CSP Center for Sustainable Finance & Private Wealth
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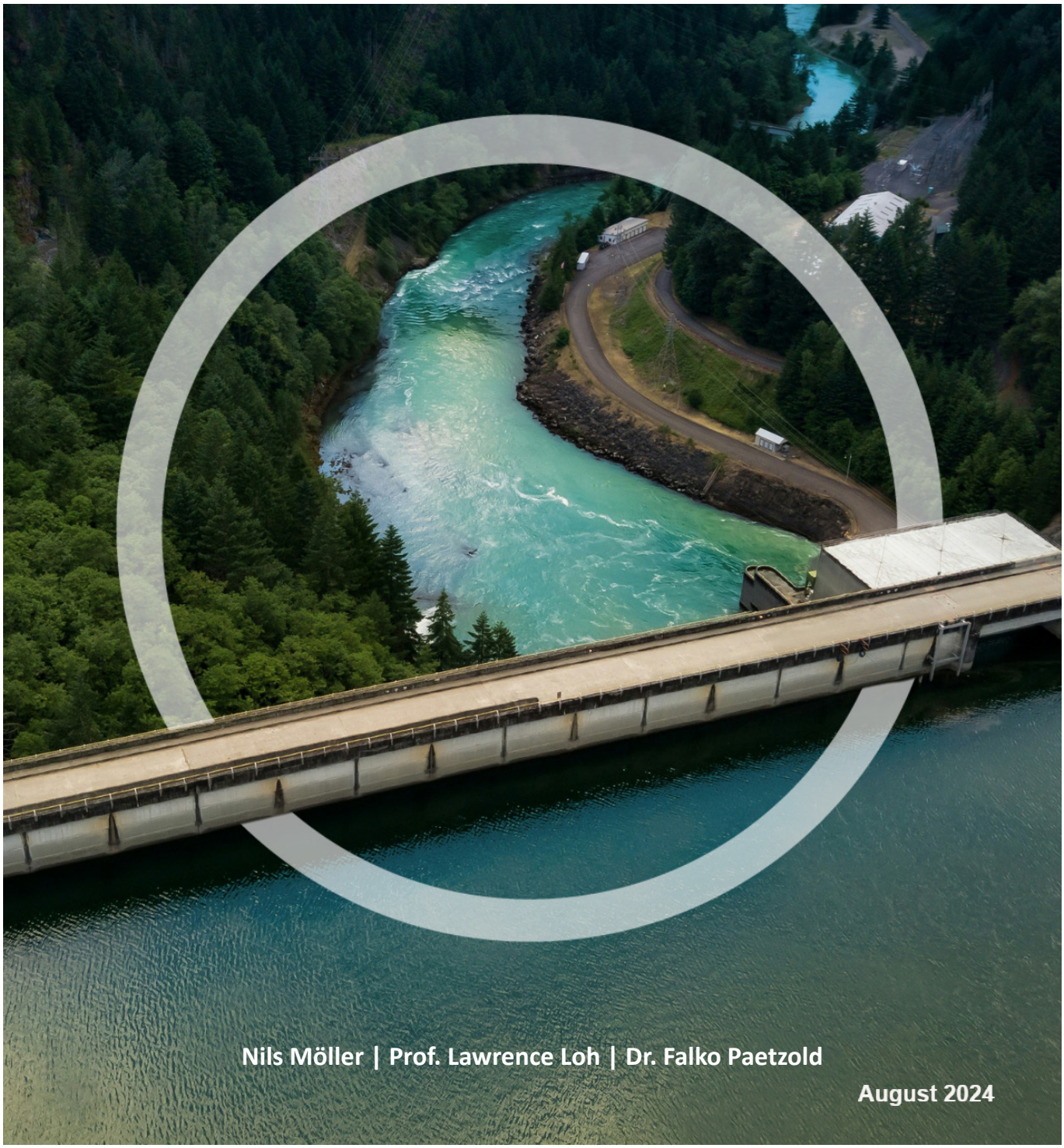
NUS Business School

Beyond the Boom:

A Critical Examination of Current Barriers in Cleantech Venture Capital Funding



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August 2024

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I. Foreword

This report is the result of the collaboration between Center for Sustainable Finance and Private Wealth (CSP) Singapore and Centre for Governance and Sustainability at National University of Singapore with the goal of advancing sustainable development and sustainable finance globally, and in Asia and Singapore specifically.

