SHAPING THE FUTURE IS HARD

FOSTERING SUSTAINABLE TRANSFORMATION BY IMPROVING ACCESS TO FINANCE FOR HARDWARE-BASED CLIMATE TECH STARTUPS
THE TEAM
SHAPING THE FUTURE IS HARD

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**DEFINITION: HARDWARE-BASED CLIMATE-TECH STARTUP (1/2)**

**Hardware-based**
- Develop and implement complex hardware solutions
- Often supplemented by a software component
- Innovation driven by deep technical and scientific developments
- Require large-scale investments
- Often operating in industries such as: materials science, manufacturing, chemistry

**Climate-Tech**
- Wide range of innovations aiming to mitigate the effects of climate change or improve approaches to coping with consequences of global warming
- “Climate tech” is interpreted in different ways throughout literature but strongly connected to the terms “green tech” and “clean tech”
- Can be divided into subcategories such as: energy, agriculture & food, recycling & waste, manufacturing, transportation, buildings

**Start-Up**
- Founded by entrepreneurs
- Differ from conventional companies or SMEs
- Distinguished by the characteristic of “novelty and innovation”
- Are “new”, “active” and “independent”
- Intend organizational or technological progress which is scalable or replicable
- Business models focus on multidimensional growth
- Create novel goods or services based on innovation

Understanding of definitions was necessary to conduct the quantitative analysis

SHAPING THE FUTURE IS HARD
HCSs are early-stage companies driving innovation of physical systems to address the climate crisis. HCSs bear the potential to generate ground-breaking innovations in the most relevant technology but also encounter unique obstacles due to their distinctive features.

**Characteristics**

- **Market:** HCSs compete against established, non-sustainable players with often cost-effective and mature technologies in high volume markets. HCSs bring technologies to market internalizing negative externalities and therefore bear a green “premium”.

- **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.

**Prime Example**

- Eco-friendly energy source using laser-driven fusion, raised $25 Mio Series A
- Undertake complex and visionary hardware development and are exposed to significant technological and financial risk

Defining hardware-based climate-tech start-ups was necessary to give interviewees specific context in the interview analysis.
FUNDING GAP

- Problem first identified in 1931 in the UK by members of Macmillan Committee
- “Market Failure” describes a situation where market mechanisms fail to allocate resources efficiently
- Often described as the cause of the “Funding Gap” phenomena and “Valley of Death”
- It refers to the disparity between the demanded capital by a startup to achieve its financial goals and the supplied financing options
  - First Valley of Death: faced during lab development, demonstration and early commercialization during a phase of high technological risk
  - Second Valley of Death: lack funding as startups move from the initial revenue generation phase to the scale-up for widespread deployment

Information Asymmetries
- Present between the demand and supply sides of financing
- Cause substantial risk and leads to costly due diligence
- Greater level of complexity leads to increased asymmetries

Coordination Failures
- Arise when communication between parties is lacking
- Investors who aim to invest in projects that match their requirements for returns and risks cannot find suitable opportunities that need funding

Externalities
- Externalities, such as environmental sustainability and reduced emissions, may not be reflected in financial return
- Meaning that the undervaluation of natural resources can fuel an unwillingness for investors to fund

Case of HCSs: high technological risk, long development cycles, high capital expenditures and high uncertainty about exit opportunities

A proper understanding of the funding gap was crucial for conducting the quantitative analysis and for conducting interviews
### THREE QUESTIONS

1. Does a funding gap for HCSs exist in Germany?

2. If so, what factors contribute to the funding gap for HCSs in Germany?

3. If so, what are the potential solutions to solve this challenge?
METHODOLOGY
# Mixed Methods Approach

<table>
<thead>
<tr>
<th>1</th>
<th>Qualitative</th>
<th>Literature Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Qualitative</td>
<td>Interview Analysis</td>
</tr>
<tr>
<td>3</td>
<td>Quantitative</td>
<td>Follow-up Survey</td>
</tr>
<tr>
<td>4</td>
<td>Quantitative</td>
<td>Descriptive Analysis</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Interference of 1, 2, 3, 4</td>
</tr>
</tbody>
</table>

