to the reasons. What is your opinion on why this funding gap exists? Especially in the phases you mentioned?

I10: It exists from history, conditionally. In fact, there was no industry in the field. There was big corporate venture capital that financed certain things from the field. But we didn't have any prices for carbon and no policy on how to actually achieve the goals. Actually, everything came into being after Paris and has to become really concrete. Of course there were mechanisms, but it only became really big then. It also took years to get to that point.
But before that, in 2015, we had a VC but no real exit market or market for carbon. Now that we have prices and the topic is generally coming out of the corporate social responsibility corner with the finance department, a market is emerging. That was also the idea of the agreement, that a market would emerge, and it has already worked, at least in the beginning. So I think that is simply historically conditioned.

Constantin Gehring: Okay. Where do you see the biggest challenges for investors, banks, corporate for hardware-based start-ups in Europe?

I10: Unfortunately, it's very, very technical as an investor, as an insurer and whatnot, I manage other people's money. And I also have to invest certain securities in the money so that I can pay for the premium position later on. Accordingly, I look at the figures first and foremost. What have these products brought in terms of returns in the past and there is simply not much there. Logically, there are new markets, new products. That is certainly this mobilisation of private capital. That is really the task of us and of people like us, to mobilise it. And it's actually working quite well. All we can say is that we start to make people aware that something new is being created here, and then everyone starts to play there with, let's say, pocket money, and builds up the market bit by bit. This is the institutional capital market that we have to mobilise to finance the turnaround. They can't even move this morning. They simply have a different role in the system, and you have to be realistic about that. Even if the climate crisis seems so urgent, they can't throw all their principles overboard. It's a shame in some cases, because politicians can be very supportive. Regulation can make business models profitable at a very early stage, as we have seen in the EU, or with the
Action Act in the US, these are really strong programmes. If we intensify this, these companies can break even relatively quickly. And that means on the financial market, exits, multiples and figures with which you can then show up at an insurance company or a pension fund with the track record.

Constantin Gehring: And where do you see problems for venture investors when investing in climate start-ups, especially in the hardware sector?

I10: I don't really see that big of a problem, I have to say. The market is not so different from many topics. So, you need an idea. Of course, basically not always, because the technology exists, of course. But after the technology, and that's only when we can really invest, because we can't work on the technology with the founder. We can't say we'll use the alloy or the alloy. He has to find out for himself how the technology really works. Coming from a call with other founders, I have to say he understood everything. He also put everything down and now? Now he's just looking at how he can get scaled. And in this phase you can help the capital, and of course the experience as an operator or something else always helps. And that's why I also find the models in which we see digital entrepreneurs who are now building up or going into air-conditioning companies with strong technical partners to be very promising models. So it's not witchcraft, hardware, scaling. So that's a different mindset. But at the end of the day, so the curve, it looks different. With hardware, you have the TRLs that you talked about earlier. With software you have a curve that slowly goes up and then bit by bit you sell more and more. Yes, and with hardware you have a long way through the pilot phase and then once the pilot is validated with a customer and then the curve goes steeply upwards and everyone knows especially in this market. But then you suddenly have a huge market. You have risks, but not incalculable risks.
And when we talk about hardware financing, we are not talking about financing, mass production or building factories. We don't do that part. That's the next generation of investors. We're just taking them to that place. I get out of the lab to the point where the technology and market risk are at zero. The companies that we have, if we take these, have these two three pilot customers and a sales pipeline of billions in two years.

Anonymous participant: Can I just maybe add a quick nuance there? I think part of the question that we're also interested in, what's stopping a Fund/MainStreamFund from investing there? Is it just the fear of technology risk? There are other issues.

I10: Yes, it's a good question. First of all, there are some who are doing both now, there are always. Now some. SpeedInvest, for example, which launches ClimateFunds. There is a slightly different skill-set. But it is not so fundamentally different. You have to understand the climate issue and what are the solutions I have to focus on? But I also say to the VCS friends from Berlin, I'll give you three books, then you'll have understood it quite well. So you have to proceed in a focussed way and not make one deal or another in the area. Take a structured approach, look at the problems from the front and invest differently. There is no point in making small solutions left and right here. That simply misses the point.

Anonymous participant: Mission oriented.

I10: Exactly, exactly. I have to be a bit more impact-oriented. We are very strong there, for example. We have clearly attached 100 megatonnes of CO2 as a figure that an investment must be able to reduce. And then we focus on the issues. It's not so easy to always find that out straight away. But it can be done and then we look at the time-value-of-carbon. So every tonne that we can prevent today has a significantly higher value than in 50 years. So no moonshots. Things that can be built on existing infrastructure and can scale well in this existing infrastructure world. Here's a clear example: instead of converting all the aircraft in the world to hydrogen, which would take decades, we need to find a solution for today's aircraft. And an e-fuel that can be used now. No ammonia or retrofitting, but using existing infrastructure effectively. You just have to proceed in this way and set up theses for investments, and I am convinced that many funds will still change. When they see what returns are possible in this area. In the end, it's also a question of which companies will be in the next round of 20-30 x. Must find times in the digital sector. There are, of course, also.

Constantin Gehring: Okay. Has your question been clarified?

Anonymous participant: Yes.

Constantin Gehring: Okay, then maybe one more question from me. What is the difference in mindset between hardware and software?

I10: You proceed in a different way. Of course everybody is solution-oriented. Software developers build a solution for a specific problem. How do I book a hotel more conveniently? With hardware, how do I make electrons more pleasant? It might be a bit more complex in terms of approach, but there is so much research in the field, so much technology that just never made it to the market. Yes, I think one problem you have in the field is the issue that all the good engineers actually end up in corporate for lack of ready capital after they have their great idea in master thesis. If you're at the TU Braunschweig, at VW, in Stuttgart, at Daimler or somewhere else at Bosch and all the ideas seep away there, they end up in corporate. We no longer have this entrepreneurial spirit. After all, it has to be said that there was such a thing in south-west Germany. Unbelievable. So some time ago. The innovation that came out of the hardware sector down there, around Swabia. Unbelievable. Well, there was that once, but somehow we lost it. The rate of start-ups in Germany has gone way down in the last few decades.

Anonymous participant: Could a better kind of CVC also be part of the solution?

I10: Absolutely. Bosch CVC hasn't done one in Europe yet, only USA.

Anonymous participant: Was there nothing Bosch could invest in?

I10: But actually there was. Now look at a few topics. So I found it amazing that there hasn't been a single German deal that's done. Yes, it's this entrepreneurial spirit and it only comes when these entrepreneurs also have the feeling that there's a market here with which I can feed my family and that's always been the case. Then, of course, I somehow started to set up my own business. Really, with capital you have to be insanely busy. What will the address book be for all the reasons in Swabia as well? Ultra thin. That's why they go into some corporate job. That's really a problem because too many are still leaving and the USA is still the best playing field. It's also a problem that VC is still an investment class for the super-rich, as a normal citizen VC is completely a foreign word.

Constantin Gehring: Coming back to the questionnaire, my next question would be: How do you assess the awareness on the political level that hardware start-ups are very relevant for the future of Germany? As already discussed. And that there is awareness that software start-ups are different from hardware?

I10: There are differences, of course. I think politics has understood it as well. The problem is how the policy works. The start-ups just don't have a voice, or only a very small voice. I have a lot of hope that Fridl will brighten things up a bit, and also in the Federal Association of Start-ups, which I think is also very well run. It is the case that the pioneering spirit is more appreciated there and is also heard more. Of course, you don't have a lobby team of 25 people sitting in Berlin like BASF or EON, who make sure they are heard every day. Of course, no start-up in the world can do that, so the solutions of Siemens, Eon and others are always present with the politicians. But they are not the ones. Unfortunately, in my opinion, these companies lacked a strong pioneering spirit. That's the word I was arguing about this week with someone from Siemens Energy. The Werner of Siemens, pioneering spirit, has been completely lost in my opinion, they only look at business and hardly think forward. Simens Energy is a gas shop. I mean, they make money with gas turbines and coal gasifiers, they are not very innovative.

Constantin Gehring: You already touched on this during the interview. But what are three concrete measures that could be taken in Europe to close this financing gap?

I10: Concretely, at the European level. What is missing is a follow-up programme to Horizon. Exactly Horizon is a super programme and the IIB is doing really good things, but the jump from Horizon to BIB is too big.

Anonymous participant: Jump out of the script. You know the new European Innovation Council?

I10: Yes, exactly, that too. And we'll have to see, it's still too early to really say what they're doing. But he also seems to me to have a later-phase orientation. I know someone who sits in the committee meetings and have sent him a few things. So, we basically have to bridge this phase. I have Horizon Grants and I have to see how I can get the next funding and it's usually not covered well enough.

Anonymous participant: Yes, this is the first attempt to tackle TRL 5 to 6 with just up to 2.5 15 results. But we can talk separately.

I10: It is possible that a good tool will emerge. That would be very desirable and it would have to be correspondingly large. What I also keep saying is that I, as the state, should match the VCs much more via the development banks. There is too much missing and we see that other countries are doing an excellent job of demonstrating how to invest very profitably. In our case, KFW goes in but the signal effect is zero.

Anonymous participant: What do you mean? Match in the first closing for signal effect?

I10: They should be the first ones in the fund. KFW or who exactly would have to work there so that they can live up to the funding effect in my opinion. They don't do it justice as the last investor, then it's already a purely financial object. Israel has done an excellent job of demonstrating this, it has to be said. With the Ian Iosamenn programme .

Anonymous participant: The BP.

I10: There are good examples to follow. The Israeli programme was excellent. The whole Israeli tech ecosystem came out of that. The big funds there all came out of that programme. The Israeli state created a whole new industry, so to speak, because at one point it gave €25 million to ten different funds, so €250 million. Ridiculous with a natural, hard capitalist clause. That was also not unimportant in order to mobilise global capital. They have predetermined returns where you can buy the state out. So you could get two x after three years and 3 x after five years. Don't know the exact figures any more. So of course it was a very attractive package for investors. And so they managed to mobilise an extremely large amount of private capital. That worked extremely well. So I think under an SPD-led government we won't get such a clause through. But maybe later. With Jamaica or something. Of course, it's hard capitalism to say that the fund is doing well and now the private investors are taking money out. For all I care, we can discuss how to do it better. But thinking along these lines would be extremely good. Publicly better funding between the programmes, between Horizon and BIB.
In general you have to say VC seeding and also not US VC matching. I find it totally strange that the European Union matches a project where Energy Ventures gives 100 million, I can't understand that at all. So that's easy and I can understand it very well. I know the story very well and it was a pure buddy deal. I don't think that's possible at all.

Constantin Gehring: These proposals were mostly on the European level, but on the German level, can you think of something concrete where you would say that this would be something that could change, or a measure?

I10: KFW should be the first investor in the fund. As I said, setting up a fund is also only something for millionaires, it's just incredibly expensive. Start-up financing is in the high six-figure range. That's where you can get funding. For serious people, for example, the costs could be reimbursed later.

Anonymous participant: What do you think about FoundersFund? So we need more private, independent of KfW.

I10: Sure, of course. So I have another LP class. That's a totally underrated financial product. We have one too, but maybe not necessarily from a financial product perspective. But we see

performance, super performance, so it's a really good thing. They are totally important and also totally underestimated in my opinion in terms of performance.

Constantin Gehring: Okay, then we're actually already at the end of the interview. Do you have any general suggestions, objections or questions regarding the topic? Any wishes that you would like to express?

I10: Well, to politics in particular, I would try to build up a forum somehow. It's difficult. We have. We have also done policy advice, in which I deal more with the innovations. It is always a pity to see that we have funded incredibly good innovations, partly BMBF and Real Labor and others. But at the solution level, only Siemens and Co. have a say. They don't even feature, even though we have already funded them with a lot of money. So somehow we need to show more innovative strength in a productive way. I don't have a good suggestion, but I would suggest some kind of innovation committee that looks at topics and then sees where we should specifically invest. For example, now with the question of energy resilience. This is an incredibly important decision. Now we can make many mistakes or do the right thing. We already make many mistakes, like LNG.

Anonymous participant: So at crucial points in the ministries of the interior, for example, or also in the civil service, better inform people about innovation that has already been promoted by the state. So, that there is a good model with technological solutions, etc.

I10: Exactly, that they at least have this on their radar when making decisions. E.g. This is the new process of geothermal energy, which should at least be included. If I look at the biomass strategy of the German government, which is being promoted right now, as a classic example. After Russia, the use of biomass has a lot to do with resilience. But there is also so much innovation in the technological field. You didn't even include it. Even if it were only in the chapter What's Next. Then I would like to read that. It doesn't even have to be a chapter. On the other hand, there is a note saying that we have invested in technology in the area that can't save itself from orders. Founded in March and now 30 million sales today, there is a huge demand. But that is not part of the biomass strategy. What else can actually come? Where do we actually want to go in this area? Where are the potentials? They are very much based on the status quo.

Only relevant when it comes to the question of capitalism or doing less:

I10: That's right. It's not like we're in thought. This structure of funding is the be-all and end-all. That's why we formed. And I think also the themes are also united, which are the themes. So then, in the end, it's a structural issue like how do I really manage to mobilise the private capital? I think that's something that politicians need to do more of, and in general, prosperity and growth also depend very much on decoupling CO2 consumption. If we don't manage this, we will simply see less and less growth and prosperity in the next few decades, and the industrialised nations will be the first to notice that everything is becoming more and more difficult, more and more expensive and more and more complicated, reaching climate tipping points and so on. So there is actually no macroeconomic alternative at all, except to somehow manage these couplings and that actually almost every price, that all other scenarios will go in the direction of really discussing something like that a few circles if it is then really so the one response so that you really say okay with our bad way of dealing with these issues we have to somehow all work three hours a day less or particularly energy-intensive day production down. There are even scenarios that are painted. Somehow. With 16, 18 days a year, you could well balance it out significantly. But that's just all hard scenarios, as they sound so 16 days, two

weeks off for these bad, but expressed in GdP. And I'm not a fan of those four now as a size or as a measuring stick for any kind of prosperity, but it still related and look in the long term also 1,2,3 percent reduction in GDP are what happens there with the dead markets and whatever else I can't even imagine. In this respect, none of these are pretty scenarios. Everything else, with which we don't have to make so many sacrifices and with which technological sacrifices are perhaps also unnecessary, should be taken into account.

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Interview with I11 5th of January 2023

Constantin Gehring: Okay. Wonderful. Then I would just start by asking a bit more generally in which sectors and technologies you personally see the greatest potential for change through climate tech startups.

I11: Okay, so I'm the policy person for Germany and the EU, so I'm not in the venture fund, but what the project developers and the VC people say to us is. Our VC is looking at all kinds of areas, but especially in the area of project finance we are mainly in Sustainable Aviation Fuels, Carbon Capture, Direct Air Capture and then Green Hydrogen. And in long duration energy storage. But that is now project finance and then for VC. So my impression is that these are the energy-intensive sectors. So cement, steel probably the whole issue of critical raw materials that is coming up now. That's my impression from the people who are working there.

ConstantinGehrig: Can you tell me where the transformation to the sustainable economy is working successfully in Germany right now and.

I11: Yes, I think certainly with electricity. The energy transition as such is perhaps progressing a bit slowly, but the grid as a whole is already relatively green. I also think that in transport, i.e. passenger transport, things will probably move relatively quickly with electric cars. And from talking to Fliessmann and others, I now also have the impression that the heat pump will of course find its way in relatively quickly, also thanks to the crisis. But of course, these are not big VC topics and not big start-up topics.

Constantin Gehring: Okay. But you see that startups are relevant for success in transformation, right?

I11: When I look at Germany, the transformation, as it is discussed in the political mainstream, is really still the energy transition. Out of coal, out of nuclear, more renewables, then the transport transition based on electric cars and then the heat transition based on heat pumps. And I think that's all coming along somehow. But from my point of view, it's all very corporate, and I don't see many start-ups that would bring the breakthrough innovations that would make everything happen faster. But I do think that if we look at the areas of steel, cement, chemicals and all of these energy-intensive industries, and somehow there is a feedback loop. If we look at all these areas, including the topic of fuels, it will certainly be very important for success in Germany that all the innovation, all the early stage innovation that exists in these areas is also used and scaled. Because I mean, especially cement, steel, chemicals, there are really a lot of companies on the way in this area, start ups and partly also scale ups. Now I'm thinking about the *New Attack.* These innovations must then somehow find acceptance in the large industrial companies in the USA. The great danger that I see is that perhaps too many attempts are being made to rely on in-house R&D and in-house innovation in these large companies, and that the entire early-stage innovation that already exists in principle is not being brought into the companies and scaled.

Anonymous participant: Do you know about adaptations, brands of start-ups and technologies in comparison to other countries? How would you rate Germany or Europe?

I11: I don't have any figures there, I'd be happy to ask for them. One example: We do a relatively frequent tour here with long duration energy storage companies, including thermal storage, for example. And we have now also organized an investors' summit with the BvbS in Berlin, and that's where you get to talk to all these Thyssen to BASF and everyone, including Siemens. One often has the impression that one explains, then look here, we have promising technology in the area of thermal storage, heat up to 1500 degrees, Rondo or Malta are two in which we are invested and then often the reaction is yes, we already have such things ourselves. So we develop that ourselves, we can do it ourselves, we don't really need it. So that's my impression, that German industry is very conservative in this respect and that, at least in the U.S., it's absolutely different from what it looks like in other European countries. I'd have to take a look. But I have a feeling that the ratio rates are lower than elsewhere.
Constantin Gehring: As a follow-up question, do you see the success of these startups in the areas that you also mentioned as relevant being jeopardized by insufficient funding?

I11: Yes, there are many reasons for that. There are many facets that one could start with. For example, we have now also advised the federal government of the BKA on this new CCLP program. And there was also the outcry of the DIHK a few days ago that in principle the whole CCLP program is only focused on the large emitters and no SMEs are taken into account, etc. And especially with these large policy instruments such as the CCLP and the larger subsidies, I see the danger that this is often very as I said again focused on the corporate and so a bit of state of the art technologies, both in Germany and at the EU level. So if you look at what Thierry Breton is doing, the new definition of clean tech, what is now worthy of funding as a kind of answer to the financial market in America. That's just heat pumps again and a little bit of batteries, things that you can do somehow. I think that's one of the dangers of not linking subsidies on the demand side strongly enough to innovation and innovative technologies. We also see this in the Innovation Fund at the European level, where the start-ups and scale-ups with which we work are very rarely awarded contracts, for example Ecosem. We are invested there, they have applied there, for the fund, twice, they make local cement, where very little CCS is needed, never got the award. Now where H2 Green Steel Greenfield investment in steel production, green hydrogen based, Sweden, did not get a bid, but it's always the big BPs and Heidelberger Zement etc. that then do CCS projects. That's the demand side. And the other thing is, I think, that we still have a Valley of Death for the material- and capital-intensive deep tech climate startups in the early phase.
And that was also a discussion we had for a longer time with KfW and the Deep Tech Future Fund, now called the Deep Tech Climate Fund. The whole idea was to use venture capital to scale riskier technologies and to grow companies. And we have also observed that this is not very early-stage, so that this whole Deep Tech Future Fund and now Climate Fund really only starts after Series A and everything before that actually falls behind. But that's where the actual risk is. So, in principle, another instrument has been created that can probably finance incremental innovation in some SME, in some medium-sized company. So maybe a little bit more energy efficiency in a plant, but it's not really suitable to grow now capital intensive deep tech startups. And yes, and then even earlier-phase is basically also just the whole topic, and we had pushed that once. In Germany, we could perhaps introduce matching grants. Investors are still very risk-averse when it's in such an early phase. There are high material costs, there is a technical risk as a market risk. So actually no investor wants to go in there. There are actually no loans from the bank. Could the state perhaps come in with such a matching grant, saying

that we people as the investment of private investors, so that was, for example, a very concrete proposal that we have there.

Constantin Gehring: We will come back to the proposals later. I have two follow-up questions to what you said. So one, I wanted to ask, the earlier phases that you talked about, where would you classify those? Is it one or 1 through 3? Where do you see the most severe problems there? So below. This is just for orientation, what kind of programs there can be. There are also other ways of looking at it. But maybe just orient on the top of that as different TRL's.

I11: Well, you have two problems. You have there once early stage, basically getting the first investors on board and there I would say everything up to three. So everything you need to get to step 4. And then there are also later phases. That is then rather with the large projects, but scale, exit, because then you already have in principle something that works technically, but which in principle still represents a risk and the demo plans first a first large demonstration must first be financed. That's also another problem. It's already somehow feedback here with us.

Constantin Gehring: I wanted to ask if you were just in the. If you also see the scale-up phase as problematic. Is that related to the fact that corporates in Germany are so conservative? So you're saying that a lot of work actually has to be done together with corporates. In terms of scale up, in terms of exit.

I11: Yes, I think so. So if you think about it now, it's got Scale Up. It has a technique and technology that is really strong. But it's not yet bancable, because it's still a young company. It doesn't have the track record yet, also in terms of financial flows. You don't have the assets to back the guarantees. So no bank is very keen to finance such a large demonstrator. And I think the state could step in with guarantees or cash or a combination of the two. The corporates could theoretically help finance the project or at least conclude a purchase agreement. That is certainly part of the story.

Constantin Gehring: Okay, good. The next question is what do you see as the biggest challenges for founders in the hardware deep tech space over these phases. But we've actually covered that now, you wouldn't add anything else there either, right?

I11: [00:19:56] No, we've covered that now.

Constantin Gehring:[00:19:57] Exactly. So first Valley of Death phase 1 to 3 and then again in scale up. Exactly. And now that you say there are these Valley of Deaths. Why would you say those exist? So especially when on funding gaps happen. And what are the factors that you say? The ones that influence that, so the ones that create those gaps?

I11: Yes, that is the risk that still exists with these capital-intensive assets. For these phases, there are no adequate support instruments, at least in Germany, or even players in the financial market who would take on such a risk. That is what we are trying to do with our Catalyst Fund. At least in the case of the second VOD, that we then co-finance these first large first commercial projects, so that the gap is filled. I think we are one of the few programs that does that. The question is, of course, how such a CCFD program, once it is up and running, could have a positive impact on the problem.

Anonymous participant: I think it's exactly right, so de catalyst fund, to go in there. Would you be able to make a distinction there between the U.S. and Germany? How could you describe it, how you see it?

I11: The Catalyst Fund, it has to be said, has only just invested in one project. Lanza Jet in Georgia is located in America, so that's always been a bit of a big question. The philosophical question is do you go into projects that are financially well positioned and where you can say, we can really kick-start the industry here, or do you go into projects where you say they are really particularly innovative? That's kind of the basic philosophical question that's presented. You can't really make that comparison because, as I said, there's only been one project now where there's been investment. The ALPs still and there is now also just a new VP for our great program. That's why this will now be clarified philosophically, in which direction the whole thing is now going. So it's a bit premature to draw conclusions here, but that's at least the basic idea of the program that I described. And as I said, I don't know of any other program that tries to close this gap.

Constantin Gehring: Okay, so let's go back a little bit to the point that you say that the capital requirements are too high and therefore the risks are too high. And I wanted to ask again why you don't see that there is a reasonable or sufficient compensation for the risk. So with other interviews sometimes it was said that the, that it's so technology specific and you have such a long term advantage there that the risk pays off again. What you have, you say, The risk is proportional to the gain. Or are you saying there's something like too much risk diversity that discourages investors from investing?

I11: Well, I don't think there are that many investors in this clean tech/DT area. In tech financing in Germany, we probably have the main VCs in the membership and there are not so many others and these VCs are all together not so particularly large. I think the classic VC is still (...) Pizza App. So I think there's just not that much capital yet and it's also highly specialized. I mean, who understands how a cement plant works? You need specialized people in your team. I think first of all that there is too little knowledge and then, yes, as I said, the risks are high and so far there has not really been such a policy framework that you can now think of a cement, which would now secure that such an investment then really pays off. So I there is somehow Net 0 targets in 2045 and and yes and there is an ETS but that is now being tightened up, okay that will certainly again then create more confidence. But at the same time you then have standards for cement, for example, that just mandate certain products. You then say 35% Portland cement content or what. So, this is a highly complex area, simply where not everyone can get through, and so the risk increases, and then there are few support instruments from the government.

