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Capstone Project Research Report

# CROWDFUNDING CLEANTECH



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## Capstone Project Research Report

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## Executive Summary

Clean technology plays an important role to help minimize harmful impacts on the environment through introduction or optimization of technologies in processes, materials, energy and infrastructures. It is an important cornerstone of the current climate strategy to leverage technologies to mitigate and adapt to climate change. Thus, mass mobilization of finance is essential to support the development of new technologies and accomplish climate goals to stay below 2 degrees of warming, with experts estimating that \$12.1 trillion is needed over the next 25 years to stay within the goal (Ceres and Locklin, 2016). However, due to a burst of the cleantech bubble in the 2010s, investment growth in the cleantech sector has been consistent despite renewed interest in the field by investors, following the Paris Agreement of 2015 and the rise in ESG issues.

The existing literature gives both a detailed overview of financing challenges faced by cleantech startups, the traditional investors' perspectives on its risks and crowdfunding potentials. Literature does not address the potentials of how an alternative financing tool like crowdfunding platforms can capture financial and non-financial motivations of investors, when it comes to cleantech startups. To address the gaps between the separate fields of literature in cleantech, startups, crowdfunding and investment decision making, this research gives the combined overview to assess the suitability of crowdfunding as a tool to finance cleantech startups.

For cleantech startups, crowdfunding comes at a later stage of financing than the usual risk-taker VC models. Crowdfunding benefits include creating a community of investors around the business, testing out the market and allowing the public to benefit financially from green transition projects rather than simply being at the end of the stick. The type of cleantech startup model may determine the success of its funding successes. B2C businesses might find it easier to attract individual investors' attraction whereas it's more difficult for B2B businesses. A software cleantech may find it easier to get funded compared to hardware or deep clean technologies, whose value is mostly only captured by investors with technical expertise. Of all investors, most motivated to invest in cleantech startups were large corporations or angel investors who had either strategic objectives for such innovation or the technical expertise to assess a new technology's value.

The biggest advantage of crowdfunding platforms is the introduction of non-financial motivation factors into the purely finance-based investment decision making model, making it more likely for cleantech with environmental impacts to get funded. It also expands the retail investors' access to real assets rather than only stocks and bonds, which made them more aware of their motivation to invest in projects that made an impact in the community. However, institutional investors are often skeptical of non-financial motivations within crowdfunding decisions. They perceive that the retail investors that exist on crowdfunding are often not well-equipped to assess the risks of risky investments like cleantech startups, since the existing platforms do not assume responsibilities and functions like due diligence as traditional financial intermediaries do. While corporations that have high risk appetites to invest in cleantech startups due to their strategic objectives, they are more interested in developing their own crowdfunding platforms than using an existing one. This way, corporations are directly engaged with their projects like in VCs.

As investors seem to express some motivation to invest in cleantech startups and also to crowdfund, this report highlights how to best synergize dynamics between investors and entrepreneurs on crowdfunding. These synergizing factors include considering proximity and tangibility of the projects to the investors, increasing financial transparency, securing technological patents and taking into account crowdfunding regulations before choosing to crowdfund. It is also important to take into account the limitations of crowdfunding, such as its lack of appeal to B2B startups and professional investors as well as its need for significant time and resource commitments.

The holistic and general overview approach of our research has given key insights for policy recommendations, which could help to maximize potentials of crowdfund investments in cleantech startup landscapes:

- **Increasing crowdfunding credibility:** Currently we see a minimal involvement of the government in providing support for crowdfunding and we believe there is scope for policy to lend credibility and awareness among the general public. Governments should associate themselves with crowdfunding platforms. This is already happening, like in the case of the Dubai Government which launched DubaiNext, a digital crowdfunding platform to support SMEs (The United Arab Emirate's Government Portal, 2021). Government projects that have public support but lack existing funding can be funded through crowdfunding, where governments can go as far as say that they will fund a percentage of their projects through crowdfunding. Overall, this can improve public awareness about crowdfunding and specific issues the projects are aiming to tackle and increase the reputation of crowdfunding.
- **Progressive regulations:** Governments play a key role in maturing the crowdfunding market through its policies, which leads to more investor confidence in it. Policies that would positively affect cleantech startup investments would progressively allow for more capital injection from crowdfunders to equity and lending based platforms. This can also be supported by supportive financial policies like tax reliefs and financial incentives for crowdfunding investors to invest in new companies as the UK example showed. The increased capital flow of confident investors can support cleantech startups's need for large capital.
- **Risk limiting:** From a financial risk perspective, crowdfunding platforms operate with a lack of obligations towards their investors. In the French crowdfunding platform we interviewed, they do the due diligence and risk assessments voluntarily. Governments can introduce some benchmark of obligations for platforms in order to filter out potential fraudulent or extremely risky investments, and limit financial risks for non-financially expert investors.
- **Funding guarantee:** B2B cleantech startups find it challenging to attract investment due to their high capital requirements and long-time development periods. So, governments can make funding available to crowdfunding platforms, with a criteria for funding B2B companies spurring innovation. Such funding can be a guarantee for all crowdfunders that invest in the B2B project, so that in case of failure, primary investment would be returned. Government's own "skin in the game" which would incentivise other investors' risk appetites and alleviate the financing challenges of capital intensive B2B companies.