Shaping the Future is Hard
LITERATURE REVIEW

Methodology  Creswell (1999)

Databases  Scopus, Web of Science, Science Direct, Google Scholar

Keywords
- Funding Gap
- Finance Gap
- Financing Gap
- Valley of Death
- Hardware
- Green Tech
- Climate Tech
- Deep Tech
- Clean Tech
- Hard Tech

Initial Keyword Search (661)

- Titel Scan (526)
- Removing Duplicates (479)
- Abstract Scan (157)
- Full Text (120)

Total (88)
LITERATURE REVIEW

Review Process

| Database       | Query                                                                 | Hits  | Hits according to Document Type | Hits Title and Abstract Analysis, excluding Duplicates | Full Text Analysis |
|----------------|                                                                      |       |                                 |                                                        |                   |
| ScienceDirect  | ("startup" OR "startups" OR "start-up" OR "start-ups" OR "new venture" OR "new ventures") AND ("hardware" OR "deep tech" OR "deep technology") AND ("funding" OR "financing" OR "capital") | 245   | 219                             | 46                                                          | 25                |
|                | (Last Check: 13.03.2023)                                            |       |                                 |                                                        |                   |
| Scopus         | ("startup" OR "startups" OR "start-up" OR "start-ups" OR "new venture" OR "new ventures") AND ("hardware" OR "deep tech" OR "deep technology") AND ("funding" OR "financing" OR "capital") | 156   | 99                              | 30                                                          | 23                |
|                | (Last Check: 13.03.2023)                                            |       |                                 |                                                        |                   |
| Google Scholar | ("startup" OR "startups" OR "start-up" OR "start-ups" OR "new venture" OR "new ventures") AND ("hardware" OR "deep tech" OR "deep technology") AND ("funding" OR "financing" OR "capital") | 120   | 80 (Article)                    | 46                                                          | 12                |
|                | (Last Check: 13.03.2023)                                            |       |                                 |                                                        |                   |
| Web of science | ("startup" OR "startups" OR "start-up" OR "start-ups" OR "new venture" OR "new ventures") AND ("hardware" OR "deep tech" OR "deep technology") AND ("funding" OR "financing" OR "capital") | 140   | 128                             | 35                                                          | 28                |
|                | (Last Check: 28.03.2023)                                            |       |                                 |                                                        |                   |
**Interview Analysis**

**Goal**

“We want to find out if there is a funding gap for HCSs in Germany, the reasons that are responsible for a potential funding gap and measures that can be taken (by the government) to close the gap.”

**Interview Process**

<table>
<thead>
<tr>
<th>Data Collection</th>
<th>Interviews after brief literature research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampling Approach and Size</td>
<td>Sample of 24 interviewees (22 interviews) elected based on expertise, accessibility, and availability</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>Inductive coding approach using open, axial and selective coding (Creswell 2009)</td>
</tr>
</tbody>
</table>

**Interviewees**

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Public Sector (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CVC (2)</td>
</tr>
<tr>
<td></td>
<td>VC (5)</td>
</tr>
<tr>
<td></td>
<td>PE (1)</td>
</tr>
<tr>
<td></td>
<td>Startups (5)</td>
</tr>
<tr>
<td></td>
<td>FoF (2)</td>
</tr>
<tr>
<td></td>
<td>Venture Debt (1)</td>
</tr>
<tr>
<td></td>
<td>NGO (1)</td>
</tr>
<tr>
<td>Position</td>
<td>Head of Unit <em>Financial Instruments</em> at European Commission</td>
</tr>
<tr>
<td></td>
<td>Managing Partner CVC</td>
</tr>
<tr>
<td></td>
<td>CFO &amp; COO</td>
</tr>
</tbody>
</table>