Anonymous participant: Would you say that there is little capital also because the market is so young or where? Why do you think the market is not yet more filled with venture capital firms? Is it just because of the lack of security by the government, so by the lack of regulatory (..).

I11: Well, if we stay with the cement example, there isn't really a market yet, because the corporates aren't buying up these new cement products and start-ups yet, or they aren't integrating them yet. So Ecostem, for example, they just want to license out their product. Maybe that will work, but so far there hasn't really been a market from corporates, there hasn't been a purchase market and there hasn't been a market from the government. So when we think of public procurement, there's the nice buzzword green public procurement, but that doesn't work at all. Someone once gave us the example that in Berlin they somehow wanted to do

without a new S-Bahn tunnel because too many emissions were produced during the construction of the whole thing, instead of somehow saying we'll do it with green cement. So I think this is simply an enormous market uncertainty. And then it's also heavily regulated, as I said, with the standards and norms from the EU, which are difficult to change, but then you have the problem and I think it's relatively similar with steel and chemicals, although with steel and there you have the car manufacturers, who then want to use green steel.

Anonymous participant: I was actually going to paraphrase again and his point is the innovation field for DT startups. It's just so complex, so highly regulated and it needs the change of regulation to create an exit market that becomes controllable for investors. And it is just a lot of pioneering work, new work and a new understanding of risk, which they must establish with new expertise, from the investment companies out and from this policy (...) is such a great complexity that there would be a conclusion that therefore less more capital flows there.

I11: Yes, that is certainly one side of the matter and where it is now changing. In the case of fuels, especially in the aviation sector, there are now also binding targets and you can already see that this is being invested and that some of these start-ups are now also supplying and so on, so something can happen, because overall, as you have said correctly, but there is a lot of pioneering work that has to be done.

Anonymous participant: I see it the same way. I wanted statement gladly, cool thanks.

Constantin Gehring: How would you assess the political awareness that we need exactly these startups and that we have startups that are not classic software startups that are doing this pioneering work?

I11: Much too little. From examples in politics you see, so slowly people understand it too, but also with the start up strategy it was still, I found very software centered at the beginning. And that there capital intensive hardware start ups have other requirements that it came. That's been percolating so slowly. And yes, my very first comment, I had said this earlier as well, is that the. The whole turnaround to climate neutrality in Germany is just still really very much seen as we rely on existing technologies, wind solar, which the electric vehicles battery, the heat pump. So that was almost it. And even if regulation is being considered, I think very little thought is being given to how regulation can be used to create new technologies in the market.

Constantin Gehring: Okay, thank you. Now we come to the part that you already touched on earlier. And that is concrete measures that could be pursued in Germany to close these funding gaps and to make startups more successful.

I11: Yes, exactly. We have also summarized this in a paper like this. Is it perhaps even better to simply read it here? So if I now present it here orally. Here is the link, these are the three points in principle, i.e. the matching grants for the early phase, then setting up the DT Climate Fund and then creating the demand push with the public award. These are the three topics that we have now addressed in Germany. What is still missing is a little bit of the topic of the first demo plans in the later phase, where it is said yes, where it would probably be good if the state would set up a kind of catalyst fund, so that you use guarantees or cash, you would have to think about it. And then at the European level, of course, there are a few things that could be discussed.

Constantin Gehring: Okay, thank you. Then we will bring that in so. Do you have ideas for the European level or what? Do you have two suggestions for the European level?

I11: So maybe you could look at EIC. It is still somewhat inspired by Horizon Europe, that you have to come back with such a consortium. Perhaps we could think about whether we could make this accessible to individual recipients. Because this consortium is of course not always so easy for smaller ones. That is one thing, and the other is the Innovation Fund, which I mentioned earlier. This is again in the later phase, where the contract is usually awarded to the large companies. And the innovativeness of these projects is not always so guaranteed.

Constantin Gehring: Okay, thank you. Do you know of instruments that are used abroad for financing hardware, DT startups, that we don't have in Germany but that you would consider useful?

I11: I don't know the details, but that's often cited. I guess that's relatively successful there. And then APA-E of course also. certainly a role model and especially a role model in terms of speed. What we have as a problem here in Europe is often that these funding instruments are not very fast, i.e. that there is a lot of time between the application and then the point in time when you actually receive the funds, the award, and we also had the EIC actually the problem that even the start ups had received the award then did not get any money because the budget was somehow blocked in the Commission because of some infighting. And what you get with APA-E is simply this, this first-come-first-served principle, that you apply and as long as there is still money, you get a lot of money and then it goes relatively quickly and you don't have these long deadlines that we often see here.

Anonymous participant: And then exactly as a question in Germany you would as a meaningful player for funding. Who would you see there? How could the state or what areas of the state could help in a meaningful way?

I11: Yes, well, I mean, there are already a lot of them. For example, there is also the Sprind, which is actually a good approach. But as far as I understand the concept of the Sprind, you then have the state somehow as a co-owner, so to speak, which many find unattractive. So I think we simply have to take stock of the situation and see what instruments we already have here and how we can realign them in a meaningful way. That could be the Deep Tech Climate Fund, which has to be more early-stage. They have now recruited a new team or chemists, people with technical expertise. But then, of course, you have to look at which competencies you really need, which sectors, how can you rebuild that? Sprint, as I said, is a good sub-facility and should be looked at. Is it possible to reform it in some way and give it more room to maneuver? Can we make it so that the state is not the owner of the startup? Yes, those are some of the issues. And what I hadn't even mentioned yet is that we've also been dealing with this a bit in Germany. Now the whole issue of spin-offs, in principle even before the innovation and start-up, there are massive problems that, in principle, in order to be able to use the IP that belongs to the university, you then have to give up equity shares of up to twelve or 20%. So, of course, it's an absurd situation that leads to many very good innovations from German universities never finding their way onto the market.

Constantin Gehring: Okay, so this TRL 1, on the far left again is particularly a problem also again the spin-off.

I11: Yes exactly exactly the spin-off at all so before we even talk about a startup yes that is, we have not yet come to.

Constantin Gehring: So from me there are no more questions, but just to you, if you still have suggestions, objections or questions and somehow still want to mention something that you say.

I11: Well, we have. I'll just shoot you a few publications here in the chat. So this is the topic of spin-offs now and then, then we had also done a paper again last summer, it was about that has it so a bit touched on, what is actually the what actually the VC funding in Germany one we have that somewhere in German. Well, we or the consultants we had commissioned had calculated that in principle there is a gap of €23 billion per year in Germany alone if you want to achieve climate neutrality. So of course you can look at that methodically now and see whether the figures are the right ones. But the paper was an attempt to point out that climate neutrality will not work without innovation and without it in this area. Germany is perhaps also a good impetus for the Sustainable Finance Advisory Council and also paves the way for the start-up strategy, so that the whole issue is taken a bit more seriously.

Constantin Gehring: Thank you. Do you have that feeling or is that just suggestive question? But I always have the feeling that startups are perceived by many corporates as a small thing and that it can't actually be a solution to their problems. This gap, I very often find it to be very big. Yes, what is your experience?

I11: Yes, absolutely. So that they are often not taken seriously, in fact, or even worse, bought up in order to keep them down. The problem is, as I said, this almost arrogance, that people think they can actually develop everything themselves, somehow internally. That is my problem.

Anonymous participant: And if you add to that the topic of off-take agreements, well, for example, Tier in the U.S. has simply come together with more gigantic commitment. We see that now with a Startup here the one, the largest with the number make the shipping and in the Maersk I now times so one on the market created and by the fact that they convert so massively container ships or the new with methanol many places. So so massive. How important do you find in relation how important do you find offtag agreements and what kind of leverage is that?

I11: I would say they are very important, especially if you. For example we had a look at some of the projects of this European High Guardian Alliance so we fund for us, we give you energy money that they get a sacred accelerator called the European Green Exploration Center. So that's a part of us and that's how you Energy does the program and they helped among other things to get Green Steel off the ground. So their job is actually then, you try to develop projects and then you look for the financiers and investors together and you then help to organize the uncovering of things and you know for example they have not yet produced a ton of steel, but they will start in 20 25 and they have already sold their complete order for 2025 to Scania, they have and also from Scania came then by the way also the CEO of is not at all and so at favorable prices. So that's a good start. So that's how it works and I think that the Office Agreement was very central to that. And as I said, then we looked at these other projects that came out of the European Green Alliance, so this European Alliance is this IPCC process, the EU Euro subsidies are distributed. And a lot of these projects were just not good and based on subsidies and especially don't have a revealer. These are no start ups, in any case, but often they were and that was a big weakness of these projects, that one somehow simply assumes, one produces

hydrocarbons now and somehow it sells itself and without that one then also. What often happens is that the infrastructure is not planned or there is no idea at all how to get in. Of course, that's another matter with a network infrastructure like hydrogen. But I mean, so would I as an investor go into a cement startup if I'm not sure or how much startup that they're selling these products as well. So we would do that. We're planning there, yes.

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Interview with I12

Constantin Gehring: Okay, then maybe we'll just start right away. And a more general question about the relevance of the topic. And the question is, in which sectors and technologies do you see the greatest potential for change in society?

I12: It is indeed very complex and this ties in a bit with what I just said. I am an impact investor myself. That is, what I see is of course all the transformations that are necessary to improve our environment. And the lives of the people on the planet. That's, that's one side. But of course there are very, very much deep tech changes that will change our lives overall. And not necessarily with the big direct environmental impact, but with a big impact on our society as a whole. And these are actually very long-term investments, because these are not things that can simply be tackled with a business model. And here we are again where the innovation is much bigger, much more continuous, where the development times are longer. And here we are again very close to the topics that you are currently investigating with the hardware. Only because it's not just hardware alone where it's difficult to find money, but that's the case overall with all topics that have a longer development time.

Constantin Gehring: Okay, where would you say the transformation in Germany is currently working successfully towards a sustainable economy? And what would be a driver that you could assign to it?

I12: Well, I mean, as impact investors we are a bit in our bubble and you get the feeling that a lot is really happening. I think that on the macro level, i.e. the economic level, the gaps are much bigger than the successes. What is a success, of course, is that we have the expansion of renewable energies, which is now actually going a bit faster than before, and that we are moving in one direction. Certainly not only for reasons of conviction, but also for geopolitical and forced reasons in the direction of greater independence from fossil energies. And that, of course, will give us a very big push. Because if we think it through to the end, if we actually obtain our energy from renewable sources, then at some point the price of energy will be very, very low and then we can develop our national economy in a completely different way. If we produce energy in a climate-neutral and cheap way, then we have a real, huge opportunity to make something great out of it. Nevertheless, if you look at what is happening worldwide and also in Germany, we are not achieving our CO2 reduction targets at all. We are totally behind the agenda. We have a huge raw materials problem worldwide. We still have a big, big problem with energy and environmental pollution worldwide. So it's always, always very difficult to say, that's the, you have to set the standards right to say whether you can be satisfied with progress or not.

Constantin Gehring: Okay. And now you have assigned a clear relevance. These start-ups, the ones that can help us in the future as a society. And do you see the success of these start-ups endangered by insufficient funding?

I12: I think you have to look at this in a very differentiated way. Until a few years ago, it was very difficult to be a clean tech start-up. I believe that it is now much easier to be a clean tech start-up in the early phase than it was ten years ago. In that sense, I would say that at the moment, funding for a clean tech startup is not problematic. Especially not if it's, if it's not just hardware. In the growth phase of the startups. The picture is a little more differentiated there, but things have changed there, too. There are now very large funds that can invest in the stage area in these segments. They didn't even exist six years ago. That makes real growth possible. Corporations are very interested in buying cleantech start-ups. That means that at the moment there is more momentum for these start-ups than against them. It has improved a lot. It's not perfect yet, but it's definitely better than it was.

Constantin Gehring: Okay, maybe to go a little bit deeper into the reasons, the different phases, I wanted to share this with you. See. My screen.

I12: It's just about to boot up.

Constantin Gehring: So, maybe if you can or could assign it a little bit more to the phases now. With the first two phases, you say, it's getting easier. And something is already happening with early commercialisation. Can you categorise that somehow exactly?

I12: Well, at the beginning you have University Affiliated Programs, Government Programmes. I think there's really a lot. And then they go from. So the University Affiliate Program. They go up to the First Pilot. From my point of view.
And Government programmes are also sort of for the whole blended finance. I don't know what you guys mean. You probably mean this mix of grant and equity. They don't start that early from my point of view and I wouldn't present them at this point. Accelerators, you can sort of put those under Final Product Market Fit and Technology Validation. So, some go up to the first pilot, I would say. And then corporate venture capital with partnerships and venture capital.

Constantin Gehring: The question is not whether the allocation of the different instruments is correct. That's just by way of example. My question is, in which of these phases do you see the biggest problems?

I12: Yes, yes, that's why I'm going through. So the funds that you have then in the middle in grey, they actually start at the first pilot and then go all the way to exit. Corporate VCs usually don't go that long with Scale Up because they usually buy then if they're interested. In Traditional Venture Capital Funds. I wonder why you don't have the scale ups in there, because they should actually be there. There are few in Germany, but there are funds in this segment. I think something is wrong. So that's not a gap. Well, there is something. Maybe not quite as much as in the previous segment, but there is something. And the evergreen fund alternative of Structures Evergreen Funds. Yeah, so honestly, there's actually not a lot of those. But I don't know if you can get through those over those four things. From my perspective, it's not quite right. With venture debt. That's mostly not there at the First Commercial Contract. In fact, in Germany there is relatively little venture debt and that is normally you have to be almost always cash flow positive to use the venture debt instrument. And there my view is not that there is little supply, but there is also insanely little demand and that would also be over the whole time. So actually it's more in scale-up than First Commercial Contracts. What I wonder about is this phase: Institutional Investors High Net Worth Individuals, so for me they are just the High Networth Inidividuals, they are actually like the traditional venture capital funds at the beginning.

These are the larger angels, who, in my view, are more likely to be seen at the top and not just at the commercialisation stage. In some cases, they even invest super early in the process of finding the product market fit. They are a bit harder to find, but they exist. And when they are enthusiastic, they invest over the entire term. Project finance is complicated because you need a certain bankability and that comes later. It's like venture debt. It's actually not so much for these projects of start-ups, but rather later. And yes, acquisition, IPO's, that's the phase that actually comes after the scale up. And the specs, I think, they're through, that's not going to come anymore. But if you ask the question so without this table again, so where there are actually gaps, it's in the scale up phase, but that gap is getting smaller over time. So it was bigger before, it's less there now. And for some projects that are very early, i.e. in the first two phases, but have a very long development time or are very expensive, they are very, very difficult to finance. That means it's not just a question of the phase, but a question of the capital requirements. If the capital requirements are very high, it is very difficult.

Constantin Gehring: That goes directly to the next question, why do you think this funding gap exists, to the extent that it exists, but what is the reason for it and what are the factors that it exists?

I12: That's not an easy question. And it's a very, very complex answer. The first thing is, with such complex projects, you actually have to have dazzling financing, so hybrid financing. There are parts that are project-related, that are still very R&D intensive. And then you have to see to what extent it can still be financed under the R&D funding programmes. So all the research work in a project, for an innovation, should not be financed by venture capital, because it is simply too expensive to finance it all with VC, but you have to find other means of financing, and very often it is public funds. It's the same in the USA, it's the same in Asia. Either you have a contract, a research contract, or there is a research grant, or you buy first and say I need this and that, and then you buy. It's a fairy tale to believe that you can finance everything through venture capital. And that's very important, because it's often mixed up and even the EU often says that now with the EIC, for example. It takes elements that were actually always R&D funding and financed through R&D grants. And that has now been changed to equity financing. Of course, this means that the founders have to give up a lot of their shares and ultimately the incentivisation of the founders is no longer there at all. In other words, this is a very strange fallacy that is being made by financing things that the state is financing wrongly, i.e. with the wrong instrument.
That is one thing. The second is that if you have innovation financed by VC funds, then you have to stay within the fund logic. Fund logic is a fund that has a 10-year term, plus two years extension or plus one plus one. And that means that in the time I have invested until I get out, I have to have managed to produce the value or to produce it in such a way that I can then sell and have generated my return. And that's the big crux, because there are a lot of business models that you don't manage to bring about in the short time, so to speak, where you can make an exit. And a lot of funds fail because they invest in things that can't be brought to a stage where they can be sold at a price that generates the necessary return within the term or within the investment time. And that is what happened especially in the first phase of fintech investments five and 15, 20 years ago. You wanted to finance very large investments with VC, and then you invest and invest and invest. And you don't manage to produce the return you need within the time you have to sell again. And that is, I think, the big problem, that with such a normal lead time, you run against the idea of longer-term investments and very often of hardware investments.

Constantin Gehring: Okay, and you say that there is too strong a focus of venture capital firms on investments in research and that other instruments are lacking. So you're saying that the ecosystem is too focused on venture capital as a provider of capital for R&D, although it really shouldn't be.

I12: Yes, I didn't say it quite like that. The start-up ecosystem works to a very large extent with venture capital. Which I think is very, very good. And we have seen some great successes, for example in the life science sector. The life science sector is just as long-term, insanely capital-intensive. And there was, for example, a programme by the Federal Government that was a research and development grant for a first phase and for the second phase you only got this grant if you found venture capital investors. And the combination of these two components, where you say that one part is really still a research project, and the state finances that as a research project, and then I incentivise my founders to take care of building a company out of it. And then, of course, they have to get investors. I think that's a very good combination. And the investors are of course very interested if they also have a lot of subsidies in this financing round, also from the public programme. For some reason, this combination has not been practised very much so far, and very often it runs parallel and past each other. And I think this interlocking of instruments would be very important.

Constantin Gehring: Okay, okay, that's what you want. Do you also want to make a recommendation that we look at whether we can adopt similar practices, whether we can adopt practices from the life science sector in the area of climate change?

I12: Absolutely, that's what I'm also doing for Sprint and I hope that we can get that through.

Constantin Gehring: What do you see as the biggest challenges for investors who invest in hardware-based start-ups in Germany?

I12: Well, if you have a pure business model, then the capital intensity and the duration to the point where you can make your exit is way too long compared to what you have to pay back when you have to pay back your money yourself. That's, that's the problem. And what we do, for example, is we say we always need hardware because most of the time hardware is where the technological uniqueness is. But for the business model to work well, we definitely need recurring revenues, because only then do you have a chance to build a VC business model on it. And then you can also say that you are financing the software layer, so to speak, or that with the recurring revenue via venture capital. And if you have a lot of hardware produced, you can then have it financed via an SPV and financed by a bank, because then you have assets and then you can say okay, I have something that I can give as collateral for the financier and don't have to finance it with expensive equity, which doesn't work. Otherwise you have to bring in far too much equity into a company. And the example my colleagues always give is what they did with Sonnen. Sonnen only had battery at first, but they have now managed to convert a model, a business model, so to speak, so that they have recurring revenues. And then they were really able to massively increase the turnover within the time they were invested. So they went in at 40 million turnover. We sold it, sold it to Shell at 80 million turnover and now the company has a turnover of half a billion. So it's working. But you have to build the business model so that you are not just a hardware start up. Otherwise it gets very complicated for the VCs.

Constantin Gehring: Okay, fine. And why don't more companies like venture capital firms adjust their lead times...?

I12: Yes, because you very rarely invest alone. And that's a market standard. The market standard is ten years plus two, if you say okay. I don't care. I have a 25-year maturity. First of all, your IRR is calculated by time. That means you have to earn more capital then. But you're mostly invested with other investors in the company and if. And they all have to have the same interests. That means if you say I can wait 25 years, but the others have to leave after ten years, then the investors have to leave and then the company is sold and it's no use. So the entire industry would have to change, so to speak, and that's unrealistic, because you won't find enough investors who really say I'm willing to invest my money for 25 years. Of course, they also want to see the returns.

Constantin Gehring: Okay, thank you. And in which sectors would you say that the state should take a more active role to promote these markets?

I12: Well, I mean, the state should really only act where there is a market failure. And this market failure is constantly shifting and you have to analyse it again and again. When we built X, the market failure in Series A was agnostic, even in the sector. Within a very short time, that was almost no longer the case. So we were set up as a Series A fund, Paribas X. That means that we invest at the market prices. So that means we invest on the same terms as private 50-50. And after three years the segment was totally full of VCs. And then you ask yourself why the state still has to do something? Of course the state has a role to play in all areas where there is too little capital. That is, you can of course say that the state could have an evergreen fund. But if it also has its Evergreen Fund as a co-investment vehicle, then it is just as useless as what I just told you, if it is alone with an Evergreen structure and needs a co-investor. As far as I know. Maybe that's changed, but since the Deep Tech Climate fund, I think it's set up that way, then it's complicated because I mean, you have to have co-investors that function the same way as you do as a state and then you probably don't find them. Actually, everywhere there is this market failure. And at the moment, I think you can say that everything that is still very innovative and research-intensive and long-term is still something where the state has to get more involved, in my view. Everything that is deep tech, that is really very capital-intensive, very complicated, that is where the state should also act and, of course, continue to act in the life science sector, because that has proven itself and then it has to be that way. So at the moment we can't finance all that. That is also the case worldwide. And of course everywhere where the state says I want to achieve something special. If the state says that climate is important to me, then of course something could be done. Of course, the state could also give special support to all climate funds. But they're not really doing that at the moment. At least not noticeably.
Indirectly, so to speak. Just don't invest directly in the start-ups, but in the funds. I don't know what Fridjof told you about his investments in funds. But theoretically there really could be a separate pocket where you say okay, we want there to be funds. And then, as KW Capital, you can of course invest either more or earlier or whatever money in these funds.

Constantin Gehring: Okay, now let's move on to the funding measures. You've already talked about the gaps where there could be some and we've already talked about the life science model and the transferability. But what are three concrete measures that you could think of where you could say that could help, that would make sense?

I12: I have already mentioned all of them. But I would like to repeat them. The first would be a programme with a combination of project funding, i.e. research and development project funding with corporate financing, i.e. with equity capital. The second would be more effective support for funds. And the third would be an evergreen, a handsome evergreen fund, but set up in such a way that it doesn't have to co-invest, but it would have to be a public-private

partnership. Probably 70 % public, 30 % private, in order to invest in topics that are crucial for technological sovereignty. And in case of doubt, these are also topics that are very close to climate issues.

Constantin Gehring: Okay. And are there any instruments that you can think of that are used abroad, that are not used here by the state, but that could be useful?

I12: Well, these public-private partnerships do exist. I know that they are thinking about something like that in the US at the moment, working together with foundations on these really deep tech hard core disruptive topics with state money and private foundation money. There is something like that for example on hydrogen in France. It happens a lot and we should definitely look at that. On the subject of how the state fund operates. This also exists in other countries. I can only say, and I'm happy to repeat myself, look at BPI France. They invest 1.5 billion a year. I think X Capital is doing 250 million at the moment and it should be more with the Future Fund. But it hasn't started yet and it's mainly an anchor investor, so they're the first to go out and say yes, we'll support this fund. In any case, if you support the fund, you should do it much more proactively and this combination of financing is also something that already existed in Germany and that also exists elsewhere and that should definitely be revived. So everything already exists, that's nothing new, but you have to do things very spiritedly and very seriously.

Constantin Gehring: Then we have already reached the end of the interview. At this point I would like to thank you very much and ask if you have any suggestions, objections or questions that I should take with me.

I12: As I said, I think that if you look at all the issues that I haven't addressed and that are on the table, on all the issues that affect the funds and the ecosystem as a whole. Be it the employee ownership programme, be it taxation, be it the lack of diversity. There are a lot of issues and balancing entrepreneurship and family and there is very, very much and everything plays into it. What is important, you have to define the issues very clearly and prioritise them very clearly. If you say we have an issue that can be solved with technology and needs to be solved with technology, then you have to think carefully, okay, what do I need to do to get serious and not half-heartedly, but really fully. And if you do that, and I think you really have to do that, then you really have to think about it, both at the German level and at the European level. How can we regain our competitiveness through technology? The EU has already started there. They have defined these areas of particular strategic relevance for the EU. And in this area, at least, the German government would have to take massive action. And perhaps a state fund with private money would be a solution, where we really say, okay, we'll set certain priorities because we have a great need there. Or we could say that we won't do it directly, but indirectly through VC funds that we support in a big way. But then you would have to do it massively, because other countries support their ecosystems much, much more massively. And yes, I believe in the market. I also believe that it is important to let the market act. But if you want to make a difference as a state, then you also have to give yourself the means and not just a little bit everywhere, but you have to make it big.