The report critically explores the complex barriers hindering cleantech venture capital funding, which plays a pivotal role in the transition to sustainable energy.

Drawing from insights of 22 experts, 12 barriers were identified that address the misalignment of venture capital models with cleantech needs, gaps in investor knowledge, overreliance on secondary exits, and regulatory and cultural challenges.

Reflecting on the cleantech sector's previous boom-and-bust cycle, the report advocates for tailored, long-term investment strategies and collaborative efforts among key stakeholders to overcome these persistent obstacles.

Offering strategic insights, the report aims to pave a sustainable path for cleantech ventures, emphasizing the importance of converting current enthusiasm into impactful environmental and economic advancements.

We look forward to further contributing to this critical and emerging field.

Yours truly, and towards impact,

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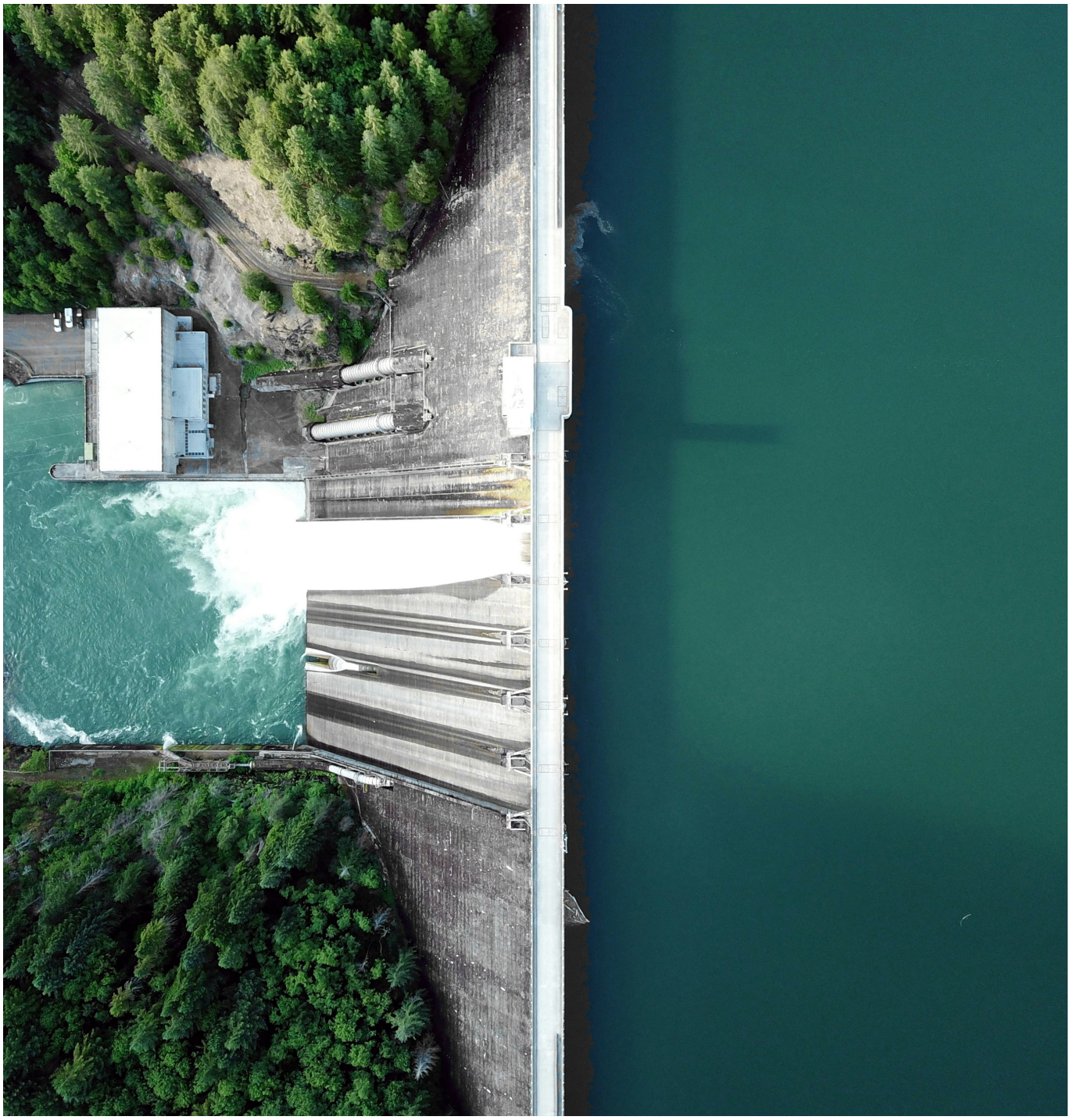
About Center for Sustainable Finance and Private Wealth (CSP) Singapore