Overall, the findings reveal that there is a potential for crowdfunding as a complimentary financing tool for cleantech startups and brings with it certain advantages to investors and cleantech startups. It is a tool that can support investment into cleantech startups by highlighting its non-financial returns, however, its potential to sustain larger funding to cleantech startups is limited. The existing limitations also provide scope for governments to design policies that incentivise the various stakeholders involved. Future research should focus on deepening some of the insights brought through this report.

## 1. INTRODUCTION

As the world rushes to reach the goals of the Paris Agreement to limit global warming under 1.5 to 2 degrees celsius, one of the cornerstones in achieving this global objective would be development of technologies which mitigate or adapt to climate change. Within this context, investments into development of ‘clean technologies’ would play a crucial role in reaching not only climate but sustainability goals of the future, where experts estimate that the world will need to invest \$12.1 trillion over the next twenty five years in order to limit global temperature rise below 2 degrees celsius (Ceres and Locklin, 2016). Clean technologies are those technologies that are designed to minimize impacts on the environment through more efficient or less harmful methods pertaining to industries such as energy, energy storage, pollution and waste, mobility, manufacturing and so on. Some define cleantech as not only being limited to an energy sector, but define it as an ecosystem of firms, technologies and service providers which may include enabling and crossover technologies such as IT, life sciences or advanced materials (Caprotti, 2012).

While the cleantech industry started attracting investment in the early 2000s, with the dawn of the 2008 financial crisis, the cleantech ‘bubble’ had burst by late 2000s and investments dried up. However, in the recent decade, with an increased attention on climate change and determination to transition to a green economy, investments in cleantech have been picking up where the new investment in clean ‘energy’ in 2019 alone was \$302 billion U.S. dollars worldwide, signifying a 2% increase from the year before (Statista, 2021). Investments in cleantech not only offer opportunities to tackle climate change but also provide avenues for increased growth of the economy through the

creation of new jobs and competitiveness through innovative business models. However, the overall cleantech investment trend, since the cleantech bubble burst, has not been showing a constant trend of investment growth rate with a recent example of decrease of 8% cleantech investment rate growth in 2017. IEA (2021) estimates that by 2021, cleantech which would consist of energy and efficiency technologies, would receive \$750 billion U.S. dollars, which is comparably a small fraction of the total \$1.9 trillion U.S. dollars that are expected to be spent in the global energy investments in 2021. According to IEA (2021), such moderate investments make it difficult for the world to meet its Paris Agreement climate target of 1.5 degrees and that more investments in market-ready and early stage clean technologies are essential to ensure climate change adaptation and mitigation.

Within this context, as a subproject on “Crowdfunding Cleantech” under the research project “Financing Cleantech” under the Swiss National Research Programme-73 on Sustainable Economy that aims to understand how new financing models can help attract investors into cleantech, this research aims to discover the potentials of using the new financing method of crowdfunding as a one way to spur investment into clean technologies. The project is about researching whether current crowdfunding tools can match the preferences of investors who act as capital injectors, with those companies with clean technologies that are looking to develop and deploy their technologies with the capital investment. For the stakeholders who are researching and looking to invest capital or receive capital in cleantech, we present an overview of challenges associated with investing in cleantech, investor appetites and the potentials of crowdfunding as a financial tool to address the stakeholders’ motivations.

## 2. POTENTIAL FOR CROWDFUNDING AS AN ALTERNATIVE SOURCE OF FINANCING FOR CLEANTECH

Given the urgency to mobilise financing into clean technologies in order to reach climate goals and avoid drastic global warming related impacts, there is a need to explore the potentials of different financing tools to invest in cleantech. The research focuses especially on early stage cleantech firms as the financing challenges faced by them differ from the established firms in the cleantech industry. As research on crowdfunding platforms as a way to finance cleantech startups is limited, our report aims to fill the gaps by exploring the following research question:

### **“Is crowdfunding a good solution to finance cleantech startups?”**

Thus, the review of existing literature guides the framework of our research. The main elements include literature on cleantech startup financing challenges, crowdfunding platforms, investment decision making and their interconnections.

Firstly, the review of the financing challenges faced by cleantech startups highlight the difficulty faced by these businesses in ensuring their environmental and social value creation is captured by the market. This ties into the lack of governmental policies in setting up financial infrastructure to support such value creation in the market. Cleantech, particularly cleantech hardware compared to clean softwares, tends to find it difficult to attract investment as they require large upfront capital investments, long horizon development and suffer a lack of exit opportunities for the investors given its high technological risks. Furthermore, these firms face information asymmetry as this is a relatively new and disruptive technology that requires high knowledge of the sector and technologies. Literature suggests that the investors in cleantech startups tend to possess specialized knowledge of the fields relating to cleantech. For example, an individual investor with expertise in

clean energy is able to properly assess the value of a disruptive cleantech business and a large firm may possess deep industrial knowledge and thus, pursue strategic objectives by investing in cleantech startups within their ecosystems.