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Interview with I13

Caroline Schmid: In which area do you see the greatest potential for positive change in society?

I13: So in terms of climate change? In any case, probably more like 2, 3 of the solutions. And when I talk about solutions, it's mainly about emission reduction or avoidance will most likely come from the DeepTech hardware tech area. So why decarbonisation? We as the X have a strong focus or exclusive focus on decarbonisation because that is what we need to stop global warming. And with global warming there is the climate crisis, which we are already in, and the consequences of global warming, which are becoming more and more catastrophic, which has catastrophic effects on society, people and animals, on life, nature and also on the economy. And the way our system is built, disruption comes primarily from companies that develop technologies and drive this decarbonisation forward. That's why this is the background for decarbonisation. Why that was the case for us, why we also believe that this can have the most positive impact for people and humanity. And what I have listed is exactly where technology plays a role. When you talk about other impacts, I have to admit that I don't know that much about it. Of course, there is also an enormous problem of social inequality, the gap between rich and poor, which is definitely also an issue that is very much related to the climate crisis. I could imagine that this requires less tech hardware to close this gap that has opened up so much. But it is something that we are only indirectly affecting through our focus on our climate, also through climate technologies. So now, with the cushioning of the worst consequences of the climate crisis, I think we will also cushion these social aspects. But that's just us. Note social impact because we don't know, that's not our goal so directly.

Caroline Schmid: Okay, thank you. And what instruments do you see for this transformation financing that are currently available and are also being used?

I13: I'll give you two things. On the one hand, it has to come from the investment sector itself, or I would say the investment and start-up sector. Then the problem has to be expanded into several topics. But I'm going to do it roughly in such a way that I then discuss the internal changes that need to take place in order to undertake these technologies and turn companies into really scalable and large companies that will help us to generate the impact and prevent the worst consequences of the climate crisis. So that's where things have to happen, which I'll tell you in a minute. But then of course there are external possibilities. Regulation and regulation is then of course at least three aspects have to be taken into account. Firstly, insurance companies and institutional investors must be allowed to invest large amounts of venture capital. That's why we only have small funds throughout Europe where this is not allowed because of the risk. Although the last decades have shown that VC is definitely an asset class that performs and also performs consistently. If you have a longer-term focus, then once again external regulation in that of course a super CO2 tax or I'm not completely unbelievable would be helpful of course and then last but not least, um, yes, regulation in the sense that industries that stand in the way of the positive impact are cut back, so that there are no more subsidies for agriculture that destroys our agriculture, the way we do agriculture.
Just as an example, in Europe this is a dead end and in the end it always leads to death, it sounds like that, but there are many examples of industrial subsidies, which is systematically a mistake. So okay, and now I'll jump to the internal reasons, what we can do independently of politics and regulations and taxation, so to speak. We need larger funds, and thus also more courage, so to speak, among the venture capitalists, so that they actually launch larger funds, that we launch larger funds, of course also has to do with regulation, again what I said at the beginning we need investment teams that understand tech. So we don't just need McKinseyys and BCGs and business economists in teams, who are really important. But we also need physicists, chemists, biochemists, engineers with investment experience who really understand this technology. And thirdly, internally related to this, we also need capital, yes, capital that has a longer-term focus.

Actually, we have that too, but somehow we don't have this, how should I put it, this short view of the next year or I'm only looking three years ahead. There absolutely has to be this app, this e-commerce start-up that I give only €3 to and that we then return if possible €3 billion in two years, so this it has to be so we just have to invest with a longer-term focus.

Caroline Schmid: And do you have any examples of what already exists where you could learn something from other countries, what already exists?

I13: I think the Back to Energy Venture is definitely a great one in the US, which is set up for 20 years. I don't think it really needs that anymore. But in the US, the funds are simply bigger and there are a lot of things going on, namely investments, support for start-ups and foundations, that are much better than in our country. In our country, there are also funds that are not afraid of tech and hardware. Which is how I see it. I would describe us as a modest role model, with a good 350 million euros in funds. And we hope that we can even manage to travel a bit more, because that takes time. So we just come up with small ones. I wanted to do with smoking. We need big funds. We can do hardware that needs completely different broken or maybe completely different capital requirements. You simply can't go any further with such small funds. So I really hope that in Europe we will have a lot more, not more people with Windows, who are there from.

Caroline Schmid: Thank you and can you agree with me when I say that the success of start-ups is endangered by insufficient financing? What would you say to that?

I13: Absolutely. And in Europe specifically is one that threatens the industry of the future. We have made massive investments in Europe in the tailgating sector, we are world leaders in that. There are also a lot of studies on that. There are a lot of figures on this. I will mention only two things. One is from the European Patent Office. The figure of 28% of all patents in the field come from Europe, although this is a very broad-based Bertelsmann study. The last one, which came out in 2021, looked at the quality of patents. And this study came to the conclusion that the highest quality patents in the Clamitec area are European. Unfortunately, we are behind the USA and China in other areas, but we can deal with that. In fact, we are ahead in terms of technologies and investments. But we will run the risk that we in Europe will once again lose something that we are actually leading at the moment, that we will pass it on to other digitalisation we are also ahead in research, but the companies, the big ones have emerged and that could happen to us again now with Karma Zack. And then we will really be a distant second in Europe. Then the industry of the future will take place somewhere else. We are then just don't know.

Caroline Schmid: What are the biggest challenges now for the founders of these start-ups? Or, for example, are there certain challenges?

I13: It's almost exclusively capital. Yes, and then actually already the external. That can be even better, of course. But I don't want to complain about that. Europe is already there. I mean, a lot has happened this week with regard to emissions trading. Everything has to be done much faster and much more massively. But subsidies must also be reduced in the agricultural sector, and subsidies in the research sector must be reduced. That's where the wrong incentives are. But the main problem is simply the lack of capital among Clamotec founders, especially when they are in the tech and hardware sector. So, when there is a lack, there is simply a lack of money. So, and that's issue number two and number three.

Caroline Schmid: And what would you say now, what then for you, for example, as an investor? What are the challenges regarding these start-ups?

I13: The challenge is simply to find the right investors who have enough money. In other words, large funds that have investment teams that understand this technology and can also support it with their network. So they also have a network with universities, with follow investments, with politics, regulation. So the new modesty. I think that's what we bring with us as the X, and that fits much more, also for us in Europe. And yes, that is what they need and those are the challenges of. But perhaps the last thing we need is to add technical brilliance to the founders. Sometimes they lack the business, uh, competence. In the university landscape, we could also, how should I put it, at the moment it's still the case that you go to university and then you do the sacred science and business. No, business is not necessary, you simply bring science out onto the street, out of some quiet closet, and it can then finally serve humanity. And that is actually the goal. And such technologies serve humanity above all when they are cast into companies.

Caroline Schmid: Okay, and you've already mentioned the financing gaps, there's simply a lack of capital. But why would you say that? What is the reason for that?

I13: I think I've already answered that, but I'll do it again because it's a bit more specific. So these internal and external factors are partly. So we have the money in Europe and I think we have a savings 13,000,000,000,000,000,000, so trillions, which we can invest in Europe, which is just a fortune invested. And of that, just last year 1,200,000,000,000 flowed into venture capital in less than 1/100 and then again less than 10 % of that. So roughly, yes, eleven 12 billion. Therefore, if this money at least. That's why this regulation is so important, that pension funds should also be allowed to invest in Wiki and PI. Insurance that should be allowed. And then, on the other hand, we must of course also build up this competence, because we do not even have a problem traveling money, especially as X, although we are still from. The only problem is that we are almost at the beginning, so we are new. That's why these institutional investors are hesitant, but they just want to block us in that direction. But there are not the funds that just have this IPSec understanding, that have this focus. And the funds don't exist either, because the institutional investors usually want to invest 50 million, 100, 200 million and then they come up with 350 million, they say okay. No.

Caroline Schmid: How do you assess the awareness, the mentality of investors around this topic now? So the mentality is also a problem.

I13: But it's not so easy to answer. There is already an awareness that this is a rituality. I'm beginning to think that fewer and fewer people are explaining that impact doesn't come at the expense of profit. In Germany, unfortunately, we are still backward. But outside of Germany, in Europe, people expect the same returns from a climate fund that is fully focused on impact. So in Germany, that's all that's happening for everyone at the moment. But that is a topic in itself. So from there. I don't think that's so bad any more. Mentality problem Yes, and then back to Germany. My God, we are simply the biggest economy. We're just shit rabbits. That's venture capital, and in our country success is spread around. A city. You've gained experience and may make fewer mistakes. Congratulations. That's just the way it is with us. OK, failed, but that's generally related to the start-up landscape. That's why people don't take many risks. That's why people like to be employed. At Siemens and the like, I say, where it's supposedly safe to work. Yes, but that's another topic.

Caroline Schmid: But then you would say that Germany, for example, is culturally very risk-averse in this sense, what then?

I13: We are an old society with. Few cities where innovation really takes off, so still. It's different from what we had ten and 20 years ago. So Berlin in particular, also Munich, Beijing, from Hamburg onwards. But to be honest, that's what it's always been. And then we are just this middle class, which has tried to defend its sinecures wherever possible. But SMEs are simply not fast enough for innovation and cooperation is coming faster and faster and change is coming faster and faster. That's why, back to your previous question, I'm afraid that we really will become a second world continent and then win, even though we have such great technologies in Europe, that we really won't have any industrial significance in 10 to 20 years.

Caroline Schmid: And also now already from the mentality of investors inside. But you also think that there is awareness of these issues in politics, but there is a lack of it.

I13: Very limited, and that is also a political system error. We are simply incredibly fragmented in Europe. Die Welt The Hessians think Hessian, the Germans think German, hardly anyone thinks European anyway. Yes, politics is very, very self-centred. And this, this Europe. I'm glad that we now have a Commission that's already rocking a lot. I have great hopes that we will grow together even more at the European level, because that is actually the only thing that can secure us in so far as it can still play a role in the future as a European continent with half a billion inhabitants, which is more than 8 billion in between and probably 10 billion by 2050, which is 1/20 of the population. If we then want to somehow make up more than 5%. Economically, you just have to think as Europe. That is somehow. I don't know. I don't think that has got through to politicians. I think we are very fed up and believe that Europe will always be in front and that it is the original continent of industrialisation. So, and I don't think we've even begun to understand this, but these climate technologies really do offer enormous opportunities. And I believe that we should not miss this train, that we really should not let the innovation, the industry, the green industry of the future, which we have thanks to the technologies, thanks to the many research and development expenditures that we make here in Europe, thanks to the top patents, that we then let this train pass us by again.

Caroline Schmid: And you've already talked a bit about the regulatory obstacles in Europe for deep tech start-ups. Could you perhaps go into more detail about what the obstacles are and how they could be improved or what could be improved?

I13: I must confess that I wish I were more competent in this area. It is definitely lacking. So what would be desirable is if we had a plan in Europe, like Norway actually has and then also at the German level etc.. A few days ago, I was told by the Federal Ministry of Finance that this Road Fund and the 3 billion that are to be paid for are not much. 3 billion is not much. The stuff that will be invested in big funds over the next 30 years won't make any difference, it's not always clear, it's so general. We just think in such unbelievably small dimensions. I don't know. I notice that your questions leave me a bit perplexed. Well, yes. We should just. Just from Germany. Illegally. We have to be braver. And then. I think in the end it's really a question of mentality. Then also failure. Don't punish them like that either, but give them a second or third chance. It's simply the one that is usually used. So actually, if everyone avoids falling, which is not to put it down as a mistake, but rather as important progress.

Caroline Schmid: So what do you think about state funding for these start-ups?

I13: Unfortunately, first of all, it's important in the US, where endowment funds simply do that. What do universities do, invest 50 billion? We don't have all that. I also don't know where our universities are supposed to get the billions to invest in technologies, as a real fund that then actually returns billions to its donors, year after year, like Yale. That's something that should start, but it will only have the kind of impact you need in 20 or 30 years' time. In fact, in Germany and in Europe we are even more state-driven than in the USA, which has a lot of good things going for it. Yes, I also believe that it is very good to pay taxes. And we need that in order to deal with these problems that we have. The social problems. And that's why I think it will have to come very much from state institutions. But as I said, I think there is a lack of understanding and courage.

Caroline Schmid: I saw that I skipped another question, but you already touched on it a bit. It's about the risk-return expectations that investors have of transformation capital. You've already said that you think it's more likely to have too high an expectation for what?

I13: In terms of return on investment, no. I don't believe that digital and hardware yield less return. There is also evidence that the opposite is the case, if time is given to it. So why are they doing it now? Why are so many in the solar industry now earning insane amounts of money? The world Because for decades, technologies have been developed differently. And today it is the cheapest way to produce electricity worldwide and cannot be done overnight. The suppliers are not the problem. I believe that one can have high expectations of returns. But you have to know that you have to be broadly diversified, and the more broadly diversified you are, the smaller the upward and downward fluctuations will be.

Caroline Schmid: And if we now move on to the funding measures, which I have already touched on, would you say that this is the biggest main player?

I13: So because the state is a buyer of reserves, yes, a state is a big buyer and spending money on support measures is actually not just saying that we have 3 billion that we want to invest in big funds, but 30 billion or even more. There could be some kind of funding measures. It always goes back to the money.

Caroline Schmid: So simply that, but then also a bit of mentality in the sense that you have to start somehow so that the money can be loosened for these problems. Very good, thank you very much. I will be very brief, because you are already coming, but only briefly. So, any suggestions, objections, questions, something that I forgot, what you absolutely want to say or what needs to be said on the subject of fasting.

I13: I think I have said everything.

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Interview with I14 6th of Feburary 2023
Olivia Suchy: Where do you see the biggest opportunities in climate tech at the moment by investing into those startups? In which sectors do you see the biggest opportunities for change?

I14: Everything linked to synthetic biology because we complain a lot about the fact that we would like to recycle plastic or we would like. But the reality is we probably are able to develop today. It's a technology that we can avoid plastic altogether and have things that are biodegradable in the end. So a few examples of companies that I've seen recently that do things

would be, for instance, instead of making bad textile, you get mushrooms to grow cotton like that, purely biodegradable and doesn't need to be mixed with polyester and things that are plastic. And as a result, you solve it from the root. So that's one example. And the example that I've seen would be like a company that does bio surfactant. So they grew in bioreactors. They grow, for instance, like chemical components that are sustainable and that are organic. So bio surfactant, you have them everywhere, you have them in all your cleaning products, go home, you have all your shampoos, in all your soap, and it makes things foam, right? Those are like billions and billions of liters of shit that we produce with petrol when we could make them with bio material or just getting microorganisms to produce them for us in a way that in the end if it gets dumped, in the sewage or whatever, it's not a petrol based. You've heard about all the meat that is being grown, and so that's only one tiny, tiny part because they think that 60% of everything physical that's been produced in the world could be replaced by synthetic bio material.

Olivia Suchy: Regarding the startups in general, the climate tech startups, do you agree that there is a funding gap and that the development of those startups is threatened by insufficient funds?

I14: That's correct. And it's two things, is one, because for them, once they've proven a different, for instance, methodology to maybe produce energy differently or to recycle differently or to produce a new material that can be more sustainable. They need to find the funding to fund the research, and then they need the funding to build the infrastructure. And so, I think there is infrastructure companies that will finance it once it works. But that thing in the middle, I don't think they find a lot of financing for: like this is my proof of concept and I want to bring it to the industrial stage. There is not a lot of funds that finance at that moment.

Olivia Suchy: I think that's a perfect way to just quickly show you a slide. So in which phases would you say startups face the biggest challenges with funding?

I14: Venture debt, gross debt that tends to be maybe across that cycle, like they'll go to the scale up so the exits sometimes. So it depends, like it stretches a little bit longer. In the stretch, that little bar would be a little longer and it will go to maybe like up to the merger acquisition exit. Why, is because very often we use bypasses to finance acquisition or to finance pre exit discussions, they just don't want to have. So that's why.

Olivia Suchy: So where do startups need the biggest funding that they cannot get in those phases?

I14: I do know for Germany in itself, but I imagine that a lot of the VC money is not going to climate tech that much. They go to, like the Summer Brothers, more soft market, e-commerce businesses and I think that you clearly have a need potentially at the very beginning when the research starting at the accelerator level. But I would imagine that for the climate tech companies, the biggest need is when you are not fully commercialised. So you are at the stage where that first commercial contract like to go and finance that bit. I'm sure it's hard for them to find financing.

Olivia Suchy: And from venture debt perspective, where do you see the biggest challenges in investing?

I14: For us especially in climate tech companies, if they have solar panels or things like this, I don't think that venture debt is the best investor. It should be infrastructure funds that come and invest at that stage. And so sometimes it's hard to find the exact moment when we become relevant for some of those companies - when they're too develop, when they're at this stage of early commercialization, maybe it's harder for us to make a case. In the technology and first pilot - so if there is a lot of VC funding, we can do this bit as well.

Olivia Suchy: My question was what is the biggest challenge to invest into climate startups?

I14: The biggest challenge is just to find the understanding of the technology and the knowledge of how this technology is going to change the world. And second, in venture debt we like when VC invest and co-invest and come with us because we can't be the only source of capital. It needs to have, the VC is behind it. And when I find with climate companies is there were not a lot of VC in that field. A lot of the ones that exist today, they've been financed by family offices or private investors. Or sometimes just by government subsidies. And so you don't have the same level of ecosystem that you find in other parts of the startup world. For instance, the software companies, they get a lot: You have like all the VC investments or the private equity that end up investing in them. You have a little bit more of that ecosystem. The German government should definitely help bring VCs, people who are experts in finding the company is helping them, being on their board, helping them raise money externally, helping them develop on the operational side. and what I found, at least, for instance, in France, is that a lot of the funding comes from subsidies of the states, which is great. The issue is that it is just money. So you also need to have the overall ecosystem to develop professionals that just know that ecosystem really well. They know the challenges of scaling the technology. They know the challenge of bringing a proof of a pilot or proof of concept to being industrialized for the hardware. For the hardware we have a few other companies. For instance, I have hardware companies that make electric motors in my portfolio. And the first time the company failed, we have reset them and found new investors and the second set of investors on board were experts in E-mobility. So they've already seen this. They knew how to negotiate contracts, they knew how to help the engineers. And so then they became very successful because they have the right ecosystem of investors around them. While the first guys, they were private families. It was a government subsidy for a long, long time. And so they didn't have that knowledge to help the technology become commercial. And so the ecosystem of the VC is the accelerator and all of this. There is a need to help that ecosystem.

Olivia Suchy: So to summarize, you mentioned two points. The first one that for you, for venture debt, there needs to be more VC action for you to also invest more venture debt. And the second thing you said is that there needs to be more knowhow in the whole investment ecosystem in general.

I14: Yes, correct. It's not only capital. It's the danger of governments, which is also the beauty of governance. Because I'm French, so I love government funding stuff, but it's just that you end up thinking: I'm going to open a program where startups are going to access money and this is great because then you have subsidies or you give guarantees for loans like things like this. This is great, but that only encourages money to come in. And what these companies need is knowledge. People that do that every day, that are on boards of similar companies, that can plug them into manufacturing. With Flextronics, for instance. I had this in one of my companies, they didn't know how to manufacture but one of the VCs brought in the relationship with Flextronics. Flextronics could manufacture the hardware and things like this.

Olivia Suchy: Do you have an idea on how the government could do that?

I14: So I think they can definitely try to bring entrepreneurs that have been experts in that field in to help build accelerators or help build venture capital funds. So that you have funding teams in a span that are not only financial people, that they are also entrepreneurs and people with the knowledge.

Olivia Suchy: And how do you rate the mentality of investors at the moment? Towards investments into climate tech solutions. We can also talk about deep tech.

I14: So the issue that I find in the investment world is they support software companies for climate. So they will tell you: oh, it's efficiency driven, it helps you report on the green, on the CO2 emission. Great. Or you have to track whatever, like waste in a plant. Okay, great. It's a software business. It's good to support them, but climate change needs hardware financing and they are scared of hardware business.

I14: And so I try for some of the companies we're invested in, because we do some hardware, try to trace the VC. It's been ten or something in Europe. A lot of them will say ah I do climate tech but they come and they'll do I don't know e-mobility. So, it's not game changing, right? It's not how to change. Like all the appliances we have at home are electric. We spend too much electricity and whatever, but you need something that will be physical to produce electricity in a different way or to spend electricity in a different way. And the reason why they're scared is because there was already a venture, a cycle that failed around sustainability. So maybe one way the government could do this. They could encourage CapEx spending. So they could co-finance CapEx spending because they're afraid of the big CapEx spend that one VC cannot finance a 15 million plant. Right. So they're afraid of that. We could have a program around co-financing the first plants or something like that. That could be interesting. You to make sure that you don't get scared about spending big amounts of money to build a plant or something. Well, especially the first pilot.

Olivia Suchy: And maybe also regarding the government to talk about the challenge for another second, do you have regulatory boundaries that make it difficult for you sometimes to invest?

I14: I mean, for us, not specifically. I think for us, the hardest part it's not a very well known strategy (venture debt). It means that it's hard to raise money for that strategy in general in Europe. It's very, very common in the US but in Europe the government tends to do a lot of subsidies, like KFW. So for the companies in Germany, the main issue is for boards to take debt they might be personally liable, which makes it harder culturally for the German entrepreneur to decide to put debt into their companies.

Olivia Suchy: Are there any best practices from other geographic locations that enable climate tech investment better than in Germany and Europe that we could use? For example, financial instruments or governmental support?

I14: What we see in the US are strong legislations. I have a company in the US that does water filtration and depending on the states, they have very strong laws that forbid, for instance, to use a soft based water filter. Because, when you try to soften your water, I don't know if you have that ever, but people use water softener to that. And what they do is they reject soap into the ground and the soap impoverishes the soil so it's harder to grow things, etc., And so the US depending on the states, you have very strong laws that would forbid things like that. As a

result, it encourages businesses to find solutions to go around it. And in Europe we are quite good with GMO. We're quite good with some things like that. I don't know if we've gone far enough in terms of some of the most polluting things, like pesticides, for instance. But that will be the government role trying to protect us. And I don't know if they can do that without Europe. I think it creates an environment where you try to find solutions and then it forces big businesses to work with smaller businesses as well. And then if you are more market driven, some of the more market driven solutions. For some of the things like plastic, for instance, I think the health of the government around the solar cell a few years ago, like a decade or two ago, was extremely expensive. And then there were government subsidies that helped. And then it started being produced for very cheaply. And so the government incentives help people's demand for ordering photovoltaic systems. And as a result, it created the scale so that it could be then produced in a cheaper way. And so sometimes the government incentivises the consumer, helping create a huge market on a scale.

Olivia Suchy: That's out of curiosity: do you have any good ideas or things that you've never heard that were mentioned to you in this interview?

I14: So yeah, there are many funds. The thing is, it is really hard for them to raise money from the funds and Europe tends to want to replace them. So what they do is they, I love Europe because they invested in us, but they have this fund of funds, right. But as a result, they haven't necessarily always allocated themselves to fund the fund, almost like if it's a competition and why they say they should have those professionals and professionals would be very good at finding teams that are passionate about the climate. Instead of trying to think that fund of funds is a competition. Venture debt is 20% of the US market. And so it's fascinating. And I'm not saying they do this for the climate fund of funds and things like this. Maybe it's the case. In the story of venture debt in Europe, Europe decided, okay, we're going to launch our own vehicle and this is a very large vehicle. That's one or 2 billion a year of investment in what they call venture debt. And it was not like venture debt. And so it ended up competing with all the venture debt players. And in the story about building their own financing instead of saying we want to collaborate with the existing player, they say we will never co-invest together. And all existing players co-invest together. So the problem with Europe was that they took a view that they would be competing with the market when this should be different, they should allocate to both: the existing teams and and they should invest as well directly and I feel I that with fund of funds the state might take the view that they're competing with fund of funds. They should see it that way. They should allocate to fund the funds and they should see it as a way to multiply the power of them looking at investing and allocating to change the world.

I14: Be they should do both and they should collaborate and co-invest and they should do both. So it's not mutually exclusive. They have so much money as a state anyway. They should invest to seem like investors to themselves.

Olivia Suchy: And one more point that we hear more often from other people that we were talking to was that in Germany and Europe we have a very fragmented market. And they said institutions and hubs aren't very fragmented, which can be a strength and a weakness at the same time.