The Center for Sustainable Finance and Private Wealth Singapore (CSP Singapore) is an independent nonprofit that emerged out of the Impact Investing for the Next Generation training program held for the first time in 2015 at the Harvard Kennedy School.

Established in Oct 2021, CSP Singapore collaborates closely with CSP Zurich at the University of Zurich and CSP North America. We bridge the gap between research and practice, connecting scientists, wealth holders, and investment professionals to create knowledge and direct capital towards impactful initiatives. Our comprehensive training programs equip professionals with the necessary tools to guide private wealth towards sustainable development, while also empowering private wealth holders to align their capital with their values and sustainability goals.

About Centre for Governance and Sustainability (CGS)

The Centre for Governance and Sustainability (CGS), formerly known as Centre for Governance, Institutions and Organisations (CGIO), was established by the National University of Singapore (NUS) Business School in 2010. It aims to spearhead relevant and high-impact research on corporate governance (CG) and corporate sustainability (CS) issues that are pertinent to institutions, government bodies and businesses both in Singapore and Asia. This includes corporate governance and corporate sustainability, governance of family firms, government-linked companies, business groups, and institutions. CGS also organizes events such as public lectures, industry roundtables, and academic conferences on topics related to governance and sustainability.



II. Introduction

In recent years, the cleantech venture capital (VC) sector has emerged at the forefront of the global transition towards sustainable energy, driven by an urgent need to address climate change and reduce carbon emissions. This shift has been significantly bolstered by legislative and financial initiatives from leading economies, notably the European Union's Green Deal Industrial Plan and the United States' Inflation Reduction Act. These initiatives have not only underscored the commitment of governments to combat environmental challenges but have also unlocked unprecedented levels of private investment in cleantech solutions. The year 2022 witnessed a staggering investment of 1.11 trillion USD in the energy transition, marking a seminal moment in cleantech's ascendancy to a position of parity with the traditional oil and gas industry (Bloomberg, 2023). In 2023 investment in cleantech increased to 1.8 trillion USD (Bloomberg, 2024). This surge in capital investment is poised to catalyze innovation, fuel research and development, and accelerate the deployment of cutting-edge technologies across the energy sector.

However, this remarkable influx of capital and the attendant enthusiasm for the potential of cleantech solutions must be tempered with caution. The cleantech VC sector is not unfamiliar with the cycles of boom and bust, as evidenced by the period between 2006 and 2011, during which VC firms invested over 25 billion dollars in cleantech startups, only to see less than half of that capital return to investors. This historical precedent serves as a stark reminder of the volatility inherent in the cleantech investment landscape and the perils of unbridled optimism (Gaddy et al., 2017). While the current wave of investment represents a pivotal opportunity for the advancement of green technologies, it also harbors the risk of precipitating another bust, potentially resulting in substantial financial, social, and environmental setbacks. Against this backdrop, our report seeks to navigate the complexities of the present cleantech VC investment environment. By examining the reasons behind the first cleantech bubble's burst and identifying the current barriers to investment, we aim to provide stakeholders—venture capitalists, entrepreneurs, incumbent firms, and policymakers—with a comprehensive understanding of the challenges and opportunities within the cleantech sector in 2024. Drawing on insights from 22 experts who have identified 12 critical barriers to cleantech investment, this report endeavors to chart a course for sustainable investment strategies that heed the lessons of the past while embracing the possibilities of a greener future.