Secondly, review of crowdfunding literature highlights that investors that invest through crowdfunding platforms are motivated by ideological considerations to make social and environmental impacts. They are often attracted to crowdfunding because the platform allows investors the autonomy and flexibility to choose from a diverse array of projects that differ largely in impacts and goals that may satisfy the personal investment motivations.

Lastly, the limited literature on crowdfunding cleantech startup sector sheds light on how investors prefer to invest in local cleantech projects that have an impact on the local environment. It is suggested that given the cleantech’s particular investment challenges associated with long horizon development and large upfront capital investment, lending-based and equity crowdfunding may be more appropriate to raise sufficient patient capital.

Existing literature does not address whether crowdfunding investors can be fully financially motivated when investing through crowdfunding and primarily focus on the importance of non-financial motivations when it comes to crowdfunding. By addressing this gap, the research explores the additional question of “can crowdfunding be treated as a legitimate financial tool?” Additionally, the literature does not distinguish between institutional and individual investors and their motivations within the crowdfunding sector, since many institutional investors and companies are developing crowdfunding platforms of their own. Finally, there is a need to address whether the covid pandemic has had any effect on crowdfunding cleantech trends since digital platforms have been the key platform of usage during the pandemic era.



## 2.1. Cleantech and its financing challenges

An interesting starting point to explore cleantech investments is the so-called “cleantech” bubble that existed between early to late 2000s. From 2004 to 2008, venture capital (VC) investment in cleantech alone increased from approximately \$1 billion to \$5 billion with an average annual growth rate of 47% (Gaddy et al., 2016a), which is a drastic increase compared to only 2% annual growth that existed in clean energy investment in 2019 worldwide (Statista, 2021). However, funding dropped sharply following the 2008 financial crisis, with the number of early-stage investments and the funding into cleantech companies remaining low and stagnant. The financial crisis created in the minds of many the fear that investment in cleantech is a ‘bubble’ (Caprotti, 2012). The crisis brought out the vulnerabilities of the global financial system and according to Caprotti (2012), highlighted that social-driven motivations lagged behind its technological developments in the cleantech sector.

In the contemporary financial literature, cleantech startup investment is often deemed difficult because of its long horizon development and commercialization, high capital intensity and low opportunity to exit for investors since it does not offer easier exiting such as from biotech startups (Hegeman et Sørheim, 2021). Hegeman et Sørheim (2021) also describes cleantech investment as having a double-externality problem. The first externality is shared by all high-tech startups, where spillover of the technological innovation impedes investors from fully appreciating the investment’s value. The second externality is only specific to cleantech investments since the “clean” value from the investment does not translate into financial returns since the market tends to fail to capture such positive externalities. Owen et. al (2021) also adds that SMEs in the cleantech sector may lack track record and collateral despite its significant innovation potential that may shape a wide range of sectors including energy, transport or manufacturing. However, when such a factor is coupled with under-valuation of environmental and

social impact benefits by the market, it makes it too difficult for investors to fully grasp the value of the cleantech SMEs to invest in. Furthermore, Bergset (2015) mentions that investors and public funding institutions may not invest in cleantech startups as they are not equipped to evaluate their business models since they are non-experts in such new cleantech business activity sectors and the market lacks an established benchmarks in evaluating early times of many types of cleantech market activity.

Literature makes distinction within the cleantech sector in terms of hardware and software. Gaddy et al. (2017) study shows that early-stage investments in cleantech softwares were more successful and returned capital to its investors compared to investments in cleantech hardware, materials, and processes, which tended to lose money. Cleantech hardware often requires a larger capital investment and often takes a longer period of time for returns to be realized, as a result it is more costly for VCs. This is despite the fact that VCs are more risk-taking private capital, it is still a big gamble for them to take on startups in the cleantech sector. IEA (2021) mentions that VCs invest in clean energy startups that have a clear near-term value proposition, without a high level of upfront capital as it enables their market creation and scale-up of technology. However, most investments in cleantech startups are coming from governments and companies as they continue to spend large sums on energy R&D projects (IEA, 2021).

The investment barriers in cleantech startups are often linked to lack of stringent policy and regulations by the government to build a financial infrastructure that can promote innovation and investment in cleantech startups since the current outlook consists of unclear government policy signals, spurring uncertainties associated with clean energy (IEA, 2021). Given energy sector has a political nature and that clean energy and tech have to compete against conventional forms of energy, a governmental policy to support the clean sector in the form of government grants and feed-in-tariffs,

works as an effective market signal for the investing community (Bürer and Wüstenhagen, 2009). Without an effective financial policy by the government to limit risks of investors, Migendt et al (2017) suggests that the investment community is unlikely to differ in their approach to cleantech startups despite few types of investors such as private equity (PE) and VCs having comparably higher risk appetites than institutional investors like credit unions, large banks and funds. In a Bürer and Wüstenhagen study (2009), investors favored the most consistent government policies that encouraged supportive investment environments for cleantech.