I14: But it is fascinating because the other countries have the exact opposite. So what they do is they will try to encourage companies to be started in Leeds, Manchester or Liverpool, because they don't see enough of that outside of London. Paris is the same. It concentrates everything and the French government is trying to encourage other ecosystems like Bordeaux, Toulouse,

and so they have the opposite. So I think this is a strength of Germany. The US is very fragmented in the sense that you have a huge ecosystem in Austin, a huge ecosystem in Houston, the ecosystem in Dallas, and all three cities are in Texas, right? So you have the same as San Francisco. You have New York, you have Boston. So the US has sensors everywhere. I think it's a shame because it means that you really get to create knowledge across the country. What you should encourage is clusters of knowledge, so communication among the same industry. So for instance, Houston is very good with water.So you could have different knowledge in different geography and try to encourage that semiconductor to be developed in some places and try to bring people together on certain topics because they communicate.

Olivia Suchy: That makes a lot of sense.

I14: Knowledge hubs rather than geographical hubs. The one thing that was very useful in the UK and fuelled the UK system was tax breaks on individuals. So if you want to pay less tax, you are encouraged. You invest in startups, and if you don't recuperate your money, you can deduct it from your tax.

Olivia Suchy: Is there a name for this?

I14: Yes, it's called EIF. That has fueled a humenderous amount of money into very early stage companies. And people were very happy with this because then they consume those products, which will help preserve products. And if you're looking to do something quite drastic. I believe that is a reason for the boom of startups in the UK and the fact that it is 2 to 3 times bigger than Germany.

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Interview with I15

Olivia Suchy: So my first question to jump right into it is, so, you know, we're talking about Hardware-based climate tech startups and investments into that innovation. So my question would be, where do you see the biggest potential for positive change in our society through investments into hardware startups?

I15: Oh God. I mean, if you really want to know about game changing hardware, the question is like what sector would have the most impact? I mean, there's fusion. But obviously one of the first things that comes to mind that might be still 30 years away, but that would eventually be quite a game changing partner on that. Another thing is, you know, hardware in robotics and automation and you start looking at a country like Germany, for example, which has a fast aging economy, very low birth rate. There's been a lot more deaths and births in Germany since 72. You're going to have a substantial percentage of the workforce going offline. So yeah, the faster Germany can automate, despite the fact that the German government's kind of pushed against automation too much, I think the faster Germany can automate, the better it's going to be for their economy.

Olivia Suchy: [00:02:41] Okay, thank you. And looking at the status quo before we really look at the challenge that we have right now and we're facing right now. Are there certain measurements that, you know, that are being taken in Europe, for example, financial instruments that really support investments into hardware startups? At the moment.

I15: I think most of it is pretty useless. I mean, you get a lot of co-investments teams, you know, there's the EIC fund, but the EIC fund hasn't lived up to expectations. I mean, there was a large delay between when they actually had the money, they actually came to the agreements with the companies before they actually deployed the capital. So I think that's been underwhelming. I also don't think that, you know, it's not attracting large ticket international investors. If you're a hardware company really trying to raise scale of capital in Europe, you have to raise that money from abroad.

Olivia Suchy: [00:03:39] Okay. So would you in general agree with our hypothesis that there is a financial gap or like investment gap when it comes to hardware startups at the moment?

I15: [00:03:47] Yeah, huge. There's no I mean, if you're a hardware company, I invested in a lot of hardware companies and if you're a hardware company in Europe and you want to raise any kind of growth capital, there's just no options in Europe. There's not a single hardware focused scale up fund in Europe it doesn't exist.

Olivia Suchy: [00:04:05] And what's the reason for the fact that this challenge exists? Why does it exist, in your opinion?

I15: [00:04:13] It exists in Europe for, I think, a few reasons. I think, one, you have an LP base that isn't well educated on sort of deep tech in general, let alone hardware. I think they have a lot of misconceptions about exit potential. I think they have a lot of misconceptions about exit horizons. So if you look at if you're investing in the hardware space, particularly at scale ups, by the time you're investing in, say, series B, series C run at hardware, there's very little chance you're going to lose money. I think what's happened, though, in the past is that you just haven't had a focus on, unfortunately, I think also from the government LP's as well. We were just talking about government LPs and kind of their over sort of disproportionately large influence on the LP ecosystem in Europe.. if you talk to EIF for example, you know, they've had for every one euro they put into deep tech and that includes life sciences, whatever they put 4 euros into into software digital. Right. So Europe has had this kind of obsession with going to the cliche when the German and French governments try to create a European Google a few years back and they ended up blowing €600 million. They've had this obsession with kind of catching up to the US on sort of the digital and software side, and it was just a futile effort and unfortunately it took the eyes off the ball of keeping up on deep tech. That's one of the reasons I mean, there's a lot of other reasons. I mean, there's just not enough capital. There's not enough you know, you've got IP issues in Europe if you're trying to spin off this company, these technology from universities in Europe, the universities typically are you know, they're they're spit out terms. They're much more arcane than you would get in some of the larger institutions in the US. So it's just to keep going on the list of why there's problems in Europe, actually.

Olivia Suchy: I mean, it's quite interesting if you would like to mention like one or two more reasons that come up in your mind, maybe the one that you would prioritize the most.

I15:So you've got lack of LP interest. So there's no VC money. You've got, you know, issues on the university spin outside. So you end up having hardware companies being spun out where the university has 25 to 30% of the hardware company, which essentially just kills it before it even gets going. You have ultimately one of the biggest issues in European deep tech is also you just have corporates that don't want to be customers. So if you look at sort of how, you know, there's an old joke that in B2B that, you know, European corporates take twice as long to give you half as much money. And I think there's a lot of truth there. And I think ultimately,

like if you look at deep tech, right. The companies that win in deep tech, it's not the best tech, it's whoever gets the biggest contracts first. And unfortunately in Europe and the CEO, head of innovation from Bayer just had an article in the Financial Times about this is that Europe is just doesn't have a customer base for deep tech. The head of the NSA, the European Space Agency, has said the same thing that Europe could end up losing out in a space tech race just because there's no customer base. So I think that's also if you've got you can give all the subsidies in the world, but if these companies don't have customers, then they're going to die.

Olivia Suchy: [00:07:33] Okay, I understand. And maybe going a bit still like staying with the challenges, to the best of my knowledge of experience on both sides, the entrepreneurial side and the investor side, and maybe starting with the investors, where do you see the biggest challenge for investors with investing into hardware startups?

I15: I think it's about, you know, understanding that there has to be a balance. When you're investing in deep tech, you have to really understand, you do have to have a technical knowledge, but you also have to understand that the types of businesses that are successful in deep tech, it's a very different blueprint than, say, digital. I think in Europe you've got a lot of generalist, sort of digital focused VCs, right? The holy trinity of European venture capital has been fintech marketplaces and SaaS, right? And the type of, you know, what you look for in a deep tech company where, you know, a deep tech company might not reach revenue until year ten and then all of a sudden it's hockey stick growth, right? That's very different from a SaaS company which is going to start seeing potentially hockey stick growth in year two or three but then be wildly unprofitable or in deep tech, you could have a company that's wildly unprofitable and then once it starts getting market adoption, that becomes very lucrative and the IP value also goes up as well because it's not just about customer base. I've seen a lot of large corporates pay huge amounts of money for IP driven companies for the IP, not necessarily the customer base where in say, fintech you'll have a bank buy a fintech company because they're just trying to acquire the customers.

Olivia Suchy: Okay. And then I do have a slide prepared that I like to show when we're talking about the challenges. Let me see if it works. I mean, we show it so that we have like a holistic overview so that we know each interview partner is talking about the same phases. So we have a slide with risks and we have a start with phases. And I would be interested to to know where do you see like the biggest difficulties for investors and where do you see the biggest difficulties from an entrepreneurial side to either give investments or gain investments?

I15: I think one of the you know, something that I don't think you know, I'm just thinking of university affiliate programs, all this stuff and going back to kind of spin out terms in Europe, I don't think most countries are taking that as seriously as they should. I mean, I've seen, you know, just looking at Germany, for example. I mean, you get what are there? Max Planck Institutes, for example, and there's over 80 of them spread out a geography that's about the size of Mexico. So when you have very disparate, very fragmented ecosystem, most of them don't work together. I was just talking to two PhD students that are involved in Max Planck Institutes and they were trying to get the people from their institute to talk to people at another institute in another part of Germany. And nobody was talking together. And then when they tried to spin out the company, the terms are so bad that they were just like, Screw this, we're not even going to do it. So I think that, you know, you get you get a big issue there is just that kills a lot of these companies before they get going. I've literally talked to young scientists who are just like, look, the terms are so bad that I don't even want to bother starting a company. So you get back, you get through the whole spectrum of Europe creates some really phenomenal IP. They don't

take commercialization of it seriously and that starts at a university level, right? You look at the average commercialization officer and you kind of Continentale university, and it's usually one of the first jobs out of school and they're salary shit like you're not going to get quality people based on that.
But again, it's these institutes, these universities just don't take it seriously. And so I think that's also another major problem and it's something that governments could address. There should be some pressure to come up with standardized term sheets for the fact that if you're if you're talking to like one university in one part of Europe and even within a country in Europe and a university 30 kilometres away could have wildly different terms for the exact same type of tech. That's a disadvantage, you know, corporate VC. I mean, that's I think a lot of Europeans want sort of these. I just talked to a professor at INSEAD who was talking about how, you know, Europe should encourage more CVC. When I was an entrepreneur, I had CVC money. I would not encourage most people to take CVC money. I think most corporates are much better off as LPs. And so on the corporate side, which is very important in sort of deep tech, I think there should be a lot more pressure and a lot more incentives for these companies to be customers rather than investors. And again, because the only things you see in Europe is you see a lot of companies kind of get drip fed, right. Where they get in the early stages, they come out and there's, you know, a 600 K grant from the government here and there's like a 1.2 million subsidy program from the government there. And instead of going from A to B, these companies kind of get distracted. So there's really early stages in Europe are actually quite muddy, where if you look at kind of the type of investments that actually end up being the most lucrative in deep tech in Europe, it's getting those early stage companies out of Europe into North America as quickly as possible, which is the hard truth. And most of the governments are just in complete denial about it. And they don't want to hear that. They don't want to hear that there's fantastic IP that would just be better off going to the US market because it's a large monolithic market with corporates who are not afraid to spend cash early. You know, I just had that conversation with the head of innovation at Tallis, the big quasi French government corporate that does everything from satellites to defense and everything. And so because of Ukraine, they've been told by the French government to, I think it's like three X, they're R&D over the next five years. And I was like, how is it going to be for SMEs and startups? He's like, Shit, because they haven't changed the actual procurement laws. So we just have to keep going back to the same corporates, right? Like, sure, IBM is going to profit a lot off of that because, you know, IBM does a lot of stuff in that space.

But you know, unless there's actual programs to get procurement amongst government institutions and ministries, you're losing out. I mean, look, I mean, the US, the US Department of Defense is going to spend over 850 billion USD this year, and 4% of that is dedicated to SME’s, right? So that's 35 billion is going to go to SME's. That's an advantage to those companies that the European companies are just never going to have.I could keep you in German examples because it's the German government, but you look at like a company like whole thing, right? So Helsinn got $100 Million from from premium material, which is Daniel X Family Office and they're trying to kind of do a defense, the defense tech startup in Europe and everybody kind of made this I was talking to some people in the German Ministry of Defense. They're like, Oh my God, if we'd have a European champion, I was like, Do 100 million. Just nobody gives a shit. I mean, their competitors in the US of all raise over a billion. And, you know, talking with the founders of Helsing, they're just like, yeah, it's, they're realizing just how tough Europe is because it's like, okay, great. They get some contracts in Germany and now they have to go to, say, France and get some more contracts. But having those contracts in Germany do not help them. Get the contracts in France and then go to the UK and do it all over again.

Anonymous participant: So may briefly interrupt here. I mean, mostly a silent observer, but I think what you say is also resonating in the sense that one of the ways of encourage more startups, including deep tech hardware startups in Europe, would be to deepening the single market. Right?

I15: You look at like if you look at God, what's his name? Joseph Borell. The you're right. I mean, he was talking about you just keep it. Talking about the fact that if you actually looked at I think the European Union's goal is to have last year to have had something like 35% of defense spending be sort of multi country programs. Right. And like it came in at like 8%. But it's just there's not enough scale. Right. And you look at the history of deep tech. It's very much so, at least in North America, Right. It's very much a connected to Department of Defense Department of Energy programs like that. And the thing is, in Europe, it's just you know, there's a German one, there's a French one, there's a British one, there's a Dutch. I mean, it's just there's none of them are at scale. Right. And when you do start to get these pan-European programs, unfortunately, you don't get those economies of scale because those countries start to say, well, you know, you guys just invested in a German one and France would be like, Well, now it's your turn to invest in a French one. Or you get kind of like however much money those countries put into these sort of pan-European programs they want that spent out proportionately. So instead of the best European companies getting the funding, you know, they're like, oh my God, desperate. We have to find a company in Bulgaria to put this money in because we don't have any so far. I've just seen it play out so many time and time again. And that's ultimately, you know, that's that's kind of an issue that's sort of a higher level is just, you know, is there such thing as an integrated Europe?
The Germans have their agenda, the French have their agenda, and you kind of see that play out in the government side.

Olivia Suchy: Before diving deeper into the the contrast between Europe, US or, for example, Germany and the US. I would like to just shortly mention the risks and go just like over it. If you think there are like specific risks that are like important to be stressed when it comes to hardware investments.

I15: I mean, yeah, I mean, earliest times is always, you know, you always get at scientific and technical risk. But then the nice thing about deep tech is once you start having customers that you start to become a post tech risk entity, which is not the same thing in like sort of mainstream tech where, you know, mainstream tech, it's a lot about the business model, but the business model is in deep tech, are usually figured out pretty early. It just becomes market adoption, right? Like, can you actually pass regulatory risk and can you get start getting contracts. Going back to my point is that usually in deep tech, again, it's not the best tech that wins. It's whoever can actually get the contracts and it's about big contracts, right? So that's always an advantage for us deep tech companies because once you do get a DOE DOD type of contract, then you're in. Where in Europe, even if you get one with like the German Ministry of Defense, it's usually not big enough to actually sustain you. So then you have to get a French one and you have to get a British one and a Dutch one just to equal that one DOD DOE contract that your US competitor has.

Olivia Suchy: [00:18:34] Do you have an opinion? I can stop sharing the screen now. Do you have an opinion on the German states awareness towards the problem of the investment gap?

I15: I would say that there's, you know, given the fact that the Camp W is really not up to par, I would say that their awareness is not very high. And then you start looking at some of the German government's sort of deep tech initiative. Well, that was the one. It was SPRINT or some sort of weird and it's like it's weird. The only emails I ever got from that organization were like the guy in charge of it, like, wrote a book and it was like he was constantly trying to sell his book. I was like, Come on. I mean, it's just like, again, it shouldn't be your organization shouldn't be driven by some sort of cult of personality, of some guy who, by the way, I've never heard of before, ever. And like the guy, they made it look like, Oh my God, this is so amazing. We got this guy to run this organization. Never, never fucking heard of the guy before. And then all of a sudden he was peddling a book. So again, I just don't think the government takes it particularly seriously. And then you kind of see just how I mean, the reality, I think kind of of the post war reasons why, you know, the Max Planck institutes and all these different institutes were kind of set up the way they were in a very fragmented and they didn't want to have to do any city with too much of a concentration with these things.

But at some point in time they need to just review the fact that it's. It's 2023 and they need to change a lot of that. I remember hearing from the woman at the time who was running the it was the Max Planck Institute in Saarland, and she's like, Oh, we're really struggling to attract people here. Like, no shit here in Saarland, right? I was just like, How the fuck is it surprising? And that's the thing. It's like IT, right? It's like something that's quite technical. Like, if that thing was in Berlin, I would get it right. But having that that institute in Saarland, I was just like, It just doesn't make sense. So I do think there needs to be kind of more common sense approach taken by the German government. And there just doesn't seem to be that because, again, it's how the politics are done in Germany with lots of parties involved and governing structure. And it just seems to be a very kind of confederated approach.
And I think you don't unfortunately end up with critical mass in any of these ecosystems to kind of really push anything you get a bit in like Berlin and Munich, just because there are large population centers and they have like tum in Munich kind of attract stuff. But there's no, you know, they were trying to create like I was just up in Aachen and they're trying to do a lot of semi-conductor stuff up there. And I asked one of the founders of one of the companies like, How's it going? He's like, Well, it's not well because whenever somebody has to come visit us, like it's impossible to get here. I think they're expecting some people to come in from Nividia and like, you had to like, you know, I can't remember, like it was just some really complicated way to actually get there. I remember like, even for me, like I visited a friend in Luxembourg and we drove up from Luxembourg to get to Aachen. I was just like, Guys, you can't you can't build a major tech hub here. There's no there's no there's no major transportation up here. So getting people from Apple and Nvidia and Samsung to come to these places, it just doesn't. It just doesn't make sense.

Olivia Suchy: And next to you, like the culture and the mentality of politics that we're talking about, where do you see the biggest German or European regulatory boundaries?

I15: I think a lot of times I think regulatory bodies for a lot of the stuff. So I think for Germany, for Germany, for everything, the tax situation is usually too complicated. You know, you get you know, it was complaint. It was the complaint that the guy from Bayer was making was just the fact that there's just there's just not a lot of incentives to really do innovation locally because the incentives are better in Asia and North America. And same thing with funding right in the VC side, like it's Europe is not an attractive place for early stage funds to set up shop, for example. I mean, it's the fund industry in Europe is very much so designed for larger funds. It's just cost prohibitive to actually set up if you wanted to do. I was just talking to Nathan from

Air Street. Right. And he said if everything in the US, even though he's investing in Europe, is based in Europe, his whole fund structure set up in the US just because it's just far simpler and far cheaper and you get that as well like right, You get yeah, from a subsidies perspective, it's just thinking about a medical device company, a European medical device company that I invested in, which has now moved its headquarters to Boston. You know, they get there like, honestly, we get just as much subsidies and sort of government programs in the US at a much lower tax rate. So at some point in time, you have to decide, you know, what's your Europe is inside, what's its priority? Does it want to be pro-business or not?

Olivia Suchy: That makes a lot of sense. And maybe now I would love to use the last part of our interview for a very important part, which is which concrete measurements can be taken by the government to change something about the situation. What are the actors that can change something? Yeah, that'll be interesting.

I15: Oh, God. There's a lot, you know, concrete measure. I think there needs to be more. You know, if you're looking at kind of a top down approach from the government, one thing the government could do, which they're not doing, particularly in Germany is there needs to be incentives to make increase the diversity of LPs. Right. To actually increase the types of institutions who are being active LPs and also incentivize them to put money into deep tech. Right. I mean, you know, if you look, you know, Israel, which is a per capita basis, the most attractive venture capital market in the world, there was no venture capital in Israel before the mid 1990s. They came up with a lot of tax incentive schemes to attract LPs, to attract venture firms. So, you know, a lot of firms from the US setting up shop in Israel because it was financially attractive to do so. That hasn't been a European approach. Right? And I think you need to one in Europe, these sort of national LPs need to take down a lot of their boundaries on geography. I mean, you're if you're an investor based in Germany, your deal flow shouldn't stop at the German border, right? So that's one. And there also needs to be a lot more financial incentives to get you know, I talked to German family offices and none of them invest in venture because they just don't feel the need to or feel good incentive to do that.
Where there is, you know, a lot more financial incentives to be LPs. Instead, the capital is doing the exact opposite and trying to get institutional investors to give them money, which is actually going to take away from the diversity of the LP base. So if you end up with the KFW ends up being the dominant LP in Europe, in Germany, I don't see how that's attractive. I don't think that's healthy to the ecosystem. So that's one thing that it can do. Standardized terms coming out of universities, I think, you know, so everybody goes in kind of knowing and it has to be attractive to the founders. I think unfortunately, you get a lot of I hear this a lot in Europe of these universities would be like, oh, well, you know, we funded it and we co founded it, so we should get a stake. It's like, no, you didn't like you're just third party, Like the government gave you money, you took that money and you put it into your labs. Right. Taking 25% to be a third party is just absolutely ludicrous. Right. So they should basically if I was Germany, I would try to, you know, I would study the most attractive sorry, if you hear my dog is snoring next to me. If you hear something.

Olivia Suchy: We don't.

I15: [00:26:30] Have a bulldog who's just like snoring his ass off. And so if I was a German government, I would go to, you know, MIT and Berkeley and the places that I have really attractive term sheets and just study them and just how they can apply that across the board. I would also modernize and streamline the different sort of national research institutes in Germany. And just like with the fact that, you know what maybe was an interesting solution

when these things were created after the Second World War, maybe that same approach doesn't make a lot of sense in 2023. Because I see that as a major issue. They just don't collaborate enough. You don't have any, you know, fragmenting it so much means that you just don't get critical mass most of these ecosystems. And I think that's very problematic, particularly in deep tech. Right? In deep tech, you need a lot of scientists, a lot of researchers in one place, and that can attract corporate offices in one place. And then you can kind of go from there, Right. It's just like if you if you think or if you're in the medtech sector, everybody knows you have to go to Boston. Like, that's just it's just a given, right? Because it attracts just so much talent and money and everything in that space. There is no European equivalent of that, right? There's certainly no German equivalent of that. I mean, the hardware side, I mean, I just got invited to, what was it, a space quantum event in Ulm. Am I going to go to Ulm for like and I was like, why, why, why, why? What is going on here? And they're like, Oh, it's the place where the German space agency has like their A.I. and Quantum Center. I'm like, is there a university there? They're like, No, it's just where we put this stuff. I'm just like, again, like, that's counterproductive in a way because it's not by the universities producing a lot of AI and quantum researchers. So again, it's just like this kind of deliberate fragmentation. Just I think ultimately, I mean, Europe is highly fragmented and then you get individual countries in Europe which try to fragment themselves even more. I think particularly in deep tech. Like there's just know there's a lot of research around the fact that a lot of IP. IP generates IP, right? So if you can get concentrations of this, whether it's the Bay Area in California, whether it's Boston, whether it's Southern California, these types of places, it just sort of self perpetuates. Right? And then you can build up ecosystems and investors because they've also seen that the more investment money there is in an ecosystem, the more number of startups get created. Right? So which is one of the big reasons why Oxford launched its own fund, even that I mean, Oxford launched its own fund. And, you know, there's probably a better argument that they should have. You know, instead of having a billion for one fund, they should have created ten 100 million funds and let them grow organically on their own. Right. Which has been the endowment model in the US, where Harvard, Harvard funds a lot of VCs in the Boston area, plus San Francisco and everywhere else. And that's just and it's also something you don't have in places like Germany.

Olivia Suchy: Thank you so much. I'm just looking at the time and I know that you have another meeting.

I15: Yeah, it got pusehd back 15. So we're not super stressed. I just want to plug my laptop in. But I think. I just can't value some AI thing somewhere near Frankfurt. But again, it's just like, you know what? Why not, Major? I don't know. And it's just it's not to say that small towns can't do interesting things, but it just seems in Germany, like every smallish medium sized city is trying to do something. And I do think that just ends up sort of diluting the talent pool out a bit, but also especially in deep tech, where you need universities and research centers around because it is going to take years and you have to have a constant pool of talent. And that's why in Switzerland you see interesting stuff coming out of Zurich because there's ETH and in Lausanne, because of EPFL and because there's an anchor university that kind of sets the ecosystem where yeah, in Germany it's everything is spread really thin.

Olivia Suchy: And is there I will just ask one more question or like two more questions. The the. The first question that I would have is are there any best practices like we've been talking a lot about the difference between US market, Europe, Germany. Is there are there any best practices that Germany could use that are being used in other countries and other places that are not being used yet?