III. Reasons Why Cleantech Venture Capital Failed in the Past

The initial enthusiasm surrounding cleantech VC promised a green revolution, confident to transform the energy landscape with sustainable, innovative technologies. Between 2006 and 2011, VC investments in cleantech soared, driven by a collective aspiration to mitigate climate change and capitalize on the anticipated shift away from fossil fuels (Giorgis et al., 2022). However, this period of intense investment was followed by a significant downturn, with many VC firms witnessing their cleantech portfolios underperform or fail outright (Eilperin, 2012). Several key factors contributed to this failure, offering crucial lessons for current and future investments in the sector.

Unsuitability of the VC Model: Cleantech investments inherently involve long development timelines, substantial capital requirements, and complex regulatory environments. The traditional VC model, characterized by shorter investment horizons and expectations of rapid growth and high returns, proved ill-suited to the realities of cleantech ventures. Gaddy et al. (2017) highlighted this mismatch, noting that the VC approach did not accommodate the time-consuming processes and high capital needs of cleantech startups, leading to a lack of sustainable exit options and thin profit margins.

External Market Forces: The period also witnessed significant external market forces that adversely affected cleantech investments. Fluctuating prices of silicon, a key component in solar panels, and the availability of cheap natural gas emerged as formidable challenges. The 2008 financial crisis further exacerbated the situation, drying up available capital and redirecting investor focus away from cleantech. The rapid ascent of China's solar industry, benefiting from substantial

government support and lower production costs, created competitive pressures that many Western cleantech ventures could not withstand (Eilperin, 2012).

Lack of Policy Support and Market Demand: The cleantech sector's growth was significantly hampered by the loss of policy support and weak demand for green products. Van den Heuvel and Popp (2023) underscored the critical role of demand-side policies in cleantech success, pointing out that financial constraints and the absence of strong market demand for green technologies limited the potential for outsized returns, deterring VC investment.

Technological Breakthroughs and Scalability Issues: The expectation of rapid, disruptive technological breakthroughs in cleantech often went unmet. Many cleantech innovations, while promising on paper, faced challenges in scaling and achieving cost competitiveness with established energy sources. This gap between expectation and reality further contributed to the disillusionment with cleantech as a viable VC investment target (Giorgis et al., 2022).

The cleantech VC boom and bust serves as a poignant reminder of the complexities and risks associated with investing in green technologies. The sector's failure to live up to early expectations was not merely the result of market dynamics or external pressures but also a reflection of deeper structural issues within the VC model and the cleantech industry itself. As the sector undergoes a resurgence, it is imperative for investors, policymakers, and cleantech entrepreneurs to heed these lessons, adopting more nuanced and patient investment strategies that align with the unique challenges and opportunities of sustainable innovation. Therefore, it is important to understand current barriers to cleantech investments to not repeat the mistakes from the past.

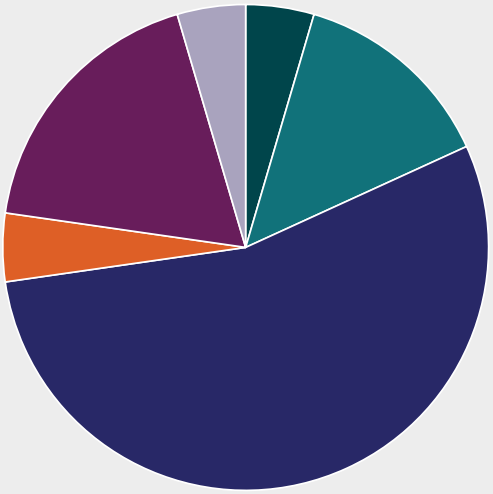
IV. Current Barriers to Cleantech Investments

As the global economy pivots towards sustainability, the cleantech sector emerges as a pivotal arena for innovation and investment. However, despite the promising influx of capital and the critical role of cleantech in achieving environmental goals, the sector faces multifaceted barriers that challenge its growth and viability. This analysis, based on interviews with 22 experts across the cleantech ecosystem, identifies and explores the key barriers currently hindering cleantech investments.