## 2.2. Investors in the cleantech sector

Despite barriers in investing, cleantech startups are estimated to attract a growing investment. While a study on VC investments in technologies by Gaddy et al. (2016) finds that investment in cleantech tended to have lower returns on capital compared to non-cleantech investments, this may indicate there are factors beyond short-term financial motivations for the growing interest in cleantech. Hegeman et Sørheim (2021) compared the motivations of SMEs and large corporations when they invest in cleantech and it was found that both categories of firms had mixes of financial and strategic objectives when investing in cleantech. Whereas SMEs focused more on financial objectives for business development and revenue generation purposes, Hegeman et Sørheim (2021) found that larger firms that invest in cleantech tended to make more strategic investments. Moreover, larger firms are well equipped to pursue strategic objectives through investment in cleantech startups as they are in proximity to their existing knowledge base, and so, corporate investors can leverage their expertise and make optimal investment decisions that are well-founded (Hegeman et Sørheim, 2021). According to Hegeman et Sørheim (2021), the corporate venture capital (CVC) investments by firms are on the rise, despite financial risks because “even if the investment fails, the learning provided to the investment firm can be such

that the endeavor is still regarded as a success because of strategic returns” (Hegeman et Sørheim, 2021, p. 4). The literature proposes that firms are motivated to invest in cleantech because of exploitative corporate learning opportunities, green development opportunities or may even replicate investments in cleantechs as competitors have done so (Hegeman and Sørheim, 2021).

Literature on investment decisions goes beyond modern finance theory that is based on understanding of rationality that are based on profit maximisation, risk and return. In entrepreneurial finance theory, large information asymmetries exist between investors and green startups, and therefore the very few investors that may invest in green startups tend to be specialized experts in cleantech or energy sectors (Bergset, 2015). Investors with specialized knowledge are able to properly assess the value of the cleantech business models whereas average institutional or individual investors, as mentioned by Bergset (2015), could react negatively to green startup investment proposals as they do not fit the conventional simple business plans. Green startups make sustainability-related information central to their market models, which may be deemed by investors as “superfluous information” (p. 269). On the other hand, behavioral finance goes beyond rationality to explain that investment in green startups may be driven by moral considerations or values, and factors such as emotion and intuition may be prevalent in investment decisions. Similarly, Caprotti (2012) makes an argument that investors in cleantech are driven through the discursive strategies in social and cultural relations, one example being that of the 2012 Paris Agreement that signalled the global acceptance of climate change, its grave impacts and motivation to mitigate and adapt to its risks as a society.

Bergset (2015) suggests that informational asymmetries create mismatch between investors and startups, but such mismatch is solvable through use of intermediaries with specialised knowledge in the cleantech sector or relationship building procedures

between investors and entrepreneurs, which can reduce informational asymmetries and risk between investors and entrepreneurs. Thus, the least mismatch between investors and entrepreneurs exists in the family and friends sector as these informal investors may be better informed about the entrepreneurs' motivation and capabilities (Bergset, 2015).

### 2.3. Crowdfunding

In recent years, crowdfunding has gained popularity amongst startups as a means to raise capital. The rise of crowdfunding tools accelerated after the 2008 financial crisis since the crisis made it rather difficult for many entrepreneurs and early-stage companies to access capital through traditional means such as bank loans (World Bank, 2013). Mollick (2014) defines crowdfunding as a way to collect relatively small amount fundings from a large number of individuals through the internet. For our research purposes, we refer to such a large number of smaller investors that crowdfund through digital platforms as 'retail investors' in order to differentiate them from institutional investors. Testa et al. (2019) explains that crowdfunding investors play an active role to develop the product or service in comparison to the traditional business models, which have lesser direct involvement of funders involvement in the product or services. Therefore, some literature emphasizes that the defining characteristic of crowdfunding is the close connection between companies and their crowdfunding investors.

There is a wide variation in the type of financing mechanisms found within crowdfunding and its implications for investors and firms. According to Belleflamme et al (2014), Collins and Pierrakis (2012) and the World Bank (2013), depending on the funding purposes and the method in which financial capital is raised, crowdfunding can be categorized into four models: donation-based, reward-based, equity-based and lending-based. Among these four types of crowdfunding platforms,