**Interview Structure**

| Part 1 | The current state of the hardware/cleantech industry in Europe and Germany |
|        | Part 2 | A potential financing gap in Germany |
|        | Part 3 | The main reasons for a potential funding gap for HCSs in Germany |
|        | Part 4 | Measures to increase financing for HCSs Germany |

**Quantitative Information**

| Number of interviews | 22 |
| Number of interviewees | 24 |
| Average interview duration | 44 min |
| Number of open codes | 311 |
| Number of categories | 32 |
| Number of themes | 12 |
### INTERVIEW PARTNER

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stephanie Heller</td>
<td>Managing Partner</td>
<td>Bootstrap Europe SCsp</td>
</tr>
<tr>
<td>Stéphane Ouaki</td>
<td>Head of Unit for Financial Instruments</td>
<td>EU EIC Council</td>
</tr>
<tr>
<td>Matthias Koehler</td>
<td>Ministerial Director</td>
<td>Federal Ministry for Economic Affairs and Energy</td>
</tr>
<tr>
<td>Rafael Laguna de la Vera</td>
<td>Director</td>
<td>SPRIND Federal agency for disruptive innovation</td>
</tr>
<tr>
<td>Michael Jackson x</td>
<td>Venture Partner</td>
<td>Multiple Capital</td>
</tr>
<tr>
<td>Anne Lamp</td>
<td>Co-Founder &amp; CEO</td>
<td>Traceless</td>
</tr>
<tr>
<td>Thomas Lange</td>
<td>Senior Advisor</td>
<td>Achleitner Ventures</td>
</tr>
<tr>
<td>Sebastian Schütz</td>
<td>Head of Capital Market Strategy, financial market monitoring and Eurosystem asset valuation</td>
<td>Bundesbank</td>
</tr>
<tr>
<td>Max Wirsching</td>
<td>Head of Investor Relations</td>
<td>KfW Capital</td>
</tr>
<tr>
<td>Hannes Ring</td>
<td>Associate</td>
<td>Meridiam</td>
</tr>
<tr>
<td>Philipp Offenberg</td>
<td>Senior Manager Europe</td>
<td>Breakthrough Energy</td>
</tr>
<tr>
<td>Isabelle Canu</td>
<td>Partner</td>
<td>Green European Tech Fund</td>
</tr>
<tr>
<td>Markus Solibieda</td>
<td>Managing Director CVC</td>
<td>BASF</td>
</tr>
<tr>
<td>Sebastian Heitmann</td>
<td>Co-Founder</td>
<td>Extantia</td>
</tr>
<tr>
<td>Peter Jorgensen</td>
<td>Partner</td>
<td>Maersk Growth</td>
</tr>
<tr>
<td>Christoph Stresing</td>
<td>Managing Director</td>
<td>Federal Association of German Startups e.V.</td>
</tr>
<tr>
<td>Danijel Višević</td>
<td>Founding Partner</td>
<td>WorldFund</td>
</tr>
<tr>
<td>Maren Eckloff-Böhme</td>
<td>Founder &amp; CEO</td>
<td>Brightpoint Fund Services</td>
</tr>
<tr>
<td>Christoph Gründeringer</td>
<td>Chief Evangelist</td>
<td>Enpal</td>
</tr>
<tr>
<td>Nicolas Burkardt</td>
<td>CFO</td>
<td>Marvel Fusion</td>
</tr>
<tr>
<td>Heike Freund</td>
<td>COO</td>
<td>Marvel Fusion</td>
</tr>
<tr>
<td>Helene Huby</td>
<td>Co-Founder &amp; CEO</td>
<td>The Exploration Company</td>
</tr>
</tbody>
</table>
INTRO | FOUNDATION | RESEARCH QUESTIONS | METHODOLOGY | RQ1 | RQ2 | RQ3 | ANALYSIS | CONCLUSION