Chart 1: Expert Interviews

Types of Organization:

- 12 Cleantech VCs
  1 Head of Sustainability, 5 Partners, 1 Principal, 5 Investment Managers
- 1 Angel Syndicate
  1 President
- 1 Family Office
  1 Investment Manager
- 1 Investor
  1 Business Angel
- 3 Cleantech Startups
  1 President, 1 Director, 1 CEO
- 4 Incumbent Firms
  1 Investment Associate, 1 Manager, 1 Senior Investment Manager, 1 Sustainability Manager



These barriers span government policies, investor strategies, entrepreneurial challenges, and the stance of incumbent firms, each contributing to the complex landscape that cleantech ventures must navigate.

Entrepreneur-Level Barriers

Knowledge Complexity Requirements: Cleantech ventures often require a multidisciplinary approach, blending diverse technological fields. This complexity demands that entrepreneurs possess or acquire a broad spectrum of knowledge, challenging the sector's accessibility for founders with specialized expertise.

Strategic Investor Selection Risk: Securing funding that matches the developmental stage and specific needs of cleantech startups remains a pivotal challenge. Entrepreneurs must navigate capital gaps and find investors who not only provide financial backing but also understand and support the vision and long-term goals of cleantech ventures.

Cleantech's Adoption Hurdles: The adoption of cleantech solutions faces obstacles from systemic resistance to new technologies and market readiness. Entrepreneurs must overcome these hurdles to ensure their innovations can achieve meaningful market penetration and drive systemic change.

Incumbent Firm-Level Barriers

Legacy Business Profit Paralysis: Incumbent firms in the energy sector often exhibit a reluctance to invest in cleantech due to the profitability of traditional energy sources. This "profit paralysis" hinders the sector's willingness to embrace potentially disruptive cleantech innovations.

Innovation Skepticism and Selectivity: A cautious approach towards new technologies characterizes incumbent firms, particularly in the energy and oil and gas sectors. This skepticism and selectivity in adopting innovation can delay the integration of sustainable technologies into the existing energy infrastructure.

Corporate Investment Culture Trap: The cultural mismatch between the entrepreneurial spirit of cleantech startups and the established processes of incumbent firms poses a significant barrier. This divergence in cultures can lead to missed opportunities for collaboration and investment in cleantech solutions.

Government-Level Barriers

Political-Economic Investment Volatility: The cleantech sector's susceptibility to political and economic fluctuations presents a significant barrier to sustained investment. Experts highlight the impact of policy changes on regulatory support and subsidies, which can shift dramatically with political cycles. Such volatility undermines investor confidence, as seen in varying commitments to cleantech under different U.S. administrations, illustrating the sector's vulnerability to external political and economic forces.

Long-term Regulatory Dysfunction: A consistent theme among interviewed experts is the challenge posed by regulatory dysfunction, particularly the lack of long-term, coherent policies supporting cleantech development. Disparities in government support across cleantech sub-sectors exacerbate this issue, with critical areas like domestic heating and ecosystem regeneration often overlooked, stalling their growth and investment attractiveness.

Investor-Level Barriers

Fund Structure Dilemma: Traditional venture capital models, characterized by relatively short investment horizons, clash with the cleantech sector's need for long-term capital commitment. This dilemma complicates fund managers' efforts to structure investments that align with the extended timelines required for cleantech innovations to mature and scale. The disparity between the expectation of quick returns and the reality of cleantech's developmental pace is a recurrent barrier cited by experts, necessitating a reevaluation of fund structures to better accommodate the sector's unique demands.