I15: It was interesting. So I was talking with God. There's a program at MIT which is helping regions around the world kind of come up with best practices. And they told me that they actually got contacted by a couple of regions in Germany to kind of come in and consult. But the Germans passed the last minute because it was too expensive, which I thought was kind of funny. Yeah. No, I think there's a lot of there's a lot of universities that are doing an excellent job. MIT is, you know, one of the first places that comes to mind. I mean, they're doing it just an outstanding job. You know, they've got they've got through their endowment, they're funding a lot of local VCs. There's a lot of there's a large angel community that done a really great job of having very attractive terms. They've done.. you have programs like The engine at MIT, which are also kind of helping a lot of deep tech companies come out. And so yeah, Canada, like if you want a non US example, I think there's a lot of really interesting stuff happening in the Canadian ecosystem. You have like MIEL in Montreal, you have Mars in Toronto around the University of Toronto. But again, you have these sort of epicenters that are trying to make themselves big on a couple of verticals.
And I think that's another thing that countries like European countries kind of struggle is because weather, especially the bigger ones like Germany, France and the U.K., they try to do a little bit of every vertical when they probably just don't have the capacity to do that. But if you look at Germany, like an industrial, like Germany should be a leader in automation. But again, they kind of spread themselves very thin. And everybody in Europe, for whatever reason, decided they wanted to be a global player in fintech, despite the fact that, you know, there's no real stock market in Europe that's actually globally dominant. So and most of them are having horrible down rounds happening because, you know, fintech is just you cant have every country in Europe be a fintech hotspot. Know London makes sense because London is by far the biggest financial centre in Europe. But yeah, I don't think Berlin is going to be long term a fintech hotspot. But if you told me like, yeah, Munich wants to do stuff around robotics or automation or things like that, given the industrial sort of history of Germany, that would make a lot more sense. But again, they just need to pick a couple of verticals and really go hard at it.

Olivia Suchy: Okay. And one last thing. Is there any question that I didn't ask you that you would have liked me to ask you or anything that you like a statement that you would like to add to our interview?

I15: [00:34:10] No, it's not. It's interesting because pretty much like every European country is kind of asking themselves the same question. So I'm on the advisory board of the Dutch government, Dutch governments asking themselves all these same questions. Right. I think the thing is, is you just it needs what I've noticed that. So you sit on the board of French tech, right? And they ask me kind of like, what's the difference between sort of the Dutch approach to it and the French approach? I mean, the Dutch really have a really a lot of good elements around deep tech, right? I mean, the most important tech company in Europe is Dutch. It's ASML. You've got the four big technical universities in the Netherlands. But again, there's no there's no champion in government to push tech or deep tech. Right. And I think without that, these initiatives usually just kind of fall flat. The French with Macron kind of just said, okay, let's just fund the shit out of everything, good or bad. The BPI is just putting money into absolutely everything, but at least, you know, within the government that initiatives being championed.Right. And that's kind of his solution to everything. He's coming from the financial world. So he's like, let's really just put the BPI on steroids. I mean, the economy of the world is just going more and more tech, tech, tech. And yet most European governments, they don't have a ministry focused on tech and tech alone. Right. Which is just kind of absurd in 2023 that

that's the case. You have ministries for a lot of industrial era subjects, but you don't have one for tech and innovation, which is just silly.

Olivia Suchy: Okay.

I15: Yeah. So it's going to who's going to be your fairy godmother within the German government, I guess for I was interested like, like when Angela Merkel was I mean, it was weird, like she almost had like an anti startup, like I would go to some German government stuff and they just didn't like the word startup. It was just like, which was kind of sad. So I think the Germans kind of lost know they lost a lot of ground probably on that.

Anonymous participant: So interesting. Can I ask one last quick question on venture debt? Because obviously in the US it's much more prominent, assuming we have longer development cycles. Companies may need alternative types of financing. And would that be a small puzzle piece perhaps to make more capital available to?

I15: Yeah. No, I think that is something that's potentially available. I do think I think I mean, venture debt works great for established companies. I think the problem you get with a lot of the.. I mean, there is some older you know, there's some older venture debt providers in Europe, like Crios Capital has been doing venture debt in Europe for like 20 years. There's some other ones. The problem with like the venture debt, even I know in one of the partners at Crios pretty well and he was just like ultimately the problem in Europe is just there's no there's no liquidity events, right? Like, there's no but a lot of these companies just, you know, they end up just paying off their debt for longer. Where in the US debt is often used sort of pre exit pre IPO and there's just a lot fewer exit events in Europe and those exit events tend to be smaller.

Anonymous participant: And we tried to solve this issue with SPACs last year with some SPACs.

I15: SPACs was a nightmare. I had some friends who launched SPACs. I was like, Guys, it's just total bullshit. And I think, yeah, that's one of the problem. So you got like EIB is providing a lot of debt, right? So they are there in Northvolt pretty heavily there pretty much with there's the guy with the French battery company to the EIB. Just wrote a big check for. But yeah, so they're doing that. They're getting in but like particularly in Europe where I think the debt side you just end up again like everything else in Europe, you end up getting with governments being rather large players, right? The EIB is sort of the one who ends up in pretty much everything. And that's also one of the issues in Europe, is just the EIB kind of cleans up everybody else's mess. I mean, there's also there's lots of stories about the fact that, you know, the EIF they have a bad performing fund, the EIB just buys it on a secondary market, so the EIF can kind of pad their results. So you get a lot of issues like that. But I mean, there's a lot of other I mean, the thing is like ultimately in Europe, the problem is if you really want to look at what's sort of the big systemic issue in European venture capital is just the exit markets just aren't there. They're too small. Again, coming out of a system of fragmentation, Like, I mean, I've invested in companies that have IPO in Europe and it's just I've invested in companies that IPO in the US and the US is just a much more attractive IPO market. I mean, European investors want dividends, they don't want growth focused companies. So you end up like if you're saying like I, I'm my hot startup and I want an IPO in Frankfurt. But no, it's just it just doesn't make sense.

Interview with I16

Constantin Gehring: The first, more general question is: In which sectors and technologies do you see the greatest potential for change through Climate Startups?

I16: These are the deep tech approaches. For example, alternative energy generation in the broader sense, something like nuclear approaches, etc. These are just research topics that come out of research into venture capital funding. Cold core meltdown, for example, is something that works technically in the lab, but of course nobody has really proven it yet. Then there are somehow two or three different research approaches on how to solve this, two or three companies that are working on this and are already equipped with venture capital financing. If something like that catches on, it will solve all the energy problems we have. These are just hard deep-tech topics that come from technology, go on for an extremely long time, and don't work without government money in the first financing channels before they then get private money. Like from venture capital. That's the big blow to climate-changing finance.

Constantin Gehring: Do you see the success of these startups being jeopardized by insufficient funding?

I16: I don't think so in the long run, because venture capital works in such a way that impact or the normal investors always bet on the bet and certain bets will prevail. But that costs an enormous amount of capital. If you want to keep such topics especially in Europe, then you need an extreme amount of growth capital. I don't even think so much that themes can't be implemented because of very early funding. There are enough accelerators, there are enough programs at universities, there are enough early-stage investors. I actually think it becomes more critical where significantly more growth capital is required. That's the critical moment where somehow companies stop working on certain technologies.

Constantin Gehring: My next question: across all phases, you don't see a funding gap? But because at some point, due to market principles, someone will simply always take the bet , do you see problems more in the later phases?

I16: Yes, exactly. So sorry, funding risk. I do see a gap. So I actually see a gap today. It's very difficult to say where it exists, but I would actually say in scale-up. For me, the topic designations such as Commercialization, First Commercial Contracts, etc. are inappropriate. Scale-up is not just Acquisition/IPO/Specs, that actually starts much earlier. In the purple area and that's where there are funding gaps today. So, in the long run, the market will sort it out. But currently I see a financing gap in Europe. This could lead to certain topics not developing further. I honestly see a financing risk in the black and in the purple area. Probably already in half of this blue area.

Constantin Gehring: Okay, and where do you see the specific challenges there?

I16: The rounds are simply too big and the funds are too small. The rounds, i.e. the capital that has to be raised, is simply too large compared to what the typical European venture can afford. The way ventures always work is that they build up a portfolio of diversified companies. They only have a maximum amount and the rounds are too big and the funds are actually too small. Funds should be twice as big.

Constantin Gehring: Do you have a number where you would say the round is too big?

I16: Look, this is difficult. So now this has nothing to do with deep tech in the broader sense, it's a slightly different tech area. But there was recently an early round funding. B, between the green arrow and the blue arrow, where €32 million was raised by Tokenstreet, that's also about breaking up new funding. They raised 32 million for a series B from a foreign fund. That's an order of magnitude that a German or European fund doesn't invest in companies at such an early stage. A typical fund invests 100-150 million, but then you can't put 30 million on a single investment. Actually, we need funds that have capital beyond €200 million to be able to write a 10-20 million ticket. That is exactly the problem: If you have 200 million funds, you can write maybe one, maximum two tickets a 20 million €, because you need a portfolio of more than 10-15 portfolio companies. They are clearly too small and would have to be somehow double the size on average.

Constantin Gehring: Is there another factor besides that?

I16: It sounds strange, but I would call such a risk aversion. Partly, maybe because the funds are still too small. But then you just go into such topics, like the meltdown and nuclear technology. Who wants to get their fingers burned there? That's kind of the problem, that we don't have enough expertise in fund managers in this deep tech area. They can all kind of do great B2B, scale ups, e commerce, etc.. But we probably don't have enough investment managers with the deep expertise.

Constantin Gehring: Okay, that risk aversion would you clearly write VCs?

I16: That comes from the investors. VCs naturally only pass on what the investors write in the books. We've probably also done too few of these deals overall in recent years. But this is such an issue, it's just coming up now. It's only now that funds on a broad scale are taking up the topic of climate tech. Of course, we didn't have a huge amount of expertise before. They will now burn their fingers for one fund generation, use this as training and build up the sector expertise. Starting with the next generation of funds, they will then be able to make sophisticated decisions in this area.

Constantin Gehring: The fact that VCs are not big enough, is that a symptom that you can pin down the origin of?

I16: You always have to ask: Which investors can write big tickets? Meanwhile, the biggest investor in Europe is almost the European Investment Fund. They do due diligence super and their job really excellent, but of course also somehow get to human capacity of processing. What is missing is a large institutional investor base. Many of the German or European fund managers already have international pension funds, pension funds, etc. on board. But the proportion of alternative investments in the typical German pension fund, Versorgungswerk, etc., for example, is significantly underrepresented compared to U.S. pension funds. There, of course, the system works a bit differently because over many more generations, the issue of endowment funds exists and they can write big tickets. That's missing here in the big picture. Here, the funds are too small. That means that even if an American investor says: If I do the due diligence, my ticket has to be at least 50 million. But he won't sign a 50 million ticket for a 150 million fund. The risk is that he'll get stuck with a steak that's far too big, and that's simply far too big. In other words, because the funds are so small, we don't get the big institutional tickets because institutions don't want to do due diligence on the fund managers. The effort is too high for them, and the risk of having too much risk on a percentage basis is too great for them. At the same time, German pension funds are still so risk-averse and should actually be

forced to do so. They could just write the 20-50 million tickets but are regulatory extremely under bandages.

Constantin Gehring: You don't have a point anymore as to why this funding gap is occurring or?

I16: The funds are too small, they need much more money. Because they are too small, they can hardly get large, American or international institutions on board. But at the same time, they are so small because the German pension funds, pension plans, etc. pp. do not write tickets.

Constantin Gehring: We just mentioned the challenge for investors in hardware and you said there is a lack of expertise. Where do you see other challenges when you want to invest in this area?

I16: Not really. I actually think it's the size and a little bit of regulation, so to speak. Also a little bit of the lack of knowledge, that's the three big areas.

Constantin Gehring: What would be concrete support measures to close the gap?

I16: What I find very good are the programs of the European Investment Fund. But in Germany, I think that would have to be baked a bit differently. There is KfW, but I have the impression that it invests everywhere, but doesn't really dare to do so. In order to bring these large players, such as pension funds and utilities, into the game, we would have to make things a little easier on the regulatory side. It is a high-risk investment class, and therefore they have very high capital adequacy requirements. Private pension funds or insurers, pension insurers, they invest customer money and they rightly have extremely high investor protection. But for these high-risk investments, this means that insurers have an extremely high capital adequacy ratio. That means they have to put a lot of money on the side of equity, which therefore can't work. We have to look again at the leverage to see whether it is possible to simplify certain things. But of course that's exactly what's driving this: It has to be simplified so that the capital flows, but investor protection speaks against it. But maybe the area can be covered by appropriate guarantees, can be designed with some kind of government guarantee, KfW guarantee, etc., for certain fallout scenarios. Possibly that helps to get a better rating.

So I think those are the big issues of regulation and government guarantees, where you can leverage a lot and hopefully get the private investors, the private sector, to invest more. In the early-stage area, you should lower the hurdles and make it easier for government grants. We have a portfolio company from Cuxhaven on the North Sea that can recycle ships for offshore drilling rigs with a water jet technology. Recycle ship steel in total. That's gigantic, of course, because you don't have to do the bleaching in three somehow in third countries where there are no work safety regulations. That means you can recycle ships here in Europe with European safety regulations. The recycled steel can then be put back into the economy. But this costs a lot of money. If you then want to take advantage of government subsidies, I believe a maximum of €200,000 per company can be subsidized over three years. That's a pittance for a company like that, it's not enough. In addition, it's a hassle to get these grants, which are then a maximum, a maximum of €200,000. That is simply a laughing stock. That is far too little. This means that European legislation would have to be changed so that grants could be made for things like settlement bonuses, etc. pp. That the amounts are set high.

Constantin Gehring: Okay? That would be the end of the interview, which is somehow over very quickly. The question: Are there any suggestions, objections or questions that we should consider in this topic that are not covered by our questions now?

I16: I had a suggestion. I don't know if you have already talked to the people from Future? In my opinion, you should listen to what they have to say. Maybe you are networked with them, they also have this Futurist Institute in Potsdam, there is also a cooperation. If you don't have them on your list anyway, that's Holger Vollmann and the whole team around Future. I think you should also reach out through funding gaps. I come from the VC area and I also see that the market has to regulate this and we have to somehow set the market conditions well. I don't know if you have to reach further, for example directly down in the startup area, I'm not quite sure about that.

We have talked now very, very much, actually about funding gap for this kind of investments. Of course, what we're all concerned about is the topic of regulation, article eight, that's all right, because now, now it needs. But we need to somehow get to the point that every manager simply no matter if they want to do that the don't have to worry anymore about such an article, new approach, whether they want to go, go or don't want to go, but that they see it as good business models, so to speak, to invest it in such companies. So I personally believe that we have a high impact so to speak with a high financial return from it. But you have to explain that to the conventional article six fund manager today.

Constantin Gehring: And there you say, it's just a bit historical, So it's just, when there come the first funds, which then have really good investments, the good assets, then it will, the others will also follow.

I16: Yes, yes, So what I see, especially in the industry is that many funds are extremely afraid of such an article. Nine all don't want to limit themselves, limit themselves too much. And that is of course also a huge hessian, a huge burden. What there now somehow places must become, that is. So I think that today there is hardly any fund that is not article eight as article eight at least put on. That will become so mainstream so to speak, so you can at least times reporte de invest what you want, but you have to at least times reporte if you somehow. So always have to report the risk factors. At the same time, I don't know and lack a little bit of imagination. Don't know whether one maybe again so a re-sharpening of these article nine stories whether one maybe. One or the other investor, one or the other fund could be brought to go more in the direction of impact investments. So you can. The joke of it is that when I talk to impact investors now, they say we are not interested in all these article stories. We, we look at, we look at deals that have a certain impact in their area. But what you, what they buy into is an obligation to be able to prove that they have expertise in some other stories.

So we have to do it now and there and then it becomes totally difficult. So, so to speak, you have to do it now. Let's stay with this case of cold core meltdown. Most. Or another example. Other example We just had a crazy discussion. Most funds have. Excluded from the investor side is not allowed to invest in certain things. That is, you can't invest in guns. You're not allowed to invest in pornography, nothing in alcohol, tobacco, etc. pp. And mostly nothing in gene modified things. So what you actually want to exclude from that kind of thing is human cloning. But then of course also the whole gene modification one wanted to exclude somehow.

But now a mesmerization came on the table and that was done. But it was discussed for a long time, because it is actually excluded, but it was about the fact that a substitute, a substitute product to palm oil was found via genetically modified bacterial strain. Palm oil is a big problem in the world. If you can somehow produce this artificially and bring a substitute product, which has palm oil properties, into production, the question is how do you put it down? So on the one hand you have a gene, you've modified the gene. This is something that many people rule out for ethical reasons, but at the same time it would have such a high impact, so to speak. Show yourself somehow the cutting of rainforest to build up more palm oil fields, it would have an insane impact. We decided to make the investment. It was actually against the rules and that is something that I think will move us for a long time, that we now want to have obligations here, actually impact issues invest and at the same time you have to prove that they have somehow no other disadvantage and that that will be difficult. And that's why so conventional investors are currently saying, then I'll just leave it alone, the corn just isn't, I don't want anything to do with article eight, nine, etc. This is also very short-term, because investors want that investors from investors side comes yes the exclusion not invest in genetically modified organisms there and there must still be a bit so a rethinking also so an ethical rethinking take place on the investor side. To be honest, investors have to become more risk-averse on the one hand, and on the other hand, they have to rethink their ethical principles a little bit. Yes, that's absolutely right. And that's but that's the totally that it's totally difficult, totally right that we all don't want to do money cloning. But we must somehow be in a position to make investments that can have a long-term positive impact.

Constantin Gehring: Okay. Then I'll definitely take that with me. Is just difficult. Probably where so now, so now to propose as a funding measure. Yes, so so, I take it with me in any case, but that's really not thought about it. Difficult.

I16: So quite a few support measures specifically also around support measures is, I think, something like guarantees are very effective. I can imagine very effective. And the question is actually this European subsidy limit there to 200,000? To be honest, I don't think that's enough. That hits all European countries, after all. So that's probably true, but it's not something that Germany can regulate on its own. But to somehow get creative again and raise the contributions, okay.

Constantin Gehring: Fine, if that fits. Otherwise. That was it, wasn't it? That was all wonderful. Yes, exactly. Then all I can really say is thank you. It was a very, very good interview. I heard a lot of things that have already been mentioned by other people, but also new aspects. That's actually always the perfect mix. Exactly. And then I'm happy again. Thank you very much. We will publish our results at some point and then you will also be informed what then became of the whole study or what the whole results were.

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Interview with I17

Olivia Suchy: My first question would be: What do you think is the biggest potential for positive change through funding start-ups in Germany?

I17: Well, at X in my current role, I actually deal less with start-ups. Nevertheless, with this sector itself. What you could understand by transformation financing is that, in addition to investing in, let's say, renewable energies and all kinds of technologies that make a positive contribution to the climate, let's say. I already deal with that quite a lot. Always within the framework of project financing, i.e. as an infrastructure investor we invest in larger, capital-intensive projects, less in companies, i.e. less in start-ups, but really in projects that say, for example, I would now like to build electrolysis XY in this area, which should then run for 30 years and should feed green hydrogen into the grid. Then the project is ... and stakeholders the banks, investors, they then build these ... (lost connection).
We are also investing in a similar area, so to speak. But always now not in start-ups where you are looking for growth and take a lot of market risk, but rather in projects where the scope, the business model is relatively clear from the start, so where you invest and say, okay, this project will only finance this investment and this investment will then run for a certain time and you then take a little different risk. You take less of a market risk, that is, you say, okay, where are the sales markets now, where can I expand my company? Rather, I would say, for example, construction risk or inflation risk or price/quantity risk. These are things that I look at very specifically. That's why the requirements are a bit different. But it still fits. I would now assume that you also look at such things. In a way, they are also start-ups.

Olivia Suchy; Absolutely. I think that's exactly what we wanted to talk to you about as well. And it's a little bit different actually than the other interviews we've done so far. But it's actually super exciting and I would just, so we're talking about the same thing. You've just mentioned risks in the area that you're talking about. I don't know. Maybe what I'm sharing right now will help on my screen. Which risks would you say are more likely to fall away? And which ones? You've already mentioned construction risk right now. Is there anything else right now? Maybe also what you think is worth mentioning?

I17: Well, yes. Exactly. So this whole area is changing a bit. Especially because of the fact that there is this big field of transformation financing. In the past, there were public tenders where you said okay, here's where municipality XY puts this project out to tender and then various investors apply for it and it's relatively clear what's going to happen. Yes, there is a tender and then we build biogas plant XY there. And those are the conditions. Now it's changing a bit, because the field will of course go much further and the development will be much faster, for example green hydrogen means that there are also several risks, including the risk of a market, so to speak, that you don't know from the start who exactly the buyers of this project or this investment will be, that you take a certain risk. The risks that I would see now, as an infrastructure investor, are above all market risk, financing risk and construction risk, which is definitely a big deal, and market risk. You can talk about that. I could now provide input and say, well, what are the framework conditions that have to be set so that infrastructure investors like Meridiam or others invest in such a project? Well, we can talk about that, because a lot is changing right now.

Olivia Suchy: It would be exciting to be able to talk about that when we move towards solutions. And to say here, I have a second slide, because I already have this open. I don't know if you can apply that to project finance that you're talking about. We like to show this to our interview partners and ask: Where do you see the biggest challenge now in your projects, in the phases? Where is the biggest challenge in terms of financing?

I17: Yes, the first three. So a classic infrastructure investor will not get involved there, he will, I say, get involved in commercial contracts, because when the whole technology risk is taken out. With Meridiam, that's not an advertisement, it's a bit different and there are certainly others who do that. They get in a little bit before. I'm going to digress for a moment. At Meridiam we have various funds, we have a classic infrastructure fund and we also have one that tackles precisely this problem a little bit. It's called TURF The urban resilience fund. And they have a tranche, a technical facility, which is also available from other large banks, which is, so to speak, research. So everything that happens before technology, everything that happens before an infrastructure investor would invest, they spend money on it, so to speak, for feasibility studies, things like that. And right now, with these new technologies, when it comes to hydrogen, for example, I'm looking at a project where they are trying to produce hydrogen through renewable energies, to store it in a cavern, and then you can do many things with the hydrogen. You can sell it to industrial companies, you can feed it into the grid, you can convert it back into electricity and all these things are still unclear. That's why it's important to find forms of financing to fund this technology, the technical testing, the validation of the business model, things like that. And there are various possibilities. There are public subsidies for such things, for studies. The problem that these things often have is that there are a lot of studies. For example, we talked to a city in West Africa and they do a study every year to improve their sanitation situation, for example. Every year it fails because after this study there is a tender, the tender is not tailored to the private sector and nobody applies. And what this fund does. It now has a similar facility, so to speak, but it is very much trimmed to it because it is financed by us... to design the tender in such a way that it fits the investor later on. It doesn't necessarily have to be Meridiam. It can be someone else, but then these classic requirements are what an infrastructure investor wants to see. So a very long, long-term investment horizon, high start-up financing, little technology risk, public support. So all these things are then worked through, so to speak. And then these feasibility studies or these tenders that are made based on them have a greater success. So to come back to the slide, an infrastructure investor would be more likely to get involved if there is at least a business model. Construction risk many take, Greenfield. But the business model has to be behind it. And in order to bridge this phase beforehand, there is, for example, this possibility that comes to my mind. I would say to bridge this by really having a bankable project.

Olivia Suchy: That means, if I repeat it correctly, that the biggest challenges for hardware projects are before first commercialisation?

I17: For an infrastructure investor. They take little technology risk. Little to none. That has to be financed through other channels.

Olivia Suchy: Exactly. That means for the investor, it would be unlikely to invest before the blue part. And that means, conversely, that for startups, that's probably a more difficult phase if they're relying on infrastructure investors.

I17: Yes, as I said, we do not finance start-ups in the classical sense. But perhaps one point that could be made now is that with such projects, for example, we did a project in Mauritania. I think it was about waste collection, where we developed such a project with the city, where we later invested and which, in principle, created an ecosystem. In other words, many start-ups are now participating in it. For them, it has become a market, because of course a completely new ecosystem has been created for a certain area. And in the call for proposals, it was also determined that this is also an opportunity to promote the local ecosystem and to offer their sales markets. That's also a bit connected to it.

Olivia Suchy: Yes.

I17: And if you formulate that as a criterion in the tender, then you can also enforce it.

Olivia Suchy: Yes, that makes sense.

Anonymous participant: I have a very short question I17, this TURF. They give equity?

I17: Exactly, they give equity. I would have to look that up. I mean that there is not necessarily a limit. In general, there is an upper limit for infrastructure, rather than a lower limit.

Anonymous participant: Yes, where is that?