Kirby and Worner (2014) state that donation-based crowdfunding and reward-based crowdfunding can be classified as "community crowdfunding" whereas lending-based and equity-based crowdfunding can be classified as "financial return crowdfunding." The major difference between these two types is whether there is a financial payback or not and this difference affects the motives of each crowdfunder (Lam & Law, 2016). In a donation-based crowdfunding, funders are less likely to expect monetary compensation and act more like donors (Lam & Law, 2016). Reward-based crowdfunding is a system where entrepreneurs offer non-financial rewards such as pre-sale products or services in exchange for donations (Gadja & Walton, 2013). According to Gadja and Walton (2013), reward-based crowdfunding has the potential to raise a higher amount of funding than donation-based when project owners strategically prepare different types of returns depending on the amount of the donation. Lending-based crowdfunding is used by those who want to receive financial support from a group of people (Buysere et al., 2012). In this type of crowdfunding, platforms help to make a match between lenders and borrowers and in the process, borrowers can gain financial support with a lower interest rate than traditional financial sources (Gadja & Walton, 2013; Lam & Law, 2016). Lastly, equity-based crowdfunding is the funding scheme that enables investors to receive small stakes of the business, in the form of company shares, in exchange for the investment (Collins & Pierrakis, 2012). In this case, a crowdfunding platform plays a role as an intermediary which enables direct interaction between investors and entrepreneurs (Lam & Law, 2016). Both cases of lending and equity-based crowdfunding have investors who expect a monetary return and therefore, the research categorizes them as 'investment crowdfunding platforms.'

## 2.4. Crowdfunding investors

As Vasileiadou et al (2016) claims, there is a heterogeneity of motivations among investors such as gains, normative and heroic motivations in crowdfunding. Understanding these different motivations among crowdfunders is necessary for successful financing. Several researches have studied why investors choose to invest in a business through crowdfunding. According to Mollick (2014), crowdfunding methods allow a diverse range of investors to raise money for a wide array of projects without having to rely on standard financial intermediaries. Mollick (2014) argues that investors even tend to shy away from overfunded or large projects on crowdfunding as they have higher chances of having institutional challenges in meeting deadlines of the investors. Main argument for crowdfunding is that it provides investors with more flexibility and autonomy to financially invest in projects which they want to support. Moreover, beyond projects' outputs in terms of financial returns or non-financial such as social impacts, the crowdfunding platforms present projects that are largely differing in their magnitudes and goals, and present investors with a chance to build a diversified portfolio. Petruzzelli (2019) argues that crowdfunding investors engage financially in crowdfunding campaigns in order to gain financial or material benefits but sometimes they also contribute based on ideological considerations. In this regard, crowdfunding offers an opportunity to the investors to decide on the magnitude of the impact of the projects.

The literature from Gerber Hui and Kuo (2011) and Gerber and Hui (2014) identify four main motivations for investors to choose crowdfunding as their financing tool. The motivations are listed in a hierarchical order. Firstly, investors aim to collect rewards, which can be either financial, materialistic such as receiving gadgets or new technology assets, or it can be intangible rewards such as acknowledgment. Secondly, investors who utilize crowdfunding are motivated by their

willingness to help others. Thus, investors are not strictly seeking rewards but also looking to contribute to individuals or the community as a whole. Third, the authors argue that crowdfunding investors are motivated by their additional need to be a part of a community. Some investors may feel the need to belong to a group of like-minded people with similar values, which is gratifying and may aid their social circles. Finally, supporters may invest in projects that are in line with their identity and personal beliefs. In this context, it is about the willingness to invest money in ideas that intrinsically bring investors a particular personal satisfaction. While the crowdfunding investment decision making literature deepdive into multifold motivations of investors on crowdfunding platforms, it does not fully address whether crowdfunding, with all its non-financial rewards for the individual investors can still be credibly considered as a legitimate financial tool in line with all the other available financing tools like VC or angel investing.

There exists large literature on success factors of crowdfunding projects in attracting investors and often it deals with the effectiveness of the project's campaigning since according to Adhami et al. (2017), it is an inclusive capital raising process that is based on engagement between firms and potential investors. Communication factors such as rhetorical strategies, readability, length, or presentation methods of the project on crowdfunding were found to produce positive impacts on attracting investors (Petruzzelli et al., 2019). Testa et al. (2019) even emphasizes that the engagement factor also encourages better development of products and services that startups may offer.

In a study conducted by CrowdfundingHub (2016) on 27 European countries, an important factor determining crowdfunding usage is government regulations to improve the maturity of the market and build the confidence of market participants. The UK is found to have high usage of crowdfunding and increasing scale of deals, as it has

the highest maturity index in this alternative finance industry. The maturity of the UK crowdfunding industry is explained by the government's progressive crowdfunding regulations, improving SME access to alternative finance by obliging banks to offer alternative finance options to whom they refuse loans, and granting tax reliefs such as the Seed Enterprise Investment Schemes. The subsequent list toppers are Netherlands, France, Estonia, Germany, Austria, Spain, Finland, Switzerland, Sweden. CrowdfundingHub (2016) clarifies that high usage volumes does not directly correlate with crowdfunding maturity as the lack of regulations may be encouraging certain types of crowdfunding such as peer-to-peer lending.