**INTERVIEW ANALYSIS**

<table>
<thead>
<tr>
<th>OPEN</th>
<th>AXIAL</th>
<th>SELECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Break down interview in codes that reflect the key themes and ideas in the data.</td>
<td>Re-examine and reorganize the codes retrieved during open coding to identify patterns and connections that emerge from the data.</td>
<td>Form categories with purpose is to identify central topics that unify multiple categories.</td>
</tr>
</tbody>
</table>

- There’s no strategic procurement that signalises commitment to investors and startups
- Insufficient pre-commercial procurement where the government buys a product before it even exists
- Regulations hinder innovative procurement (e.g., green cement)
- Compared internationally, procurement programs are more extensive and easily accessible
- Europe does not have procurement programs amongst gov. institutions and ministries
- Government fails to create market for innovative technologies
- Insufficient governmental focus on procurement and support of HCT
- Insufficient availability and size of contracts for HCSs to overcome VoD
- No customer base for HCSs

**Lack of strategic procurement programs**
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.

- The researchers presented the results to the interviewees using an online survey
- Interviewees were asked to rate the relevance of the challenges and solutions extracted from the interviews

| Survey Design | Online survey, included all 16 challenges and 16 solution proposals, along with a brief description of the terms |
| Response Type | Ranking scale, which required participants to rank lists of items by order of relevance |
| Pilot Test | Pre-test of the survey was conducted between April 24th and April 30th with three researchers and one VC investor |
| Sample Size | Non-probability convenience sampling method with sample size reduced to the experts who had participated in the interviews |
| Data Collection | Survey was conducted using the Typeform platform from May 1st to May 10th, 2023 |
| Data Analysis | The survey feedback was mapped with the interview responses and clustered to rank different types of recommendations |
Prędkiewicz (2012) remarks on the absence of studies: "there are no specific reliable methodologies to measure the extent of a funding gap". We have identified three pertinent examples, Mc Cahery et al. is as a current reference point, but later studies investigating novel sectors diverge.

- **Absolute Approach**: Exact demand-supply match
- **Relative Approach**: Estimate a relative gap compared to chosen benchmarks

<table>
<thead>
<tr>
<th>Name</th>
<th>The European capital markets study: Estimating the financing gaps of SMEs.</th>
<th>Financing innovation in clean and sustainable mobility. Study on access to finance for the innovative road transport sector.</th>
<th>Artificial intelligence, blockchain and the future of Europe: How disruptive technologies create opportunities for a green and digital economy.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authors</td>
<td>Mc Cahery et al.</td>
<td>Concini</td>
<td>Verbeek and Lundqvist</td>
</tr>
<tr>
<td>Approach</td>
<td>In-depth calculation of the absolute supply and demand match over all SMEs</td>
<td>Calculation of the funding gap with a relative approach</td>
<td>Calculation of the funding gap with a relative approach</td>
</tr>
</tbody>
</table>

We adopt the **third approach** because, because we lack detailed data specific to the new sector. Specifically, we do not have the necessary granularity to estimate supply and demand through a bottom-up analysis.
INTRO | FOUNDATION | RESEARCH QUESTIONS | METHODOLOGY | RQ1 | RQ2 | RQ3 | ANALYSIS | CONCLUSION

QUANTITATIVE ANALYSIS I Calculation 1 & 2

This calculation compares the investigated geographies chosen on maturity. The rationale is, that these have already developed more sophisticated supply-demand match mechanisms.

**Calculation Reasoning & Databases**

**Sampling**
California and the Nordics have reached greater their maturity. They have comparable GDP and inhabitants and are embedded in a single market.

**Database**
Build a database with input from the platforms Dealroom and Crunchbase.

**Commonalities**
Searching by technology and subindustry filter

**Maturity Approach**

**Calculation Approach**

**Financial Advantage** = Δ MEDIAN or Δ AVERAGE Investment x Number of HCS in GER

**Financing rounds**
Δ MEDIAN and Δ AVERAGE of investment rounds between 2018-2023

**Number of startups**
We scanned 950 existing startups individually and found 90 to be HCS.

**Alteration**
We will increase the number of startups to project a future state.
QUANTITATIVE ANALYSIS I Calculation 3

This calculation serves as a triangulation performing a top-down approach. This is particularly meaningful trying to understand the relation to climate mitigation targets.