I17: I'd have to look it up. I would say probably 5 to 10 million. But I can send you that again. So, as I said, this is not the fund I work for, within X.

Anonymous participant: My last question. You don't have a programme or a fund or vehicle of your own that you use to fund really early-stage technology developments, for example in the hydropower sector or in the battery storage sector, with the prospect of a larger infrastructure project developing out of it at some point or another.

I17: Well, I don't think you can say it quite clearly, rather not. But for example, I recently looked at something in the area of sewage sludge processing, because there is a lot of potential there as far as recycling is concerned. Yes, and we also talked about it because the business model was still relatively open. Then it was also about a share in the IP, in the technology. And there it was about financing a test facility. That's something we can do, something that investors also do. But then, of course, always with the goal of turning it into a larger project and determining in advance the conditions under which the initial investment can be recouped. So that is certainly an effort, or with the amount of the participation or development costs that are priced in. So we do that, but the business model must also be clear about what could come later. Otherwise it will be difficult. And I mean, for example, what I just mentioned: the project with green hydrogen and the cavern, that's also something where you work together with consultancies that look at the market very closely with so-called multi-small studies. That is also something that is very popular, where you bring together the public sector, banks, investors, industry, companies, suppliers, depending on the technology, and make a study about it and then use that, so to speak, to explain business models, but also to establish contacts. And that works pretty well and often leads to projects.

Olivia Suchy: My question in general would be: Do you think that HW projects are endangered by insufficient funding or not?

I17: That they are not sufficiently financed, yes.

Olivia Suchy: That there is a funding gap.

I17: There are certainly more requests from technology-based start-ups that are ultimately rejected because the business models are not yet mature enough. So in that sense, there is already a funding gap. But of course, many of them really don't work in the end because the technology risk is too high or the business models can't be implemented in the end because of

regulatory changes or whatever. Or in the end, the costs no longer fit with the business model. So, there is certainly a financing gap in the sense that too little money flows into pure research of new technologies, because an infrastructure investor very rarely gets involved there. In this respect, I mean, of course there is a need for financing, but then it is probably more likely to be through grants or through whatever funding programmes are available for this.

Olivia Suchy: Okay, that means you already talked about the framework conditions for risk. Where do you see the biggest challenges for investors as well as for start-ups of hardware projects?

I17: Well, as an infrastructure investor, you're not interested in building up a project through private equity over five years and then measuring the added value at the exit, so to speak. The goal is to set up a project that you can really hold for a very long time, 25 or 30 years. In principle, until the end of the term, if you can put it that way. That is not the case with start-ups, because there is no end to the term. But the original infrastructure market, for example, was actually like this: there were PPP or PPP projects, i.e. public-private partnerships, where it ran via a concession that expired at some point. It was said that you would operate road XY for 30 years and after 30 years the concession would end and so would the project. You then have to try to earn a return over the 30 years and after that the project is over. Now, as I said, that is changing. The projects have an exit value, even if it is very far in the future. But what has remained is the long-term perspective. Or to put it bluntly, it is better to know how to generate 5 % over 20 years than to know with uncertainty over five years how to achieve 30 %. And that, I believe, is also one of the essential requirements, that there must be certain framework conditions. It doesn't necessarily have to be price security. I don't necessarily have to know the price for 20 years, but I have to know within what framework I am moving? Am I moving within the subsidy regime? Is there a market for it? For example, if I produce hydrogen, where I can find buyers with whom I can conclude 20-year contracts. And it comes a bit from that, because you always try to finance the projects with outside capital. In the classic infrastructure sector, leverage, i.e. debt, is very high, over 70, 80 %. So it is very important to get suitable debt financing. And the banks only finance it in certain base cases, so they know that it won't go bankrupt after five years. If you can secure this base case, then you can take a lot of market risk. One requirement, for example, would be very specific for the hydrogen project I mentioned with the cavern. That is currently difficult. Hydrogen, or in other words, the market for it so far does not allow for long-term contracts. And that is changing a little bit in terms of regulation. But it's not in that form yet. We are still taking risks because we believe that this will change. But that is a challenge, for example, where you would have to build the market with framework conditions in such a way that it allows investments in the long term. Not that it's clear from the outset where the price is, but that's one thing.

Olivia Suchy: Is there another challenge?

I17: Yes, what would be different. What is also always the case with the projects that you have very high initial investments, so very high CAPEX requirements. If you build a solar park or a hydrogen project, that will give very high investments. And that there is a market for it, that you can buy the technology. That is also something, but that is, I would say, more of a risk that can be taken, because infrastructure investments will always go into a consortium together with construction companies and whatever. So they usually secure that through partnership with a company.

Olivia Suchy: Now, looking at the time, I would say that we can now go a bit in the direction of a solution. So I would ask you to perhaps go into detail again about the framework conditions you talked about and other concrete measures that can be taken in Germany to improve this situation and meet these challenges.

I17: Very broad field. For new technologies, it is certainly important to set up funding regimes. You can set them up in different ways. So for solar you can make feed-in contracts. You can make CFDs, i.e. Contracts for Difference, where you have a difference between the market price and the foreseeable price, or you can make tenders. What is very important when you set up these systems is that the private sector is involved at a very early stage. So that they are not misguided. For example, tenders are a great thing to find the right market price. Instead of setting some kind of feed-in tariff price offer that might end up being way too high or that doesn't bring in any investment at all. So that's a model that I think works well, as you can see in the offshore market, for example. Well, in the meantime the subsidies have been reduced to zero because the market is now being allowed to speak for itself. I think the same applies to new markets, such as the hydrogen market. For example, you know the requirements of the private sector and then structure the market accordingly. For example, in the electricity market. Or a very concrete example, balancing power, where you can buy energy, electricity energy. It is currently structured in such a way that you have to buy it on the stock exchange on a daily basis or whatever. In other countries there are capacity markets, which means that you can buy capacity over many years and thus have price security. Such fundamental things are very important to bring long-term investment into the sector. And you simply need that with the high CAPEX figures.

Olivia Suchy: That is really very helpful. Maybe also in relation to that. So what do you think are the key players that can and should act to drive this change?

I17: Well, there are regulatory things, so the regulatory authority then from the respective areas. But there is also a lot at the local or more local level, i.e. municipalities, cities, which often put out tenders. And what I mentioned with the fund, the financing of feasibility studies. At the end of the day, the customers are really cities or municipalities. You have to approach them properly and they are also open to such proposals. They support the implementation and the local political support is also very important for such large projects, that you also involve them.

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Interview with I18

Olivia Suchy: My first question would be :Where do you see the greatest potential from investing in hardware startups in Germany and the greatest potential for positive change in German society?

I18: Well, that's actually clear. Clean tech hardware start-ups. So that's basically what we need right now.

Olivia Suchy: And are there certain financial tools right now that are already working well that are supporting these hardware start ups well?

I18: Financial instruments that exist. Classic investments, investors, but as you said, they are rather reluctant to invest in hardware start-ups. That in combination with debt finance. But you have to have a certain amount of security and then there's not much left. That is the simple answer. So in the end, there are still national funding programs, partly for hardware, but they actually only start when it is more secure. That is, when you have already scaled one step further. And in between, there is a bit more at the EU level. But funding instruments are not as developed as they should be, I think. That's actually the instrument that's needed now, some kind of guarantees that the federal government will take over, so that such start-ups get their share for the scaling of their use.

Olivia Suchy: As part of the interview, could you briefly elaborate on what stage you're in right now and where you've had the biggest challenges getting investments so far?

I18: We are exactly in this growth stage, where we need a lot of capital for a scaling step that is still quite risky. And that is precisely where the financing gap is for everyone at the moment. And the challenge is, on the one hand, that investors, some of whom really don't want to take the risk, that it's not attractive for investors and, on the other hand, that the fact that you're still risky, quite early stage, naturally means that these large amounts of investment mean that you have to give away a relatively large amount, because the valuations are not as high as when you have software that can then be installed. So VCs are simply the wrong instrument for something like this. It's not about somehow getting more investors to invest in hardware. I think there are simply other instruments for financing something like this. VCs are the wrong way. But there is nothing else at the moment.

Olivia Suchy: We've prepared a little slide that we show specifically in context. And I'd be interested in where you saw the biggest risks for investors in your case.

I18: None of that, actually. In the end, it's simply the fact that investors put money into concrete and steel. The risk is the same. Whether a software or hardware startup fails, but in a software startup, the return is much higher because they put the money into people and that directly causes growth, so to speak. And with us, 70% is put into concrete and steel and that is simply that. The risk is the same. The risk that it will fail is the same as with software. It's just that the money is used differently and it's just the multiplication of the money. It's just not there at first, if you write that overemphasized as a thought.

Olivia Suchy: But what I would also be very interested in, maybe also so from the ecosystem. Do you know which phase is the most difficult or presents the biggest challenges for hardware, startups and hardware projects?

I18: That is quite simple. Most of the money is needed when there is real scaling. The difficulties are the same everywhere, but the funding difficulties are where a lot of money is needed.
That also varies completely from phase to phase, i.e. where the capital is needed, so to speak. But in the end, it's always there where the scaling step is taken and the revenues don't come at first, because they come from what you've built. That is, you are still quite revenue light and on one side you need a lot of capital and there. Okay, there are the big financial difficulties.

Olivia Suchy: [00:10:31] We were talking about government funding earlier. How do you assess the awareness of the state on the topic that grants are really needed or other financial instruments?

I18: [00:10:55] So, of course, so far we haven't really heard much about it. I don't get it much either, what's being discussed there. That's what you guys get the most. That's why we can only evaluate what funding programs are available and they are quite rare. So there are a few for now in our case. But it is not transferable to others, not necessarily transferable to other hardware statups. So you need bigger instruments that can solve the problems that we have here... So I don't know how the readiness or that the knowledge about it or the discussions about it are going. I'm not in that, that's where you guys are closest.

Olivia Suchy: [00:11:46] How do you assess the awareness of the investment donors on the topic of hardware or science?

I18: [00:12:05] I would exclude science here. It's kind of a bit out of place, but hardware, you also have to do that very urgently always in the context of the market situation. So if you've done interviews now, even a few months ago, half a year ago - that's something completely different than now. You always have to take that into account, because the market situation is of course colossally different now than it was a year ago. That is very important. And otherwise the willingness is: maybe it grows, I can't estimate it was in the end the first and only financing round of the size that I have participated. That is to say, it was also during the time when the crisis was already there. That means I can't compare it to what it was like last year or what it was like years before that. The willingness is there. So there is interest, but it's nowhere near as high as it was when it wasn't good.

Olivia Suchy: [00:14:11] Where do you see the biggest regulatory obstacles, if you see any In Germany and in Europe for hardware startups.

I18: [00:14:35] Actually, regulatory... Except, of course, professionals. But it's something else. That's hopefully being worked on as well, if you can trust that - that skilled workers to come from abroad. I actually see the need more on the financial instruments side than on the regulatory side. So I mean, in the end you have to adapt to the democratic standards, that's not specifically an obstacle for start ups. You just have to go through the whole approval process. There is a reason for that. Sure, they can all do it faster, but I don't think there's much leverage to attack them.

Olivia Suchy: I would now like to go into concrete measures that could be taken in Germany to address this problem. Is there anything that you would like to see as a founder or any concrete measures that you can think of that could be taken in Germany?

I18: I'm not enough of a financial expert. So in the end, the main instrument should run through it. That would be a massive relief and not to be dependent on investors.But which instrument there I am now the wrong.

Olivia Suchy: And do you have a tip for female founders who, what they could do better in the growth phase to get better access to investments? With the status quo as it is right now?

I18: I think you can only use the tools that are there and try to put in as much work as possible. I always try to convince, but otherwise you have to resist what's there.

Olivia Suchy: Okay, all right. That is, if I summarize the conversation that we've had so far, it would be that more government funding is needed. That HW startups should be less dependent

on VCs and that the most difficult phase, the phase where the most money is needed, which in your case would be the scaling phase.

I18: I think I would replace funding with financing instruments. It doesn't have to be free money, but financing instruments that take the risk.

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Interview with I19

Caroline Schmid: And I mean, the first question would be, in which sectors and which technologies do you think the biggest change can be achieved in terms of climate? So also which sectors? Of course, this can also be the sector in which you are active.
I19: Yes. How many sectors may I name?
Caroline Schmid: So two. Three.
I19 : Well, except for. Probably Energy. Oh God, I don't even remember that right now. I mean, it's not an opinion. It's kind of a fact then. But energy for sure. And then what's the second one? Industry or transport? Or agriculture? I don't know. But I don't think that's an opinion at all, but you can look at where the CO2 equivalents come from. I don't really have that in my head anymore, because then I focus a lot on solar energy. But energy is definitely simple. Energy production is simply a massive CO2 emitter today and must be zero CO2 emitter in 30 years and therefore we must radically switch from fossil energy to clean regenerative energy.

Caroline Schmid: And what do you think? So now the one more the positive perspective. Do you think this is going well in Germany right now, or where is this transformation working? Where rather less? Or what are the drivers?

I19: It's progressing, but it's progressing too slowly. Um, I think you have to know two numbers to understand the climate crisis. One number is 50 and the other is zero. 50 is the number of gigatons of CO2 equivalent that we're emitting the metal today? And zero is where we need to be in 27 years. So that's not just so a little bit more percent renewables and so a few more electric cars and so a few more heat pumps and so a little bit more oat milk. This is a radical and profound transformation of how we consume, produce, manage, work and live. And that has to happen very, very quickly. So very profound, very consistent and very fast. And it could go faster even now, it could go faster, but it's still going far too slowly because we don't dare to move forward, because there are far too many bureaucratic hurdles in the way. And it was just way too slow for me because of that. There's not the courage. There are far too many bureaucratic shackles. Even when the money is there, it still takes longer and longer for anything to progress. Because we have a Leitz folder culture in Germany that holds us back a lot, because you always have to fill out the applications correctly before anything happens. In other words, our work here is form-oriented and not results-oriented. And that has to change so that we can make progress. In the energy transition, in climate protection, as well as in digitization, education and other issues.

Caroline Schmid: And then you would also say that it is precisely because of this, this slow approach, or perhaps that is also a reason why, for example, startups in the hardware deep tech area receive too little funding. Now also from the government.

I19: Yeah, so investors don't really like their hardware at first. It's cooler with software. Why is software cooler for investors? Well, first of all, you can roll out the beta version. It doesn't

have to be perfect. Good enough is enough. And if it's the junk on the web, it fits. You then learn from the customer whether it works or not and then you can keep improving it as you go. You just have to do that. You play out an update and it's there. Second software is replicable, multipliable at marginal costs that tend towards zero. And those are just two unbeatable advantages. The one software startup has been compared to the lite deep tech startup or to the hardware in general, where you have to research for a long time, do development, build something, manufacture something. You can't just roll it out for a short time and say we'll improve and then say on the go, so to speak, Yes, it just doesn't work. It has to be completely safe. So there. So Betsey fusion power plant simply takes longer to build, because it just doesn't exist yet and once it's there, you can't do it that easily. Zack what times update simply does not work. And it's the same with CO2 reduction and with many other things that are hardware or the DITIB, which are also deep tech in the sense of material. Of course, it's much more difficult for investors to make a business case out of that. I mean, we've overcome that, We're also a hardware company, practically. We don't manufacture anymore. But we work with hardware and we work with electricity and with a lot of people. We have over 1000 craftsmen with us. And we have managed to optimize the business model and make a product that is not scalable, namely a solar system, scalable. And it was just a living model. Innovation and and. So it worked quite well for us.

Caroline Schmid: Cool. Thank you. Exactly. So, speaking of phases, I have a quick screenshot that I can shear for you. Because now I would. I'll try this one down here for a second. Right. We would now go into a little bit more detail on these on these states in the startup and then that would be cool if you could tell me where you think you have the biggest funding gap or just the biggest risk for you guys that you're just going to have a hard time with funding.

I19: So with us. We do our own programming, but I wouldn't categorize that as R and D or r in D so really. It's probably already development, but I think that's it. We don't really categorize that now. We had so with us so. What else is there here? Well, we're kind of already at Scale up.

Caroline Schmid:No, far, far right.

I19: Yes. And in the beginning it was really like that, that we financed everything privately. So no university for the programs, no government programs, no accelerator. It was all financed by private capital. So first sohi network in the videos there that that was the beginning of the founders themselves and then so others who are in the start up scene on the road, have then given and then later came the investors with it the bank, investors.

Caroline Schmid: And so was there or did that just evolve or was there a reason why genuinely so just relying on private capital?

I19: He filled out applications first.

Caroline Schmid: Well then. Okay, so also this time problem or the hurdles are just too big.

I19: I think many people don't understand what is being done. So that is also a lack of understanding. And of course it is always difficult to justify or someone who really only ever needs state money. Why doesn't he like to give private money? Then you have to give a reason for it. So if such an experiment maybe only times 1 € on it gives where private euro, that can be a good thing. But why should you make such an aggravated selection as a state, that you just

promote those who obviously do not succeed on the private market? Since one makes a strange, perverted selection.

Caroline Schmid: Okay, and now briefly back to the screenshot. So you can't say now where, where probably the biggest difficulty is now with start ups to be successful or to get a foothold, to be successful in financing.

I19: I can not say, because n couple has also asked ten investors and I said no, then okay, hahahahaha. And then at some point I gave money and then.

Caroline Schmid: [00:09:14] Says I.

I19: That works. So we are simply already there. We this capital problem we are long out at a price, which I can now no longer say so much about it.

Caroline Schmid: [00:09:24] That's good, isn't it? Very good. Okay, then I'll put that back away. Then it's back to my normal questions. Um, okay. But if now maybe not only related to EMP, but in general, then would you say, because you've already said a little bit that there are already many, so many people have I mean fear or are just too risk-averse. The mentality, the problem, what would you, what are the two biggest reasons, my reasons I would say, why there can be a financing gap for hardware start-ups.

Caroline Schmid: Perhaps in addition to mentality and attitude.

I19: Good question. There. Halt noch. So it's just not there yet. And that's why the ROI is not always clear for the investor. So how long does it take to get something back? This is especially true for hardware. It's still more difficult than with software, because you can roll it out, see what happens, and even act with faulty software or completely perfect software. But that's difficult with hardware, because it has to work. It has to be safe, it has to be tested frequently, it needs lengthy procedures that also have to be approved. Frequently. So that's that. Hm. It could possibly be a reason, but I'm not so sure about that either. Am I unfortunately not so sovereign, Felix spoke with the.

Caroline Schmid: And so we've already talked a little bit about political changes that can be made. But do you see politics as the main player at all when it comes to funding? Or for example. You have also, if you now, so you have gone to private financing, because that also what just also goes faster, or in the sense, do you think that politics can still be the main actor at all? Or would you say that you shouldn't push it at all on this side? Or that it is difficult to push?

I19: No, we need the government. But we don't need any now. No grant programs or none. No stimulus money. With solar, yes, it's cheaper than any other energy source. So the others need subsidies. But of course, where there is market failure, the state has to step in. Yes, for example, in terms of start-up financing for the solar industry. We no longer have any manufacturers. That's such a chicken-and-egg problem then, because there's just no ES. There are only factories that are really very small in Germany and Europe. And because they are smaller, they can't produce cheaply. It needs economies of scale. But low-cost production can. And it needs some kind of basis first. And that doesn't exist at the moment. And that's where the state can act to create the foundations. And there's a good book by an economist. What's your name again? Marie Luci or something like that. I don't know. Shall I go out there right now?

Caroline Schmid: Okay, very good. Thank you. Can you give us a hand?

I19: I'm still doing what I was always out of, because that's really good, because it also shows the innovations in the U.S. and elsewhere, also just the energy transition and also just something like Tesla or how the Internet and Google and so all came about, also thanks to state funding policies. So, of course, we still need companies, entrepreneurs, businesswomen, and personalities. But above all, it needs. Then also actually . The state, which then also lays the foundations. So, let's get out of here right now. It's good that you know that. By Mariana Masugato, The Anthroporial State.

Caroline Schmid: Okay.

I19: How does innovation work? And what role does the state play in this?

Caroline Schmid: Thank you. Thank you. Cool. But then if you. If you now go to the other effective or. Or let's say we go over to best practice now , if it's still about funding, what would you say is now so for startups in your area, what is, what certainly helps or what are the best practices? Or now with you guys, because it seems to have worked, as you can see.

I19: So one philosophy of a few is actually Greeks go running. So you start very small the colleagues we laugh because they have heard the saying so often, so you start very small and try a little bit around and it seems nothing happens. So in construction it's just so ridiculous what happens there. Then you go the first baby steps looks works so okay, there you go and okay fallen. Okay you learn from it one more better and then all of a sudden you're running like you've never done anything else. And I think that's good. That's important, that you just look for a long time first, how does the thing work? And then you can really scale very quickly. That's the sum of a ketchup bottle that you open up again. And then you shake it and nothing comes out. And all of a sudden, so and so's whole swing comes out. That's roughly how you can think of it. So exponential growth very slowly at first. And then they think, well, even if they keep growing, so far one problem remains small. And then all of a sudden there's a breakthrough and it goes insanely upwards. And that's the end story.

Caroline Schmid:So. okay. cool. Thanks. And? And if we now. If we focus again a little bit more on the mentality of funders. Would you say. So politics we have already talked a bit and also. But what do you think? What is the role of VCs, for example, if it is now in this hardware area start up.

I19: Yes, so climate protection needs a lot of money. In climate protection and firefighters, but already on which the task is very large. Since we have to really. There are costs, they are there anyway. We have to build a lot of power plants anyway, we have to build a lot of new cars anyway, and so on. So there are costs that are there anyway. But now everything has to be green. But it just doesn't work then. It's either like this and it goes wrong or like this and it goes well. So here the costs are often exaggerated, but the investors just have to understand that any fossil, any fossil energy is a risk to their investment and they can actually only do solar and do renewables and do well. Everything else is just. It's just a risk to your investment. And the word has gotten out about that. There are so many good start ups around the world. That's phenomenal. An Arrow is the first green unicorn in Germany, but definitely not the last. I would like to see quite a few. A few. There are quite a few green unicorns in Germany. It just has to be a whole herd of Green Tech Unicorns. So some kind of, some kind of zebra, some kind of

zebra herd full of green unicorns. Because we can't do it without the others, because the task is just so enormous. So in the transport sector as well as in industry, in agriculture. So much has to happen that even a lot of We unicorns.

Caroline Schmid:And you've already said that the first Green Unicorn in Germany. If you compare that a little bit with, for example, the USA or so. Do you think that the whole ecosystem there is a bit more mature or why that is? Or how would you assess that?

I19: Um, yes, we already have a very progressive energy landscape here with us. There are an incredible number of pioneers of the energy transition in Germany. The energy turnaround was also invented in the past, but above all with the EEG. In 2001, the energy turnaround was really started again. So here the Germans have really invested a lot in the development of a renewable power system. But then they stopped halfway and drove the industry away again, left it in the lurch, started ten years ago and then went to Stuttgart. Usa certainly again another market. So completely, so in many things completely different. Of course larger market, therefore also simpler. But then there is still the federal system, a devastating energy infrastructure. There all solar up there do not need to meet at all. When there is a power outage in Germany. Power outage highly rare. As one of the safest countries in terms of energy supply in the world. So with us, we just don't have power outages. We simply have a good network. That's the way it is different. There. Very simple. Maybe the access to capital is a little bit easier than here. But I think that here in Germany we already have a pole position to show that hey, it works, because we have industry players here who can lead the way in the 1.5 degree mission. There is a lot of inventive spirit here. We just have to manage to put this inventive spirit into practice. And then you often ask, because we have this Leitz folder culture, which first forces us to fill out forms instead of rolling things out. So an incredible amount has been invented here in Germany, and then others have done it.

Caroline Schmid: Okay, but then it just thinks that it's the bureaucracy that you've already mentioned that you think that can be changed by the state especially so that then also just startups, but also hardware startups can get a foothold and can establish themselves.

I19: Yes, I think it works. I think so. So good startups, I think, also work in Europe. So look at Marvel Fusion... Yes, that's still virtually non-existent. And yet it's in Munich. Yes.
But it is still recommended in the USA. But they don't even exist yet. So fusion even with laser. And not in the next ten, 20 years 30 years. Yes. And as long as it was already there, you don't have to wait for the miracle technology, you just have to roll it out. And that's easy, it's feasible. We can do it, it's cheap, it's mature, we just have to execute it, and we can't do that in Germany. We can invent a lot. We can think a lot, but unfortunately we can't do it at the moment. If I dent out and. And then the startups also go where you can roll out. And there is then maybe USA or wherever and not Germany. I can already imagine that.