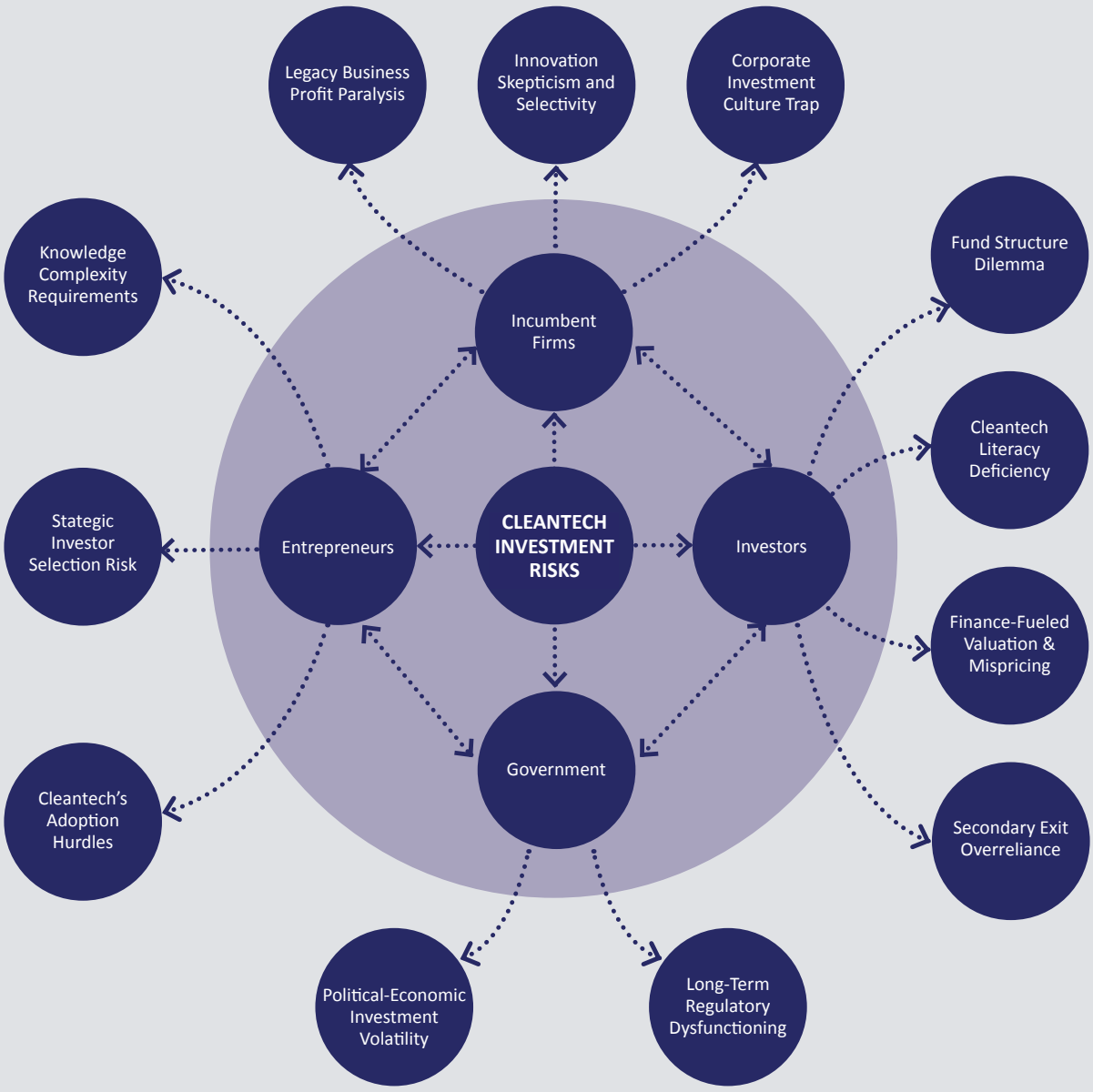
Cleantech Literacy Deficiency: A notable barrier identified is the general lack of cleantech literacy among new and mainstream investors. This gap in understanding the specificities of the cleantech market—ranging from technological nuances to regulatory impacts—impairs investors' ability to accurately assess risks and opportunities. Experts stress the importance of enhancing cleantech literacy to bridge the knowledge gap, enabling investors to make more informed decisions and support innovations with true impact potential.

Finance-Fueled Valuation & Mispricing: The current hype surrounding cleantech has led to concerns about overvaluation and mispricing, driven by an oversupply of capital chasing limited high-quality opportunities. This environment risks inflating startup valuations beyond their intrinsic value, potentially setting the stage for future corrections or down rounds. Experts caution against the bubble-like dynamics fueled by excessive financial enthusiasm, underscoring the need for more grounded valuation approaches that reflect the sector's long-term prospects and technological realities.