**Calculation Reasoning & Databases**

- **Sampling**
  The International Renewable Agency was mentioned in studies of Dhayal et al. (2023) and Polzin, Sanders, and Serebriakova (2021)

- **Database**
  They released a report with a global scenario analysis with investments targets

- **Commonalities**
  Hardware solutions in Energy, Circular Economy & Cabon Capture

**Top-Down Approach**

**Calculation Approach**

- **Climate mitigation goal**
  Annual investment demand

- **Inflow into the ecosystem**
  Of this total the share of innovation

- **Assumptions**
  1. How much potential does Germany have? Share of global GDP and beyond due to technological expertise
  2. Potential of Startups to contribute? Startups have significant innovation capabilities to commercialize HCT

**Scenario Demand = Global Demand ($4.4T) x 6% x Assumption1 x Assumption2**
FINDINGS RESEARCH QUESTION 1

Does a funding gap for HCSs exist in Germany?
QUALITATIVE ANALYSIS

ANALYSIS OF INTERVIEWS CONFIRMS EXISTENCE OF A FUNDING GAP FOR HCSs IN GERMANY

“There is a funding gap because of the nature of the innovations that we are discussing here” – Stéphane Ouaki, European Commission

Does a funding gap for HCSs in Germany?

- Full confirmation: 17%
- Partial confirmation: 83%

Does a funding gap for HCSs in Germany?

Agree that a suboptimal investment situation exists explicitly highlighting the lack of funding when it comes to the scaling and the commercialization of the technology

Most argue that closing the funding gap primarily needs government intervention addressing all stakeholders in the ecosystem to mobilize capital generic and in a "smart way"
Triangulation of interview analysis with calculation 1, 2 & 3 indicates that the answer is: YES, A FUNDING GAP FOR HCSs IN GERMANY DOES EXIST.

**Triangulation**

- **Interview Analysis**
  83% in fully agreeing giving strong indication

- **Literature Review**
  Strong indication and evidence from similar sectors

- **Quantitative Analysis**
  With less respect to the Nordics lower bound there is a strong indication

**Range of Magnitude**

The range of the magnitude lies between the upper bound values and the upper scenarios of the top-down analysis.

- $1.6B
- $2B
- $11B

- **Amount invested between 2018-2023**
- **Required annual investments to close the gap**
RESEARCH QUESTION 2

What factors contribute to the funding gap for HCSs in Germany?
### INTRO

- **Shaping the Future is Hard**
- INTRO | FOUNDATION | RESEARCH QUESTIONS | METHODOLOGY | RQ1 | RQ2 | RQ3 | ANALYSIS | CONCLUSION

### INTERVIEW ANALYSIS I EXCERPT

#### Challenges investment

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Option A</th>
<th>Option B</th>
<th>Option C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of strategic procurement</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>VC investment</td>
<td>-</td>
<td>-</td>
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</tr>
</tbody>
</table>