Caroline Schmid: But so you think that also has something to do with the ticket size? How much bigger is the one in the USA and Contracts? So I mean in Europe everything is also very very very fragmented in terms of that and that you just can't get there so well. Or quickly get a lot of capital.

I19: That has become much better in Germany in the last ten years. And of course it's also easier again. Our market map speaks for the USA, of course. English-speaking, of course. But we also have a lot of engineering expertise. That's still quite a large market. There is a lot of work to be done, especially in the small-technology sector. And I don't think we have to hide behind that.

Europe must stop dithering when it comes to the climate. If there's one thing we can do, it's climate technology. And that's why we should strive to be the leading players in this field around the world.

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I20 and I21

Caroline Schmid: Okay, maybe now to the first question. Let's jump in. And that is, where do you see that just in general. Where you see the greatest potential through investments in hardware and the deep tech areas in startups in Germany. And also the greatest potential for society in Germany.

I21: Well, I think that when we talk about innovations in the deep tech hardware area, where we consider what are the major issues that we currently have to solve as a society. I think climate change is clearly an issue, and then there are a few other issues. I think the current situation has of course made the whole participation sector more prominent than it was in the past. X can certainly talk about the topic of mobility, where a great deal of transformation is taking place. And from that point of view, there is certainly a whole portfolio of topics. We always have to think about where there is social relevance, so to speak, and what are the big issues that need to be solved? Space travel is certainly also a topic, and you very quickly come to the issues of what is based on national sovereignty or where do we as Germany and Europe want to play a role? And if we now look at the whole energy sector or climate change. I think that's where you have to think about when it comes to what role Germany can play. We account for 2% of global emissions, we are 1% of the world's population.

I21: That means the biggest impact we can have is to develop globally scalable technology, much more than behavioral patterns. And of course, that's also an important topic. But in the end, that's what it's all about, globally. So if we want to have an impact on the world's climate, it's about globally scalable technologies. And of course, many of the new technologies that are needed to produce CO2-free, clean, safe electricity are perhaps not even known today, and in this area in particular they are often hardware solutions, because that means that one is quickly told that it is not a software solution. Any new technology has to produce energy. That means that we are then very, very quickly in the hardware area. For the most part, these are probably solutions that we do not yet know today. In other words, topics that in individual cases have long development periods of 5 to 10 years, but in the end can have a really big impact and great leverage.

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I20: Exactly? Well, I had also thought about five areas. The first area is mobility, i.e. the whole transformation to electric driving, where you have battery technology very much in the background, where you are working on solid state batteries and also don't yet know exactly what chemical composition will actually lead to the battery in the end with which you can drive 700,800 kilometers? And more importantly, with which one? And that also addresses a tricky point with regard to national currency. With which composition of materials can you position yourself as a state as autonomously as possible in order to ramp up this sector? That's a big issue, and then there's also the issue of urban mobility in this area. I believe, and there I now close in my own foot, that it is not now totally change the world and that is perhaps not even what we need in the core. I think mobility electrification is one point, the other point is advanced mobility and then you can think about something like that. But the focus should be on electrification of core mobility solutions first. And the second point I see is in the meantime.

We see, if we look globally at the market and I'm now specifically going into hardware topics, because also in Asia there are companies where you go quite strongly into the scaling of artificially produced mid. And also then you need the 234 100 million, even though you might not even know yet if you want as money actually the price of. But that's also a big market where we see blue card investing, for example, where you need significant investments relatively early on, but the impact is just going to be sustainable and particularly large. The third point is Space and Defense, where you have players in Germany, such as Isa Aerospace, who are now also reaching a point where you are moving out of the venture area in terms of financing and are entering the growth area, so to speak. And of course there is now. I read through this briefly before, this European Tech Champions Fund with, there was a nice phrase with late stage growth investments, where I then ask myself Well, growth is also a very important point from my point of view.
Topic it is a fund in fund investment. B is also deep and relatively clear in there. Late Stage Growth Investment Growth vestment is I have my Uber business model and I'm now building Berlin. That worked in L.A. And I now need 5 million at some point to acquire the drivers in Berlin and then I scale it up and slam the app on top. But that doesn't work for aerospace. You have to bring in scaling, production needs collateral to build something like that, and we don't actually have that. The fourth point is biotech. And then I come to energy and fusion biotech - you also have the problem that you have a large funnel in the area of cancer treatment in the area of vaccinations, where you have any number of possible solutions at the beginning, but you have to go through the studies to actually identify the solution at the end. The market is arbitrarily large. We're talking trillions of markets in some cases. The question is, who accepts the high risk given the reward And then there are no investment vehicles and very few investors like Atos, for example, who are willing to take such a risk. And the last point is fusion. And I had already addressed this in part, but it also hits the point again here We have to set it up as a state somewhere as independent and sustainable as possible. We have to make sure that we keep our industry here with good energy prices, and that we don't just think in terms of legislative periods of four to eight years. We have to think in terms of ten or 15 years. And that requires big investments. Today, to actually be there in 15 years means you have this mismatch that governments today have to bear the risk for the report from other governments. And that to me is a big point where we just have to grow much more on our mindset and on innovation to just create pockets for that.

I21: But I think you have to think about what are the major social issues that we have? And then, of course, a topic like nutrition, topics like health and so on, that is simply also a growing world population, which is also still increasing in prosperity and where we can not assume that we can feed with the way we have fed ourselves, in the future 10 billion people, who all also still with a certain requirement, then also perhaps develop a diet, etc.. And in addition to Plan B, there are of course also exciting things like insects, proteins and stories like that. So I think it's all possible. So I think if you listen to it on all levels, once there is this issue, a growing, growing, aging, but also getting richer world population that has certain demands on nutrition, health and so on. Then there are quite a few issues that fall so within the realm of national sovereignty. So I think it's scary when we don't have the means to launch satellites into space ourselves, etc., and are dependent on someone, somewhere being able to turn off the Internet. If you think about how it works today, there is no communication with anyone in this country and that we don't have our own capacities if we don't have companies like aerospace and so on in the future to shoot satellites into the air, for example. Also the topic of defense I think just plays a whole new role there with the batteries. It's a similar topic. So on the one hand there will not be enough lithium probably in the world and on the other hand we don't have it. So here also a separate opportunity. So I think as a second big issue is I think this over quality

issue. And I think climate change is probably a third topic, where we are a bit at the interface between national sovereignty in energy production with position, but also basically the topic, where does the whole, the whole energy of the future actually come from? And it is precisely in this area that you can probably always pull up so many overriding trends.

I20: But that's a totally exciting point, because there are elements where you have national sovereignty combined with global demand, you have that with energy, you have that with food, certainly, and you have the element where you almost exclusively rely on national sovereignty, like space, for example, where you say okay, as a country I also have to be able to shoot up my satellites. We have to support the one player here now. With X, you have more of a combination, I think. And also with Nutrition you have more of a combination, because of course you would then produce your artificial meth not only for Germany, but mainly also globally. Yes, exciting.

Caroline Schmid: I mean, you already mentioned what doesn't work so well, but what do they think so what actually works well for start ups or just specifically for deep tech startups what for example how they have any vehicles there.

I20: I think there is. Me. I'm hearing this from the funding form first. Trying to start structuring. You have on one side equity classic equity where you have funds set up by the state or pseudo state funds. That's where I see the Deep Tech Climate Fund. There I see EYC, there I see HTGF as a quasi fund of funds from DTCF and that I also for example Coparion. Then there is quasi for me. Please don't put that verbatim in the text now. Equity investments where the state does not want to take any active, any active responsibility. In my view, these are fund-in-fund investments. I think that's where The European Champions Centers comes in. But there are also these KfW tranches, so to speak, where Wesquared and others, for example, have had large parts of their funds co-financed. There is project financing, that was Sprint for me, other income, that would be this classic research grant. And what I actually find most exciting are these venture growth financing loans from KfW, which also have high volumes of up to 125 million. So, let's start from the top down with equity. The Climate Fund has nothing to do with deep tech, so please don't include that either. But the problem there is that you always try, wherever you have to make your own decisions about your own vehicles, you take the part that it is more growth financing, it means more derisk, and in this way you take the decision out of making deep tech investments. I think that completely misses the point when we talk about the vehicles that we initially discussed, Mobility Energy, Space and Defense, Nutrition, Biotech. There will be, there will be probably hardly any match on these funds. From my point of view, a very strong mismatch. I also see quantum computing there. HTGF has made a couple of QuantumComputing Investmentinvest, but very small, that there a Terra Quantum and the larger players will not help. EYC Parfinder program is very much oriented to Technology Readiness Level. There is the Accelerator after that. Parfinder is TRL 2 or 3, that's where you get from the two and a half million. It's kind of nice when you get to write EYC on your cap table, but in reality it doesn't get you very far and only costs you time when you could get five or 10 million from someone else. That's my view on direct equity investments. Fund in fund I think there are good approaches. I think Early Bird has a fund where KfW is also invested and wesquared. The problem here is that the funds per se are too small. So if you look at a wesqaured or earlybird, there you have funds in one volume. They can do a series A and B, they can also invest a maximum of 30 million. But if you think about space biotech, nutrition and energy, you are very quickly in areas where you simply need sums of 150-200 million. In fact, you will only find them in the Middle East. You will find them in the Nordic area, in Norway, Sweden and the USA, but not here. Also in China and also in Japan, but factually not here. Then the

second point Sprint is, I think, an excellent idea. I'm a big fan of the concept. The issue is just that there you just finance it through pact companies and outsource it and then you can buy it back, which still makes it very nice. But one would actually prefer to leave it in-house in the company. I think that's the only point that puts Sprint at a slight disadvantage. In terms of other amounts, you have research allowance. That's capped at 1 million unfortunately. I can submit 4, get 25% back. If you look globally, the UK has just gone the extra mile. The ones that have done that sort of uncapped have said okay, 20% uncapped. That's a unique competitive advantage and is actually pushing biotech companies, among others, to push their cancer research to the UK. And that's going to happen.

I21: Think about it, if you invest 100 million there, you get 20 million back. That means you need 100 million for the same thing, if you do something in a way that only 80% equity probably exactly the same thing in Germany must have 100 million equity. That's just it's a huge issue.

I20: Yes, insane. With growth financing, the problem is that KfW provides capital, but you then need a local bank, so to speak, to take over the guarantee or a state bank. To be honest, this is not really common practice. I've seen it with Volocopter, where the l Bank has taken over a guarantee for a loan, so that we got a loan for 20 25 million. But that is not really standardized and it is very, very difficult to get it. So it would be interesting to establish something like that there, too, because and that's one of the key points in the U.S. you see something like that when you think about the IRA issue. The core of the financing from the IRA in just these fusion start-ups is via loans, via very far-reaching loans that are paid back after x years. Where that collateral is effectively not necessary, that's borne directly by the government. If we had something like that, that would actually be a huge competitive advantage for us. The last point then I'm through. What I find relatively nice are also these harmonized programs where you have this deal incentive compatibility. There are programs at DOE where you have quasi DOE Department of Energy in the U.S. where you get quasi funding across different milestones. And we honestly have the same thing in France. There is the BPI program for nuclear reactors, where you apply to State without. You have clear milestones, then you get them on TU and three, you have rough clarity on what funding you're going to get there, and we just don't have that. These structured Germany 2030 programs, where do we actually want to move as a country? What are the verticals that we need to promote? And these are the pockets for that. Something like that would be incredibly good to make us independent of the next four years, so to speak, and simply to think more long-term as a country.

I21: Maybe I would get in once even. So both such the DOE program as well as the in USA as well as research in England as well as the program in France are always milestones. Or except for the research situation that are not even above the others. Milestones basedand are always co-investments so to speak. What do I mean by that? You get 50% from the state, but you also have to give 50% yourself. This means that the state does not actually run the risk of investing in something. Just then 50 million, if someone private also gives another 50 million. And I think that's clear, don't you? The same research allowance gives me 20 million if I find someone private who gives me 80 million. That means, and I think this is the problem we often have in Germany with subsidies, that I give a little bit to all topics with the watering can, but that I don't incensify, that I get more money on a private side, so to speak, and also a program in France is like that, depending on which category you fall into. There is something between 30 and 70% from the state. In addition, in the program of the DOE, the milestone-based program now in our functional area then also about 50%. But I mean, I always have an incentive that I myself first have to find someone private who gives me money so that the state adds something.

I21: And I think that's actually a very, very good risk hedging, also from the state, that if someone has found someone private who gives 80 million and the state then adds 20 million, but you really promote innovation with it. Maybe. I found a picture what Albert Wenger had was me. It was a listing and it was related to the US. So in Germany is probably even worse, but I mean, that's what they do, you see my screen yes, so this capital by stage. I think that shows the gap quite well, in the early area there is quite good funding. In the course area there is quite good financing and in the mid capital area, there you have the big gap and in Germany it's even more glaring and that's quasi also climate related in the US. I can send you here from the study also gladly, but I think that is quasi the big problem, because if I start at the very beginning maybe newspaper a topic, what the X has not yet addressed I think simply because we said what works well.

I21: I think that the whole entrepreneurship in Munich etc. I would say that today at all universities there is actually, so to speak, this spin-off from the universities that is already very very good that has also improved extremely from the times that I imagined when I was at university at that time to today, that there are also with VCs that are closed to it etc. I think there are actually quite good instruments for perhaps times very very early stage also early stage deep tech to get follow-on financing. There are also, I would say, actually quite good funds also in Germany in the VC area. X has already mentioned with Early Bird, with Weswquare, but also Goliath and Planet A, with whom we are working here, who have the possibility, I would say, to go into the early stage topics. So I actually see in Germany for an early stage topic, if it also has impact and has a good story etc., I actually see the quite good, also private capital providers, structure and state instruments. So right at the beginning, starting with export promotion up to the things. But then comes just the problem that most funds are themselves.

I21: The big funds are 100 million funds or 150 million, giant funds by German standards, and we have to think about that. For us, it would be a Series B, so to speak, in the size that is a fund and of the funds in Germany, yes, of which we have it. That's the huge problem that you don't really have any instruments in the area where revenue generation is still a long way off, but you have capital requirements in the triple-digit million range. And also what Niko just mentioned with this European Tech Champions Initiative, the new fund of funds, they couldn't invest in Planet A, for example, because they only invest in funds that are over 500 million in size. And if you look at Europe now, how many funds there are that cost over 500 million, there are maybe 123 funds that are over 500 million in total, and from that point of view, the money doesn't get back to where it needs to be. I think it's good right at the front, so it's really a good environment, and I think a lot has been done in Germany with all the spin-offs.

I21: Right up front is actually good yes a good university too so if it comes out something university there I can good good current accelerator programs etc. good good structures also private capital providers so with early stage and business angels and blablabla. I think that's all. Already totally a lot has happened in the last ten years in Germany. Out the back. Well, if I look at the Germans, who are, unfortunately can make. But if we now have a good idea, which we are about to review generation, then you can get maybe US funds also purely and so and in the middle has such a huge gap.

I20: That you also have to briefly clarify the implications of this. So at the moment when I have early, mid and growth, there are now two tendencies. I think one tendency is, I mean the VCs also see that you are generally looking for startups that go directly from Early to Growth, meaning after Early they are validated and can raise Growth Capital, that they can then talk to the Equity Growth Guys and whoever and directly or DBS and then directly get the 150 200

million so to speak. But just the companies that they go classically from early to mid to growth and that actually need 8 to 10 15 years to go this way. They are already faced with the question of whether to do it in Germany or somewhere else. And if I do it in Germany, I might only do it up to a certain point and then have to look around. And that's the point, especially if my business model doesn't directly concern the topic of national sovereignty or or. That somehow very, very focused, but ICE Aerospace I can honestly imagine little that they now say boom, I go to the U.S., because there is a very, very clear raison d'être of those in Germany and Europe as a quasi launching vehicle for satellites but for us, for example, which are relatively open, whether we do it now from the U.S. or here, we will be relatively free is already, I think. Again, a very, very different point.

Caroline Schmid: We always show that to our interview partners. Right here. Exactly these are also these stages. We, that's now six stages here and maybe just briefly for the interview. Can you briefly say where you are with X? And then just briefly touch on exactly where you see the greatest difficulties with financing.

I20: I don't know if the phases are a fair fit on deep tech really. So actually not fair way at all. So identifyin technology is, you guys important. And then especially the topic Technology Validation and the topic with Technology Validation, First Pilot would have to be sort of five times the size of the arrow than all the others. And then topic is first Commercial Contracts okay, there you can say that actually. With that you can actually, if you have exactly the topic First Commercial Contracts that has also made this ISA Aerospace and so then at some point at the point and also like Lilium where quasi a technology is mature enough that it can go to market at some point and from that point that fits. But then and the topic was then early commercial ization and scale up, so that out the back, that's all actually so a bit then the fair is what read if you front but this topic we are also in the area of Technology Validation First Pilot but that would have to break down almost even more either but that is virtually the big fat chunk.

I20: Venture debt I would see much further down the road, that comes that I know my venture debt now structures where you pay that back over six years, there you kind of just have liquidity stretch and pay an interest on top of that which is often in the 8% to 12% range if not higher.

I20: Maybe two more things that stand out to me here. I think the issue of institutional investor is a high networth individuals are also issues when I think about issues like fusion and for example certainly space and biotech, so three, I would say, among the five that we mentioned, mobility, energy, space nutrition and biotech. I would say Energyspace and Biotech are highly emotional, globally extremely relevant topics that are emotionalizing. And with those kinds of things, you see very strongly high net worth individuals much earlier, if not at the very beginning. If you think about Bill Gates, Break through Energy Ventures and think about Bezos. Bezos Expeditions in Germany? The Susanne Klatten in Germany, the Ströngmann brothers, you usually see them relatively far ahead in the process. Institutional investors, here I would see for example a GAC, a Tim Masek. He also goes into the area that he looks at technology validation. So here, too, you see in part, especially with the Singapore State Funds, but also, for example, in Canada, also, for example, in the Middle East, that they tend to move to the left. How strongly do you stay on this topic? Early Commercialization One big thing that is really important in the core is the topic of Technology Validation, because depending on the product, depending on the vertical, for example biotech or energy, you already have very, very large sums in Technology Validation, so that CVenture Capital and Traditional Venture Capital

Funds are no longer relevant, because you have them in part much, much earlier. I would. So I would probably rearrange the whole chart a little bit.

I21: Okay, can you move away? I just wanted to say, I think the core issue is that something like that that you just laid out like that probably fits for someone like Enpal or or terraforming or something stop. But that's not deep techl to me. They're just kind of heat pumps, solar cells and so forth that just an existing product. It's really just about a revolution in the business model, namely that it's not just installed by a craftsman, by an app around the corner, but that someone has taken a look at Global in Germany. How can I then build up a supply chain? How can I build up a network of craftsmen, etc.? And that's important and that's what we need, because we're not going to get that somehow fast enough, the electric heat pumps into the houses and the solar panels onto the roof, etc. That's not the technology. Now it is at the moment so just really that a new technology is developed, a new technology is developed just always have this five years or whatever technology validation in it. And there you have with, as the indifferent province have called, there I actually see the topic of product market fit as such a topic at the beginning. So if someone manages to produce fusion energy or if someone manages to shoot satellites into space or if someone manages to develop a new cancer drug or to breed a form of meat, then they always have to hit a certain price point. Is there a market for that or not? That is, that comes also clearly later, where we must consider, what is your good to market model, thus opposite this large Contracts with somehow comes also such a topic again into the play comes the state somehow as Anchor customer in, as we see it from the USA, with which I myself and others saw. But there you have just above all this issue. Can I get the technology implemented at all? That's the bottom line for investors. That's a very, very big zero one risk in the tech companies. So I get the technology implemented and as soon as I have the green hook on it, then everything else is actually back. And there's the question of who dares to take that risk. And then the agency for leapfrog innovations in Germany should probably be the best instrument we have, but which is not yet equipped with the financial resources it should have and also currently still has a very difficult regulatory environment. For the past year and a half, efforts have been made with the Exemption Act to release large-scale industry and allow it to really get going on the market. I think that was important, but the question is really who dares to carry this zero-one risk in deep tech ventures? And that's where a lot of these high networks come in individually in the world and big institutions come in. And we have far fewer of those in Germany.

Caroline Schmid: Yes, exactly, that was also another question. If you now go more to the reasons, because we have also found, it is often mentioned that the investors or have too little knowledge and just then also from having too little knowledge, then comes the risk aversion, because they then think so, okay, then we prefer to go to software, because there is so a bit more, less risky and just also more knowledge. Can you agree with that? That this is also a problem, that there is a lack of knowledge.

I21: Of course, knowledge is an issue. Because it's just not something where you can say, okay, I've seen exactly this business model 15 times, but like you might have an e-commerce or have in similar places. Yes, so from that certainly the theme in deep tech themes, so exactly the theme or reputation theme is one. But I think much more than that, because in the end, you probably can't even break down and understand such topics to the last bit.It's really about the risk profile and the risk appetite. And who is willing about the deep tech topic and I mean really very comparable like with us like with the biotechnology topic where you can say somehow every further study is just, if it's successful, then great, then the probability increases that in the end also a drug comes on the market. The experiment, which is successful, increases the

probability that in the end our complete, somehow complete physics works. Because I think there's always the question, so who's willing to take that form of risk? If you have a funnel over time and the probability increases more and more, you have a technical risk. And who, who can bear that? And there you have, as you said, perhaps in the U.S. much more the issue of high net worth individuals or ultra high net worth individuals and the issue of pension funds.

I20: I also think it's more of a mindset problem, but I think you can see that. I mean, it runs through from the top down. I think if we were much more encouraged from the government side to also take more risk, to bear risk. Not only on the venture capital side, but also on the side of private individuals, then things could be turned around for the better. I think I already see very good tendencies. I mean, if you think about Lakestar and Earlybird, what the last few years have actually done for investments in IS Aerospace in Terraquantum, in Marvelfusion. You kind of see this clear, stronger hardware drive. And I would also mention Lukasz Kotowski, who is certainly not as present as maybe Lake Star or Earlybird, but he is certainly the largest hardware investor, I think, in Germany with all the merger investments that he has made.

I20: Something is changing, which is very good. What I think would be relevant at the core is that we. That we start. And you see that in Canada, you see that in other countries. The big asset managers. If you think from a pure portfolio perspective, CAPM asset pricing model, there are different asset classes and optimally you mix them all together. You also have a share of alternatives to optimize your return, your risk profile accordingly. Alternative investments, equity also in the private environment, makes up a large part. The Canadians have understood that. Other countries have understood that, they haven't. Why don't we open the possibility for a MunichRe for an Allianz? The largest asset managers with 5% of their capital worldwide to invest in start ups? Why don't we do that with a KfW? Why aren't we doing this with our pension funds? Why are we running to Singapore? We as a rich country? And I believe that with this change of mindset, if we can manage that, if we can also build up institutional investors here in Germany, we can solve precisely this midgap.

I21: But it is further considered, since the topics where now are GAT etc. invested is if these and those have halt the possibility into such hardware Deep Tech also to invest in their successfully will halt the pensioner gets the pensioner in Singapore the money or gets the pensioner in Canada the money, but not the German pensioner and the German pensioner has. So we also have a huge problem somehow with the financing of our pension funds, somehow. From 2030, there are various calculations, that should not work at all so. And to say, hey, you also open up the pension funds and allow them at least a certain part of it. So don't talk about it, the whole money of the poor German pensioner is now invested in fusion energy. But as Nico says, that one would say hey, 5% of it they may also invest in such topics, then I think that would be a very very exciting topic. Or I would say a topic that we unfortunately see again and again. And you can send a study from Dexter. If you look at the deep tech topics in the front, in terms of basic research, etc., unpar with the U.S., if you look at the issue of commercialization is always in a gap of over 1:8 exists between Germany and the U.S. and that of course then again with me the successful founders from the field and where again in the U.S. are who can then reinvest in the ecosystem and so Bill Gates, Jeff Bezos, etc..