### **2.5. Cleantech startups on crowdfunding**

Crowdfunding has recently gained traction in the field of cleantech. Adhami et al. (2017), analyzed 423 green projects in 27 crowdfunding platforms in Europe from 2011 to 2017, found that crowdfunding investments for green projects are particularly important. The importance stems from the difficulties that entrepreneurs in the field of sustainability face as they often find it difficult to raise capital through traditional financing methods (Choi and Gray, 2008). Choi and Gray (2008) argue that many entrepreneurs in the arena tend to lack the knowledge of business development, since the field of sustainable businesses is a recent phenomenon. There exists insufficient literature on what particular advantages crowdfunding might offer for cleantech startups from other possible tools of financing and how it may impact cleantech startups' decision to raise their capital from crowdfunding platforms. However, literature on the disadvantages of cleantech startups using other forms of financing mechanisms aside from crowdfunding, may offer an insight into why might cleantech startups exist on crowdfunding platforms. For example, Cumming, Henriques and Sadorsky (2013) explains that cleantech VC

investments lack the ability to fully capture the benefits of cleantech to society. The inability of mainstream financial institutions to fully capture the positive externalities of cleantech investments continue to be a reason for the under investment of the cleantech sector according to McNutt (2002) and Henriques et al., (2013).

The literature mentions that a cleantech project's success may depend on the type of crowdfunding platform it may choose. According to Law (2016), donation-based and reward-based crowdfunding could be suitable for small-scale renewable projects as their project delivery is achieved in a shorter period of time. On the other hand, larger scale renewable projects or projects that require large infrastructure development are most likely to be successful in raising capital through lending-based and equity-based crowdfunding as they require large upfront investments and long completion times (Lam & Law, 2016).

A study conducted by Knight (2012) in the US and UK revealed that most investors found the location of the investment an important factor as most cleantech companies focus on their local natural environments. In the cases where investors invest outside their proximity, they do so in return for the businesses fulfilling their demand for risk premiums, in the form of investment returns, that are above an average level. Several authors including Burtch et al. (2014) and Kang et al. (2017) emphasize the central role of geographic and cultural factors in explaining crowdfunding campaigns' successes. Regarding geography, Kang et al. (2017) Burtch et al. (2014) argues that distances and close proximity positively influences crowdfunding investment since campaign creators could exploit its proximate investors' social networks. Moreover, investors tend to face higher information asymmetry when it comes to clean technology since it can require specific technical knowledge, making investment challenging due to lack of understanding of its business models

**Table 1: Takeaways from Literature Review**

Section	Key information	Takeaways
Cleantech financing challenges	The cleantech bubble created investment uncertainty among investors.	Always a fear about an impending “burst”.
	Positive externalities of clean investment are not captured in financial returns. Non-experts are unable to evaluate business models & benchmark investments.	Cleantech underinvestment due to lack of investors that have expertise in cleantech related sectors.
	Hardware cleantech startups usually require more capital and are riskier than software investments.	Difference in financial challenges based on the type of business.
	Lack of government support in building financial infrastructure that can capture cleantech value creation in the market and create market signals for investment.	Government policies and its subsequent market signals help to de-risk cleantech investments.
Investors in the cleantech startups	Large corporations invest for strategic objectives and are able to make , i.e, optimal decisions based on their existing industrial knowledge.	Lesser financing opportunities for startups outside of corporate strategy and ecosystems.
	According to entrepreneurial finance theory, investors with technical knowledge are motivated to invest due to the ability to properly assess and value business models.	Level of information asymmetry between investors and businesses determines investment decisions.
	According to behavioral finance, cleantech investments are driven by morals, values, emotions and intuition.	Behavioral finance may be an important tool to assess non-financial motivations of cleantech investors.
Crowdfund Platforms	Allows for lost engagement between businesses and funders.	Reduces communication gaps and helps to quickly clarify business expectations.
Crowdfunding Investors	Investors are attracted to crowdfunding platforms due to the diversity of projects available.	Provides investors with flexibility and autonomy.
	Personal satisfaction from investing in projects that satisfy their ideological beliefs.	Integration of non-financial motivations of investors into investments.
	Communication strategies are a key to maximize engagement between investors and companies.	Might decrease information asymmetry.
	Government policies on crowdfunding such as progressive regulations and tax reliefs, build up maturity of the crowdfunding industry and its usage.	The confidence of investors to invest through crowdfunding depends on favorable government regulations.
Cleantech Startups on crowdfunding platforms	Success may depend on the suitability of the type of platform in relation to the project. Equity and debt crowdfunding are deemed more suitable for startups with high capital intensity.	Important for businesses to map their business type with the suitability of crowdfunding method.
	Location of startup (local is preferred) factors into the decision making of investors.	Project location may be an important factor to crowdfunding success.

### 3. RESEARCH METHODOLOGY

Current literature lacks clear interlinkages between cleantech startups and crowdfunding. Thus, our research objective is to give practitioners, policymakers and academics a general overview of the opportunities and challenges related to cleantech investments through crowdfunding. Based on the existing literature gaps and takeaways, the research has formulated several hypotheses to our main research question: **Is crowdfunding a good solution to finance cleantech startups?**

The sub-questions to guide the research in answering the answer the main questions:

- 1) When does crowdfunding make sense for cleantech?
- 2) Which investors are motivated to invest in cleantech startups through crowdfunding?
- 3) What are the factors that synergize the presence of cleantech startups on crowdfunding and investor motivations?