#### Interview excerpt

**Excerpt of interview coding to demonstrate process.**
17 challenges were established and grouped into 4 categories.

<table>
<thead>
<tr>
<th>STARTING UP CHALLENGES</th>
<th>MARKET CREATION AND COMMERCIALISATION CHALLENGES</th>
<th>REGULATION &amp; POLICY CHALLENGES</th>
<th>INVESTOR CHALLENGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrepreneurial Skill Gap in HCS Teams</td>
<td>Lack of Oftake Agreements</td>
<td>Lack of Strategic Direction and Guidelines Defined by the Government</td>
<td>Lack of Technical Knowledge in Investment Teams</td>
</tr>
<tr>
<td>Lack of Connection Between Research and Commercialization</td>
<td>Lack of Strategic Procurement Programs</td>
<td>Regulatory Fragmentation of Europe Single Markets Slows Down Investment Flow, Commercialisation and Exit Prospects</td>
<td>VC Investment Blueprint Does Not Fit HCSs</td>
</tr>
<tr>
<td>Lack of Standardized and Founder-Friendly Processes for University Spin-Offs</td>
<td></td>
<td>Public Financing Instruments Do Not Reach Their Full Potential</td>
<td>Lack of Risk-Taking Angel Investors with High Investment Power and Signalling Capability</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Insufficient Investment Volumes/VC Market Too Small for Institutional Investors</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lack of Co-Investment Between Public/Private Money</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Underdeveloped Private and Independent Fund-of-Funds Ecosystem</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Underdeveloped Venture Debt and Alternative Forms of Capital in Europe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lack of Exit Opportunities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Limited investment track record and data to meet regulatory and risk management requirements</td>
</tr>
</tbody>
</table>
INTERIM CONCLUSION (1/2)

- Venture Capital
  - Lack of technical knowledge and expertise in investment teams
  - Insufficient knowledge leads to wrong fund setup
  - Without proper exit mechanisms, VC cannot ensure funds
  - Investors lack know-how to understand the value of VC investments

- Underdeveloped private and independent fund ecosystem
  - Insufficient investment opportunities
  - Investors lack clear understanding of investment opportunities

- Lack of institutional investment
  - Insufficient investment management expertise
  - Insufficient investment management structure

- Lack of strategic procurement programs that help create market for new technologies
  - Lack of exit opportunities

- Regulatory fragmentation of European single market drives down investment flow, commercialization, and tech prospects

- 1st VoD
- 2nd VoD
- Vicious cycle

Market Challenges
Policy & Regulation Challenges
Investor Challenges
Starting-Up Challenges

Interdependency Direction
INTERIM CONCLUSION (1/2)

Venture Capital

Lack of technical knowledge and expertise in investment team

Insufficient knowledge leads to unfavourable fund setup

Without proper VC knowledge, fear of failure and exit opportunities

VC investment blueprint does not fit VCs

Lack of institutional Investment

Underdeveloped private and independent fund of funds ecosystem

Insufficient investment opportunities

Investors hesitations in investing into VC blueprint doesn’t match their needs

VC offers low returns on investment, lack of proper regulation

Underdeveloped ecosystem in venture capital

Regulatory fragmentation of Europe single market drives down investment flow, commercialisation and tech prospects

Lack of exit opportunities

Lack of strategic procurement programs that help create market for new technologies

Lack of sufficient agreements to establish market for innovations

Lack of investor capital and strategic positioning for new technologies

Vicious cycle

1st VoD
2nd VoD
Vicious cycle
INTERIM CONCLUSION (1/2)

Venture Capital

- Lack of institutional investment
- Underdeveloped private and Independent fund of funds ecosystem
- Insufficient knowledge leads to slippage fund setup
- Insufficient knowledge and expertise in investment
- Lack of technical knowledge and expertise in investment
- Venture Capital investment blueprint does not fit HCS

Lack of exit opportunities

Vicious cycle

1st VoD
2nd VoD
Vicious cycle

Regulatory fragmentation of Europe single market shows downs investment flow, commercialisation and fund prospects.

Venture Debt and alternative forms of capital remain underdeveloped in Europe

Lack of strategic procurement programs that help create markets for new technologies.