I21: Just as a few examples, because of course there was also of course at Google, Microsoft, PayPal and all of those clearly more than one founder, who in the end or also at least the subjects, who have looted or earned money in the end, which they can then reinvest again. And there we have just in Germany a Lukas Gadowski and we have collected perhaps still a certain

share also or however and then, then it becomes just very, very fast very, very narrow and they make just less in the area and however that becomes just very, very fast very very narrow and we have just unfortunately here at the moment also not the Ecosystem, which I would say we now have hundreds of these people who then invest in the ecosystem again or if we leave it as we are currently doing, it will lead to many companies migrating from Germany to the U.S. for the commercialization of deep tech in particular, where they may also end up. In the end, Medium went public in the U.S., not in Germany, and in the end, perhaps all the companies with founders in the U.S. are more likely to reinvest in the ecosystem there than in Germany. And I think that's a reinforcing cycle in addition to the Mainz problem.

Caroline Schmid: Perfect. Thank you. Okay, just for a second. So, but then you also see that the state can also act as a key player. And what would you guys say from the regulatory perspective, how the state could optimize more there?

I21: Well, I think one thing has been said, of course, that the state as an anchor customer is a very big issue, I think, because of course, after a certain maturity, it also involves a risk. So when the state says, I think the first 100 rocket launches from ISA Aerospace or I'll buy X aircraft from Medium or I'll buy the first five power plants from X, you know that the first five or the first 100 can't usually be offered at competitive prices in the end. I say three years before commercialization, whether I am the first X product or the state as an anchor customer, I think an important point. Then we have to look at the regulators, I think the most important regulator that has to change at the moment is really this Sprint Exemption Act, because at the moment they are only allowed to invest in 100 percent subsidiaries of the federal government and that makes everything incredibly complicated. So to give them a possibility to make direct investments in companies via the agency for leapfrog innovations, then I would also see, especially in the UK they are quite good, that we also form such clusters. So there is a functional area of the fusion cluster, in which a public-private partnership between universities, companies and other institutions are tied together. So taking on a role like that, saying I'm also bringing together an ecosystem by providing space and professional management. White papers on regulations and so on are commissioned there. These are topics where the state can also say that I have a role to play. And I just think, because I said at the beginning, so basically much more the thought not, I make somewhere a funding pot and someone can apply from a funding pot, but much more to say, I provide instruments where I give milestone based on the achievement of certain milestones money to a private investment, because I always incentivize that primarily the money first comes from a private source and I can also give the topic due diligence, etc. to a private investor and on the other hand always incentivize that quasi is invested. And in turn, investments also lead to tax revenues, etc. So we can continue to close the loop and I have the milestone based on a possibility of course also to see how I just bet on right little horses or not.

Caroline Schmid: So that would also be a bit of a blended finance approach?

Caroline Schmid: So the combination of private capital. But then also, for example, projects with the state. But what first, which actually wants to attract private capital and the state then invests with?

I20: Yes, exactly. I think about the topic of regulatory rules all the time. Regulatory rules in the context of financing. I think we have already made that point. With regulators in terms of asset managers, that you would have to open that up as well. The point then is regulatory in the sense of: How much can the government go into the customer role, so to speak? X has made that point. Regulatory in the sense of: How much can the state intensify? So quasi state banks that

can take over the risk, so to speak? That could also be a point. Yes, regulatory in the sense of yes, I think that's an essential issue. Everything else is. It's so technical. I think you could also look at the whole issue in terms of doing financing rounds, all the notary wrangling. I know it's much easier in the U.S. and here you need from signing, which is already a huge effort, to prepare that with all the separate documents to closing sometimes months because the commercial register still goes wild at will. You could make the whole process so simple, but we make it so complex for us because, in fact, we don't want to revolutionize the sector, change it, adapt it, because that often costs jobs. I think that everything is somehow still far, far too inefficient when it also falls under ecological regulations.

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Interview with I22

Olivia Suchy: I'd like to start off by asking if you've noticed this challenge as well, so far, that there's a funding gap. And if so, maybe you can give me a little bit of background on that.

I22: So we are deep tech startup. We're not really in climate or anything, but we're developing so space travel and for the first time in the world. So we don't have propellent, which is a propulsion system that is much greener than the other operating systems. And I think that's a difference, of course. We haven't really had any digestion issues, we just have a couple of pages like that. So we communicated two weeks before that we shot the biggest spectacular series, so breasts in Europe for about 40 million. That was hard to fundraise that to, that's very clear. And also the. Nowadays the VC are very, very, very careful. So I think my learning and I think it's possibly for other areas, so other startups, such a climate, so the question for us was really what the Risk Reward Profile for VC for example from our side. In the beginning, the plan was just ten, 15 minutes together and then I did some informal conversations and got feedback. Okay, what are you going to do with ten, 15 million? And I was a little bit yes, but not super big milestones, that is Risk Reward Profiles were not so good for a VC. Because the risk are very high at the beginning of the stage. But the result is not about super tangible. So the values of companies super high . And that was a little bit so to say not so natural. So that not but what we have decided or what I have proposed to my word we are not going to raise ten million, we are going to raise 22 million, so about like double our target there, then we can really go to end 24 and then have a launch of our second prototype. And then the risk reward is completely different. That is, there's always the risk, yes, but then the surge from our company if we do that successfully. That goes super, super high and we have we raised 40 million. So, I believe it. I'm not sure,there is a funding gap. It's clear that in Europe, if I do this in the United States. We don't have a good understanding of the market. We are not visionary enough. For example, in the United States. Most of the questions I got. how do you scale? Here is the question I get What is your market? All these people are old fashioned. Here, don't understand the future. I do not know why. Something different in the same city. So special. So, I think that's a problem. That is, we need to make much, much more effort and really explain to the market, also give examples in the United States, but that's really, really the right direction. That's coming. And then we may have to work on the risk profile so that we don't go to VC with give me 5 million. There's incremental improvement, but give me, give me more. And then people, okay, I'll give you more and okay, if you go broke. And if you're not educated, okay, that's potentially two, two things, billion companies. And it's worth taking that risk.
Olivia Suchy: That is, you would say that risk aversion is a problem in Europe from investors. The mentality.

I22: So investors. I would say you don't understand the market as not as good as in the United States. So I'm just speaking for space. Yes, but that's really my experience here. People they not visionary in your opinion and also don't have the technical knowledge, for example in the United States there are many people who have worked in space, and then you ask the right question, they ask the right question, and you know the field. And then we can really take a technical decision. And I think possibly, a climate is also a lot about technical. And if you're just a generalist or you've worked a little bit with McKinsey and then a little bit of general things, what can he do? And then he he goes to the expert. But we know the experts. If someone really have worked ten years in the field and have worked 15 years field and now doing VC, that's something completely different. And if I'm the VC profile for example V6 or even not, then but like or Kushner Ventures these are people who really work in this field have not all but when we talk DT or even climate they really have their technical and then that helps to be super visionary and understand that what's coming in the future. That you can also understand the small signals will this small signals create the whole industry a disruption or not? And here in Europe are considered more rich generalist who work with experts. And that is not the same knowledge. I think that's maybe why the VC don't want to take like so much risk because they just understand the area is not so good. And that's more for VC and for us entrepreneur. I think maybe we need to be our mission more in the shoes of VC and adapt our business plan so that the right profile can also have a match with the risk profile of VC and for example on our case we have. I have completely rebuilt the whole sum the business plan because I could not fundraise 10 million in this environment in this economic situation and if I would not have done that I think we will not have had such a success.

Olivia Suchy: It's good, great, I understand everything. Congratulations also on the huge fundraising. I'm happy to hear that it worked out. It's interesting to hear that there would be changes from startups side, because it's VC right now the way it works, the right tool for funding such projects that need a lot of capex at the beginning.

I22: So, what else is there? There is Loan. But Wage has to be Reinversed. I think what is missing for Loan? For example the EIB makes super Loan, is very very low rates and also the investment funds of the capital. That comes ih for example six years or eight years or so, but that's only if you already have some turnover and I think that's not adapted to DT area, because in design the turnover comes after five six sometimes seven years. Uh, and so I think for deep tech, institutions like KfW in Germany or EIB in Europe would have to have different criteria. And one of the biggest criteria is the risks already relatively low. And from pulling if a team says okay, I'll do this in two years, that comes the two years or if the two years get five, five or four years, those are just okay. Team has no credit. Now if there are 20 25% delays, okay, that's kind of normal in our business. And I was always Surprised how startup that just don't deliver anything, again for example, VC get money and money and money. Loan is a super tool, but the problem for Loan for us is that we have to make in the pay so back so reinvestment. And if it comes too early, we just don't have revenue. So it would be super if it was the possibility to have for example KfW the possibility to have a guarantee. So that we can have loan. There is also guarantee, for example of the installation hardware. We see Deep tech, that means there are also real things that maybe can also be a guarantee. And then there is a little bit more. A little bit more, a little bit more time to pay the capital. And also that also for startup that are for example very young. We are 18 months old. After one year we were on track. And that is also a signal. That's okay. We don't have revenue right now, but that means the team can deliver, right? And I that's why I'm talking about other indicator also because revenue will not we may not have for next four years. Yes.

Olivia Suchy: Okay. Interesting. Yeah, okay. So, that is, these tools can theoretically be adapted, improved.

I22: Yes, exactly.

Olivia Suchy: Okay. And I have a slide. Now, after your stage, after your fundraising stage, what stage are you in right now?

I22: Okay. In Technology Validation. First Pilot.

Olivia Suchy: Okay. And where do you anticipate the most difficulty with fundraising?

I22: That's really our staffing situation. We have something like 40 million. As I said. And that brings us to the launch of our second prototypes. We're going to launch the first prototype this year, so aerospace. Then we'll do a second prototype at the end of 24. That's super big in principle. That doesn't mean we don't have risk for the technical side. But that's really what it means to say the risk are? I would say 50% less. And that also shows super clear, the capacity of the team. And if we can do that. I think will be possibly even in the fastest space company in the world. And I think we will have no problem after that to collect a big 100 million or so. If we can't do that and for example I think also interesting for them, because in our industry a little mistake. Someone who makes software code or a bolt so is not perfect or does not know that we lose the whole mission completely. Yeah, So that means 40 million. Shit. No more. And then they come. And when things like that happen and that happens? That's quite normal in our field. Space travel. Super. Small mistake can create whole disaster. That's just one person ten years and billions can completely break. But this is also the truth for other industry also in climate. So you can make such a for example big machine is happy to break down and anyway only for a two people in the US and. That's honestly also for this a problem because then the investors. I guess but I have a big difficulty understanding that. I'll give you an example. Spacex has three times that rocket was broken three times. So three three failures. And after the third failure NASA has given a contract of about $500 million spacex. NASA saw. These are great engineers. But the big system of technology that is developed, that's great. And one is sure that these people will solve the problem. Because that wasn't a super big design problem, right? This was super small stuff. And I think if for example the state special in energy for example says okay, there's been a mistake gone, but the technology is sound and these people are sound. And so then he can give a contract in addition to the venture fund and it's super helpful because from the investor perspectives. That is, there are not only customers where customers who have so much confidence in the company that they have a contract. I'm in negotiation with a space agency right now. To create quite exactly such things to do. And they are super new. For example, space agency has never given a contract to a company that has not yet had a product. we have not made a mistake. But it is also a possibility. Yes, I think they too. And I think that's really the role of the state here. So to do such an audit with competent people, okay, is there a potential, the company, do we want to help companies really and then we can give to the companies an Early contract and it's super helpful. And I think that's also a leverage afterwards to get funding.

Olivia Suchy: Okay, okay, I understand. And talking about that, about the start up scene in general I don't know if you can even gauge that, but maybe you hear that from other start ups in the same industry. Where do they seem to have the biggest problems? To look away from Case specifically for a moment.

I22: So I, I, I know at the moment the, the number are Series C and so super hard it is also. That's also I think just nowadays because it was so hype in the companies because that's also a lot of money invested in clown startup is technology just not worth it. So, this startup exactly when Series C comes, no customer of technology will not, okay problem. But generally I think already for deep tech and climate has for me so a bit itself. Series A very hard but there is no customer from seed to Series A The technology development is limited. So what do you do with 5 million? Almost nothing. And then we have to invest again investors ten, 15 million and culture is also no product sold. Yeah I think that's really and I think I've seen that really where there's really a gap. There is another problem. No big ticket here in Europe. And then the United States comes and they invest a lot, a lot of money. And that's a super big problem especially in Series C, Series D. And here, I think the answer doesn't have to be German because there's also the same situation in France and Belgium, France was made with the BPI is a label to the venture fund so the Insurance and if you're interested I can also give you contact. Insurance like for example Allianz or AXA or so can take the money from the people who invested in the insurance, so have a part of that money to VC to invest in VC and the equivalent of KFZ makes an audit so to speak of the venture fund and says okay I KFZ I trust venture fund of ABC. And they get this label and that means these venture fund can go in to the insurance companies and say we have this label. They can give us money. And that was also super helpful to have growth venture lead. But I think that Germany is too small, France is too small. If we could have an initiative as a Europe level, for example. There is a Europe, we can be a EU company. For me, it's also super local. It's a KGB for Germany.

Olivia Suchy: Okay. So so a blended finance instrument for Europe. So such an instrument as the BPI has tried to do.

I22: For example. And that's not an instrument, that's, that's just a label.

Olivia Suchy: Okay.

I22: What is also important is that for the risk perspective, because the insurance companies, they also have a risk scorecard and you can not do everything with the money of people who have already invested in the field then it all. So this risk profile was also discussed with insurance and the credit institutions so with I don't know in Germany the Bundesbank discussed or so that if they, if the insurance companies get an audit, then the risk profile is also okay. If you have invested in this venture fund.

Olivia Suchy: Okay. And just briefly back to the point that Series A is probably the most difficult, so the Technology Improvement. That is, we're talking, if we look at this scale now, about the part, Right. So about that one. The light blue one.

I22: So, first pilot. I think it's really okay. For example, for our First Pilot, we're doing this year. Yeah, and we've already collected our Series A.

Olivia Suchy: Okay, all right. Thank you. I have one last question. Looking at the time. And that would be. Are there any suggestions as to what specifically the state could do? Any actions that could be taken to counteract this problem?

I22: Yes, so as I said, I think for growth VC this label and the insurance can also invest in VC stabilized]. So a measure second measure is really about contract would be consider. It's nothing to do with VC but that's so important and special in climate area. The government are big

customers usually.My recommendation would be how can the procurement rule of governance maybe be change a little bit so that even if the company has no experience, also has no product yet. There is the possibility of using tax barriers without taking the risk of giving a contract between companies. It also comes with contract with milestones contract which are super simple, so very very easy to choose out of the contract. So there is no really risk for tax payer money, but this procurement public procurement rules right now is completely not adapted for startup. Okay, and I think that's super important. I gave you this example of SpaceX. this contract is the reasons why SPACEX exists today. For Series A: that goes with knowledge of investors. I don't know if there is really a measure, but if I think if VC a little bit maybe more. I don't know what the state can do, honestly.

Olivia Suchy: But that's a good point. Absolutely. It's often mentioned as well.

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Interview with I23 and I24

The interviews focused on the current state of hardware-based clean-tech financing in Europe and aimed to address the potential backlog of development and propose possible solutions. The interviewees emphasized the importance of offtake agreements and strategic procurement programs in advancing the industry. However, they highlighted that the regulatory fragmentation in Europe has resulted in fewer investments, hindering commercialization and exits.

The interviewees stressed that venture capital funds play a crucial role in bridging the funding gap. They pointed out that capital needs to be more diversified to address the lack of HCS financing in Europe effectively. The questionnaire explored various aspects related to the hardware/cleantech industry, including its current state, potential financing backlog, reasons for a development lag, and measures to increase financing.

Regarding the current state of the hardware/cleantech industry in Europe, the interviewees discussed the significance of hardware and deeptech advancements for society. They also highlighted the importance of startup success in driving positive change. They further examined whether political measures were being taken in Europe and Germany to promote investment in promising technologies and accelerate commercialization.

The lack of capital and its main drivers were a central focus of the interviews. The hypothesis that insufficient capital exists in Europe, particularly between Technology Validation and Early Commercialization stages, was presented. The interviewees discussed the potential threats to startup success due to inadequate funding and compared hardware-based climate startup investments in Europe with global developments. They also identified the biggest challenges faced by such startups and capital providers in Europe.

The reasons for the lack of capital were explored, considering both cultural and systemic factors. The interviewees assessed the awareness and knowledge of capital providers regarding hardware/deeptech and evaluated the general conditions for investors and founders in the EU. They also provided insights into the mentality of investors toward hardware-based climate tech startups and the political awareness of these issues. The regulatory obstacles in Europe were discussed, along with suggestions for improvement. The interviewees shared their opinions on governmental support for hardware and cleantech initiatives.

In terms of possible support measures, the interviewees proposed concrete actions to close the financing gap in Europe. They discussed best practices that have contributed to the success of hardware-based climate tech startups and identified effective stakeholders in enabling funding for these startups. Drawing lessons from countries like the US and China, the interviewees highlighted the key success factors that Europe should adopt. Finally, they provided suggestions

for founders to enhance their attractiveness to investors during the growth phase and secure growth capital.
Overall, the interviews shed light on the lack of hardware-based clean-tech financing in Europe, analyzed the underlying challenges, and presented recommendations to address the funding gap and foster the growth of the industry.
Furthermore they gave specific examples regarding private FoFs funding, Zukunftsfonds in Germany etc.

10.5 Calculation Assumptions

The following is an explanation of the calculation assumptions used to measure the funding gap.

Rationale behind picking the geographies:

CA is known for being a global hub of technological innovation and the home of Silicon Valley. The region has a strong background in software but has also shown significant capabilities to innovate in hardware and climate tech. The state has a smaller GDP and less inhabitants than Germany but still benefits from the single market, with fewer regulatory boundaries and a more developed financing system.

On the other hand, the ND generate less than half of Germany's GDP but focus strongly on tackling climate change, leading to stronger regulatory frameworks and a successful scale-up of renewable energy. The countries have a strong purchasing power and can charge a climate premium for new technologies. However, they face issues that are common at the European level, such as the lack of a sophisticated stock exchange. Overall, after research beyond the interviews, CA and the ND appear to be viable benchmark geographies as they seem to have reached a greater level of maturity in the HCS sector.

Rationale behind the assumptions in Calculation 3:

Two assumptions were made. First, innovation is stated across all company types. The authors assume that innovation capabilities are not equally distributed among all companies, and startups have a greater potential for breakthrough innovations compared to corporates.

Second, the investment required is stated on a global scale. The authors must assume the share of Germany for innovation in HCS and assume responsibility by share of global GDP.

Assumption 1: How much startups can and must contribute to innovation? The interviews stated that corporates pursue too much incremental innovation. I.e Siemens Energy was pointed out to only pursue incremental innovation in established businesses “Siemens Energy ist eine Gasbude” (I14). Complementary, they saw the innovation capabilities for new breakthrough technologies in startups. Eventually getting integrated into corporate structures, profiting from experience to industrial scale ups. When searching literature for evidence the authors found Fontana 2022 investigating venture capital backed companies (start-ups) and their capabilities to innovate. As indicators served patents in the clean-energy space, namely generation & storage, changes to industrial production, and carbon capture & sequestration. The distinction made by the authors is between patents on incremental-, that often serve defensive purposes, and deeptech (breakthrough) innovation. Patents on breakthrough innovations are often directly based on fundamental research and become highly cited. These were growing disproportionally less compared to total patents. Of these corporates hold the majority and startups just 3%. However, the picture changes when focusing on breakthrough patents. Startups base their patents more often on fundamental research and are three to five times more likely to produce a highly cited patent. In contrast to corporates, their portfolios carry a greater proportion of deep tech than incremental patents. Referring to the International Energy Agency (IEA), an affiliated agency to the IREA and their 2050 net zero scenario. The authors attribute significant potential to startups and venture capital to produce the necessary breakthrough innovation. Here, the authors can observe the nested nature of the funding gap again. Even though startups seem to be an appropriate vehicle to achieve breakthroughs they do not receive sufficient funding. In return keeping the number of breakthrough patents down. Spiraling back to the 1.5-S of the IRENA the authors will assume, that the startup ecosystem should receive 30-60% of investment in innovation.

Assumption 2: To determine Germanies share of global investment, the natural choice is to account by the contribution to global GDP (3.7%). Still, it is arguable, that Germany has greater responsibility to innovate. First, the Ukraine war has increased pressure on Germany to transition away from fossil fuels. Second, the authors could observe a correlation between welfare in ND and the advancement in climate tech. Related deep technological advancements demand resources, like cutting-edge research institutions or individuals with the knowledge to scale complex industrial processes. Unfortunately, these preconditions are not distributed equally among the world. Hence, it is arguable, that Germany bears greater responsibility than its share of global GDP. For the calculations, the authors will assume a range from 3,7 to 7%.

10.6 Survey Questionary

The following shows the questions askes survey participants during the online survey.

1. Please enter your name.
2. Thank you for taking your time to answer this survey.

   Definition of hardware-based climate tech startups.

   A hardware-based climate tech startup (HCS) is an early-stage company that uses physical systems or devices combined with technology innovations to address the climate crisis.

   - HCS companies differ from conventional companies as they require high investments in the R&D phases, due to high CAPEX and large R&D staffing. They innovate through engineering or significant scientific developments.
   - HCS companies often face unique challenges, due to their technological and market uncertainty. Operating in a highly regulated environment, where the market potential is often unknown.
   - Examples of HCS companies are: Marvel Fusion, laser-driven fusion reactors. 2. Sunfire, electrolysers. 3. H2Green steel, first industrial scale hydrogen-based steel production plant.

   Answers are only going to be published on an aggregated level. Do you consent publication?

   A. I accept
   B. I don’t accept

3. Please rank the following challenges by the impact they have on the HCS funding-gap. Drag and drop to rank options.

   - Entrepreneurial skill gap in HCS teams
   - Lack of connection between research and commercialisation.
   - Lack of standardized and founder-friendly processes for university spin-offs.
   - Lack of offtake agreements to establish market for innovations.
   - Lack of strategic procurement programs that help create market for new technologies.
   - Lack of strategic direction and guidelines defined by the government.
   - Regulatory fragmentation of Europe single markets slows down investment flow, commercialisation and exit prospects.
   - Public financing instruments do not reach full potential.
   - Lack of technical knowledge and expertise in investment teams.
   - VC investment blueprint does not fit HCS.
   - Lack of risk-taking angel investors with high investment power and signaling capability.
   - Lack of institutional investment.
   - Lack of co-investment between public/private money
   - Underdeveloped private and independent fund-of-funds ecosystem
   - Venture Debt and alternative forms of capital remain underdeveloped in Europe
   - Lack of exit opportunities

4. Any further comments?

5. Please rank the following fields of action by priority.

Prioritise the fields of action by the impact they have on closing the funding gap for HCS.

- Align regulatory environment and perform smart capital allocation according to defined environmental strategy (eg., through strategic subsidy allocation).
- Mobilise/incentivise private capital (eg., through tax incentives for business angels, introduction of stock pension model)
- Establish procurement programs that help create market (eg., with public/private purchasing clubs)
- Strengthen and incentivise institutional investors to invest in VC/VD/FoF
- Strengthen collaboration and co-investment amongst players (eg., diversify investor knowledge)
- Create more favourable environment to produce spin-offs (eg., standardise spin-off regulations and terms for HCS).
- Increase use of capital alternatives for startups (eg., blended finance and venture debt)
- Establish good policy design & review (inclusive co-design with market participants)

6. Any further comments?

7. Now we are going more into depth. Please rank the following action items according to their importance.

- Define strategic direction and focus areas to help investment decisions
- Strategic subsidy allocation
- De-risk market through regulations/legislation
- Create advanced market commitment mechanisms
- Strategic procurement through public and public/private purchasing clubs
- Build knowledge hubs to concentrate IP
- Standardise IP terms and regulations for startups
- Promote publicly backed programs for long-term patient capital
- Keep on funding venture debt private funds with public institutional money
- Diversify investor knowledge
- Public funding to strengthen private fund-of-funds ecosystem
- Promote Investment Facilitation and Encourage Institutional Investors
- Inclusive co-design with wide range of market participants; beware of particular interest
- Regular independent, 3rd party review of effectiveness of policy framework
- Introduce stock pension model to provoke shift in mainstream
- Tax incentives for & public co-investment schemes with business angels.

8. Thank you for participating in this survey!