Secondary Exit Overreliance: The cleantech sector's reliance on secondary exits emerges as a significant barrier, underscored by the difficulties of pursuing initial public offerings or mergers and acquisitions for companies with minimal revenue or those far from market readiness. This reliance on alternative exit routes, such as selling stakes to subsequent investors, introduces a layer of financial instability and uncertainty, diminishing the attractiveness of cleantech ventures to potential investors. The overreliance on secondary exits not only reflects the current financial market's limitations but also the cautious stance of incumbent firms, further complicating the path to successful investment exits.

An overview of all barriers to cleantech VC is displayed in Figure 1.

Figure 1: Cleantech VC Investment Risk



V. Mitigation Strategies

Based on the identified risk we propose some mitigation strategies to deal with cleantech VC investment risks.

1. Tailoring Investment Models to Cleantech

Long-term Investment Horizons: Encourage and develop funding mechanisms with longer maturity periods to match the developmental timelines of cleantech projects.

2. Enhancing Cleantech Literacy Among Investors

Educational Programs and Workshops: Create platforms for knowledge exchange between cleantech experts and investors to close the literacy gap and decrease the probability of mispricing cleantech assets.

3. Cultivating a Supportive Regulatory Environment

Policy Stability and Incentives: Advocate for consistent government policies that support cleantech innovation, including subsidies, tax incentives, and streamlined regulatory approvals.

4. Building Robust Exit Strategies

Early Engagement with Potential Acquirers: Initiate dialogue with incumbent firms and other potential acquirers early in the venture lifecycle to build relationships and align expectations.

5. Fostering a Culture of Collaboration and Innovation

Innovation Ecosystems: Support the establishment of cleantech hubs and incubators that provide startups with resources, mentorship, and networking opportunities.

VI. Conclusion

The journey toward sustainable energy and environmental solutions through cleantech innovation represents one of the most significant opportunities of our time. However, as this report elucidates, based on comprehensive insights from 22 experts, the path is fraught with substantial barriers that span across government, investor, entrepreneurial, and incumbent firm levels. These barriers, from political-economic volatility to secondary exit overreliance, underscore the complex ecosystem within which cleantech investments operate. Each barrier presents unique challenges but also opportunities for strategic adjustments and innovations in approach.

The historical context of cleantech venture capital's initial fervor, followed by a significant downturn, serves as a crucial lesson for all stakeholders involved. The unsuitability of the traditional VC model, external market forces, lack of policy support and market demand, and the absence of scalable technological breakthroughs have collectively contributed to past failures. These lessons highlight the necessity for a more nuanced, patient, and supportive approach to cleantech investments, one that aligns with the sector's inherent complexities and long-term objectives.

The current barriers identified—ranging from knowledge complexity requirements and capital gaps at the entrepreneurial level to the fund structure dilemma and cleantech literacy deficiency at the investor level—demand a collaborative and informed response. Governments must strive for stable, supportive policies that encourage long-term investments. Investors need to adapt their models to accommodate the unique timelines and risks associated with cleantech ventures. Entrepreneurs must navigate the intricate landscape of technological innovation, funding, and market adoption with resilience and strategic foresight. Incumbent firms are called upon to embrace change, fostering a culture of innovation and sustainability that aligns with the cleantech vision.

As we stand at the cusp of potentially another significant wave of cleantech investment, the lessons from the past and the barriers of the present offer a roadmap for the future. By addressing these challenges head-on, stakeholders can unlock the transformative potential of cleantech, paving the way for a sustainable, resilient, and prosperous future.

This report not only highlights the critical barriers to cleantech investment but also serves as a call to action for all involved to commit to a future where innovation, sustainability, and strategic investment converge to meet our most pressing environmental challenges.

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Resources

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Dr. Falko Paetzold co-founded the Center for Sustainable Finance and Private Wealth (CSP) Singapore and is a member of the Board. He also initiated the CSP entities in Zurich and San Francisco, as a spin-off from the Next Gen Impact Investing program that he co-initiated at Harvard University in 2015. He holds advisory board seats at Pictet, ZKB, and other finance organisations.

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From evidence to impact

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