Lack of exit opportunities

1st VoD

Lack of entrepreneurial spirit

Lack of strategic procurement programs for firms

Lack of effective procurement policies

Lack of policy makers awareness and buy-in for venture debt

Risk capital procurement program not effective

2nd VoD

Lack of effective procurement policies for firms

Lack of state funding and incentives

Lack of policy makers awareness and buy-in for venture debt

Risk capital procurement program not effective

Lack of state funding and incentives

Lack of policy makers awareness and buy-in for venture debt

Risk capital procurement program not effective

1st VoD
INTERIM CONCLUSION (1/2)

Vicious Cycle

- High investments are needed but only issued if the investors anticipate a timely exit
- HCSs ecosystem lacks exit opportunities which prevent investors from investing
- Due to lack of liquidity within ecosystem fund sizes stay too small to become attractive for institutional investors
- Vicious cycle inhibits the growth of the VC industry in Europe as a whole and prompts HCSs to seek exits overseas
Survey prioritisation and frequency of mentions in interviews found the following challenges to be most impactful:

1. Lack of Strategic Procurement Programs
2. Insufficient Investment Volumes/VC Market Too Small for Institutional Investors
3. Lack of Technical Knowledge and Expertise in Investment Teams
4. Lack of Strategic Direction and Guidelines Defined by the Government

Mapping of challenges based on survey and interview results.
### INTERIM CONCLUSION (2/2)

#### CHALLENGES WITH HIGHEST INTERDEPENDENCIES WITHIN ECOSYSTEM

- Ticket sizes remain insufficient for amount of funding required partly due to **insufficient institutional investment** (from, e.g., insurance/pension funds and private fund-of-funds) - on the other hand, fund sizes are too small for institutional investors to invest.
- **VC investment model** seeks risky investment however does not align with HCT and its TRLs.
- A **Lack of Exit Opportunities** for HCSs initiate a vicious cycle that hinders money to be reinjected into the cycle (through IPOs, M&As).

#### SURVEY RESULTS

- **Lack of Strategic Procurement programs** highly ranked and frequently mentioned indicating that a market/customer base is missing for HCT.
- **Institutional Investment** is perceived as highly relevant for ecosystem to thrive and benefit from big ticket sizes.
- **The Lack of Exit Opportunities** was not perceived as relevant during the survey, indicating that the participants might perceive funding process for HCSs as linear.
- **Lack of Technical Knowledge in Investment Teams** was highly ranked indicating that diversifying investor knowledge is crucial to improve investment decisions.
- High ranking of **Lack of Strategic Direction and Guidelines Defined by the Government** calls for the governmental action.

#### KEY TAKEAWAYS

- Successful introduction of HCT requires catalytic capital that effectively **mobilises a diverse range of investors** and to bring HCSs to maturity and realize exits.
- Since VC investment model does not fully align with HCSs, additionally **alternative forms of capital** have to be explored.
RESEARCH QUESTION 3

What are the potential solutions to solve this challenge?
16 solutions (levers) were established and clustered into 8 categories. The categories were grouped into 4 overarching themes:

- **REGULATORY AND POLICY ENVIRONMENT**
  - Strengthen and Incentivise Inst. Investors to Invest in VC/VD/Fund-of-Funds**
  - Establish Good Policy Design & Review*
  - Mobilise and Incentivise Private Capital*

- **MARKET ENVIRONMENT**
  - Align Regulatory Environment and Perform Smart Capital Allocation According to Defined Environmental Strategy**
  - Establish Procurement Programs to Create Markets**

- **CO-FINANCING AND COLLABORATION**
  - Strengthen Collaboration Amongst Players*
  - Increase Use of Blended Finance and Alternative Capital for Startups*

- **UNIVERSITY SPIN-OFFS**
  - Create More Favourable Environment to Produce University Spin Offs*

Solutions obtained from interviews focus on governmental intervention and vary in terms of depth and level of detail.

Multiple solutions are generic to the German ecosystem but become particularly relevant within the HCSs context.