#### Hypothesis

With insights from literature, the research comes with 3 hypotheses that assess crowdfunding from the perspectives of cleantech startups and from investors. Understanding both perspectives are essential to identify overlapping motivations or mismatches between the capital injectors and capital receivers, to analyze the potential of crowdfunding.

**Hypothesis 1:** Crowdfunding platforms provide cleantech startups the avenue to attract a diverse range of investors that have a combination of financial and social-driven motivations.

**Hypothesis 2:** The technicality of cleantech startups may prevent most retail investors from investing due to their limited understanding of its complexity.

**Hypothesis 3:** Improved government policies and regulations can encourage crowdfunding investment into cleantech through supporting maturation of crowdfunding and the value creation of cleantech startups.

#### Research scope

**“Startup” cleantech firms**, for their particular financing challenges that may not exist for established cleantech firms.

**“Investment” crowdfunding platforms** (equity and lending based platforms) with insights from other reward and donation based platforms.

**Geographical focus on relatively “mature” crowdfunding**, which allows for significant investment in crowdfunding, such as the UK, France, US and Switzerland.

#### Stakeholder mapping

To assess the validity of our hypotheses, we conducted semi-structured interviews with 13 experts in each ecosystem of cleantech, startups, crowdfunding and investment.

**Cleantech startups:** cleantech SMEs and startups, incubators, accelerators for startups, technical experts (in cleantech or related sectors)

**Crowdfunding:** Platform developers, Communication Experts, Academic in alternative finance, People who have crowdfunded in the past.

**Investment:** Financial Professionals, Investors

**Table 2: List of Interviewees**

Expert	Background of the interviewee	Expertise
A	Deeptech incubator	Technical expert, Startup Incubator, Crowdfunder in the past
B	Non-profit association for supporting entrepreneurs	Business Development Expert
C	Accelerator and Incubator for impact tech ventures	Financial Professional Startup Incubator and Accelerator
D	Cleantech Platform by Swiss cantons for support SMEs and startups	Technical Expert Cleantech startup, Accelerator
E	School of Accounting & Finance, Technological University Dublin	Academic focused on crowdfunding
F	Geneva based reward-based crowdfunding	Technical expert Crowdfunding platform developer
G	American equity crowdfunding platform	Financial Professional, Crowdfunding platform developer
H	Swiss reward-based crowdfunding platform	Crowdfunding platform community developer
I	Communications in Geneva based crowdfunding	Communications expert
J	French bond-based crowdfunding platform of a renewable energy company	Crowdfunding platform developer Financial Professional
K	Private equity firm in UK	Financial Professional, with background as Institutional Investor
L	Wealth management in impact funds	Institutional Investor, Technical Expert, Crowdfunded in the past
M	Angel Investor	With background as a Financial Professional, Startup Incubator and Accelerator, Crowdfunded in the past

Since the main ecosystems in which experts exist can be divided into three main buckets of cleantech startups, investment and crowdfunding, two researchers took lead in interviewing cleantech startup related experts while the remaining two researchers specialized in investment related topics.

In their own buckets, all researchers collected insights regarding crowdfunding from their interviewees for comparison exercises. Such methodology helped to identify where motivations of cleantech startups, cleantech investors and crowdfunding investors may overlap or differ.



#### 4. WHEN DOES CROWDFUNDING MAKE SENSE FOR CLEANTECH?

##### **Difference in roles of Crowdfunding and Traditional Private Equity Investment**

As the research focuses on analyzing how crowdfunding can play a role to finance cleantech startups, it is useful to compare the crowdfunding to Venture Capital's (VC) high risk private equity investments into non-listed cleantech companies. Through research and interviews, we have come to the understanding that crowdfunding and other investment methods such as VCs play a different role in financing cleantech startups. For example VCs come at a much later funding stage than crowdfunding. In order to obtain an investment by VCs, companies need to either have a well-tested product or a detailed prototype along with financial projections to prove their capability and market value.<sup>1</sup>

According to the data from Hodgson (2020), although the amount of venture capital investment in Europe (including Israel) has increased to \$46 billion (as of December 14th in 2020) compared to \$41.8 billion in 2019, the number of venture capital deals has declined from 7,502 to 5,883. This means that less startup companies have opportunities to launch their business and the competition is getting more intense. This implies that VCs require more detailed financial information and startups face intense competition for limited VC resources. This leaves room for crowdfunding to come in and provide an avenue for startups to launch campaigns and gain funding without such a detailed process.<sup>2</sup> Some of our interviewees also point out that crowdfunding can help companies in appealing its potential to VCs for larger investment.<sup>3</sup> This could be the possible reason behind why VCs come at a larger investment stage. Hence, crowdfunding and other investment methods such as VCs play different roles in financing cleantech companies. The capital that companies can obtain

from each financing method is very different: VCs can offer larger investments, fiercer competition, normally come at a later stage. Perhaps Angel investors could be the comparable financing method to crowdfunding considering the size of the investment, however, this would require further research to verify.<sup>4</sup>

##### **Market validation and a sense of community**

Bringing in the perspective of a Swiss reward based crowdfunding platform, the interviewee mentions that most startups on their platform attract private individual investors who want to help in the clean transition broadly in two ways. Firstly, through the belief that startups can bring innovative change. Secondly, they want to support people within startups they already know.<sup>5</sup> Since it is a reward based crowdfunding platform, it often involves B2C products and services which can provide a tangible reward.