* relevant to the startup ecosystem in general | **HCS-specific
FOLLOW-UP SURVEY

PRIORITISATION OF SOLUTIONS

Survey prioritisation and frequency of mentions in interviews found the following recommendations to be most important:

1. De-Risk Markets Through Legislations and Regulations
2. Promote Publicly Backed Programs for Long-Term Patient Capital
3. Promote Investment Facilitation and Encourage Institutional Investors

Mapping of solutions based on survey and interview results.
ANALYSIS

SHAPING THE FUTURE IS HARD
RECOMMENDATION 1: DE-RISK MARKETS THROUGH LEGISLATIONS & REGULATIONS

“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. It seems necessary to legislate with a long-term strategic perspective” – I13 (2023)

UNDERLYING MECHANISM

SPECIFIC RECOMMENDATIONS

- Literature provides evidence that public legislation can reduce uncertainty by targeting the green premium. Especially if there is long-term stability that incentivizes risk averse investors like institutionals to allocate their long-term capital.

- Develop long term strategy
- Government push mechanisms
- Carbon tax
RECOMMENDATION 2: PROMOTE PUBLICLY BACKED PROGRAMS FOR LONG-TERM PATIENT CAPITAL

“What I find very relevant are these blended finance stories, which to my knowledge are not yet so widespread in Europe.” – I03 (2023)

UNDERLYING MECHANISM

<table>
<thead>
<tr>
<th>Development funding (Public or Philanthropic)</th>
<th>Private equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concessional</td>
<td>Market rate</td>
</tr>
<tr>
<td>Blended finance structures</td>
<td>Incentives</td>
</tr>
</tbody>
</table>

SPECIFIC RECOMMENDATIONS

1. Step in with guarantees provided by public catalyst funds

   - Private Public Partnerships to mobilize private capital
   - Matching grants: match a certain percentage of the private capital raised by public money
   - Best practice: Banque Publique d’Investissement (France) offers milestone-based financing for HCSs increasing certainty and thereby decreasing dilution

2. Make existing instruments more effective

   - Exploit: Review and double down on already existing loan instruments like the KFW or the EIB VD products
RECOMMENDATION 3: PROMOTE INVESTMENT FACILITATION AND ENCOURAGE INSTITUTIONAL INVESTORS

“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.” – I13 (2023)

UNDERLYING MECHANISM

Vicious cycle
Absence of large capital inflow in the entire ecosystem creates challenges

Virtuous cycle
Large capital circulation drives specialization and market forces to solve challenges

SPECIFIC RECOMMENDATIONS

Review prudential regulations with a view to cautiously developing risk appetite towards climate technologies

Conduct deep-dive with institutional investors (asset owners) to capture their full perspectives and design effective solutions

Orientate on international best practices to identify further solutions. Example: Danish Government incentivizes institutional investors to invest in VC and Growth capital funds.
CONCLUSION
<table>
<thead>
<tr>
<th>RESEARCH QUESTION 1</th>
<th>RESEARCH QUESTION 2</th>
<th>RESEARCH QUESTION 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>** Does a funding gap exist? **</td>
<td>** What factors contribute to the funding gap? **</td>
<td>** What are potential solutions to solve this gap? **</td>
</tr>
<tr>
<td>Confirmed the existence of a funding gap.</td>
<td>Identified <strong>17 main challenges</strong> with the most important ones being:</td>
<td>Identified <strong>16 solutions</strong> with the following rated as most relevant:</td>
</tr>
<tr>
<td>• <strong>20 out of 24</strong> interviewees fully and four partly approving.</td>
<td>1. “Lack of procurement programs”</td>
<td>1. “De-risk market through regulations/legislations”</td>
</tr>
<tr>
<td>• The range of the funding gap is estimated to be minimum <strong>$2 billion</strong> per year.</td>
<td>2. “Lack of strategic direction and guidelines from the government”</td>
<td>2. “Promote publicly backed programs for long-term patient capital”</td>
</tr>
</tbody>
</table>

The specialization within the ecosystem is influenced by the **scale of capital flow**. The funding gap **disrupts this virtuous cycle** that cascades up from individual startups to the entire ecosystem.

Challenges and solutions are **complex** and **highly interconnected**.

Challenges from the macroeconomic environment for the entire ecosystem seem **especially relevant for HCT**, but are particularly hard to overcome.
THANK YOU.