An example that came out of the discussion was a company that aimed to sell the composting trash can. The interesting bit of their campaign on the crowdfunding platform was that they not only attracted investment since it was a product that directly could be used by investors but also to test the market with low risk. Using the previous example, the company sold about 1000 units without first producing it and the only cost they bore was for marketing the campaign and in such a way they were able to verify that a market for such a product exists. This aspect of market validation allows startups to verify whether people understand the problem they are trying to solve and are willing to pay in advance.<sup>6</sup> Moreover, in the cleantech sector, launching a crowdfunding campaign also creates an opportunity to raise public awareness about critical environmental problems since crowdfunding requires intensive communication with individual investors.<sup>7</sup>

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<sup>1</sup> Expert A, deeptech incubator

<sup>2</sup> Expert B, business development expert

<sup>3</sup> Expert B, business development expert and Expert C, startup accelerator & incubator

<sup>4</sup> Expert E, crowdfunding research and Expert D, cleantech expert

<sup>5</sup> Expert F, Swiss crowdfunding developer

<sup>6</sup> Expert B, business development expert

<sup>7</sup> Expert H, Swiss crowdfunding community expert

Furthermore, it helps to build a community around the product and the company's vision. If there is a restaurant that is on a crowdfunding platform, an institutional investor will be looking to make returns on it and perks such as a free glass of wine at a restaurant will not be enough of a motivation due to the large value of investment.<sup>8</sup> However, when we look at investors in crowdfunding platforms who pay about 10 francs per ticket, a glass of wine is enough of a motivation coupled with the fact that within a few visits they can make their investment back. Through these insights we see a hybrid of both a sense of community and a financial motivation.

### Type of businesses that choose to crowdfund

There is heterogeneity across the nature of business. We see Business to Business (B2B) and Business to Consumer (B2C) firms having varying experiences due to different end users of their product or service. When it comes to B2B, it becomes important for cleantech firms to convince other businesses for which they usually need a proven financial track record, so there is a challenge in getting traction.<sup>9</sup> On the other hand, when it comes to B2C businesses we see that it might be relatively easier to gain the first few customers but then there is a roadblock in achieving larger volumes.

Additionally, it is important to mention here that even though a business is B2B, sometimes to persuade other businesses, one might need to prove that there is an existence of final customers for the same. For example if a business is selling sustainable cutlery to restaurants then it is also important to prove that this would be appreciated by end consumers who arrive at the restaurant. So there is an interplay between businesses and consumers in creating financing obstacles for cleantech firms. Another nuance is that it is not always about B2B in comparison with B2C, sometimes the choices made by the businesses about markets and geographies to enter

also influence the speed in which they attract investments.<sup>10</sup> An example that illustrates this would be a waste management startup deciding to work with restaurant chains as against builders based on avenues for financing, such critical choices made by the management also influences the nature of difficulties faced.

Financing challenges also is a function of the type of cleantech, with certain themes attracting the fancy of investors. Expert E, crowdfunding researcher, speaking of his research experience in the UK and Ireland, sees an investor trend towards energy efficiency due to it being not as disruptive as other cleantechs when it comes to changes in existing infrastructure. This is because it only needs a small tweak in an existing technology.<sup>11</sup> The expert from the cleantech association also brings in the perspective of startups that focus on software and are within the IoT (Internet of Things) domain; it is much easier to understand software, make a newer version and as a result faster to achieve returns on investment.<sup>12</sup> When it comes to cleantech hardware, it is known as patient money and often takes longer to get returns.

Therefore, cleantech startups need to actively think about their businesses, the type of end-users, their geography, their technology, and decide on the appropriateness of crowdfunding to capitalize on their strengths.

### Future Prospects

A future focused functionality of crowdfunding is the concept "wisdom of a crowd" which aims to bring out the idea that there is a reputational effect gained from crowdfunding that increases a firm's potential for attracting additional financing in the future.<sup>13</sup> The amount raised through crowdfunding has a positive effect on the post-money valuation of the firm, which is greatly beneficial to seek additional funding from

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<sup>8</sup> Expert G, US crowdfunding developer

<sup>9</sup> Expert D, cleantech expert

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<sup>10</sup> Expert C, startup accelerator & incubator

<sup>11</sup> Expert E, crowdfunding researcher

<sup>12</sup> Expert D, cleantech expert

<sup>13</sup> Expert E, crowdfunding researcher

external sources (Expert E, crowdfunding researcher et al., 2021). Banks like ING in Belgium offer clients that want to do crowdfunding the service of putting them in touch with partner crowdfunding sites such as KissKissBankBank and Seedrs (Finextra, 2015).<sup>14</sup> Through such a service, banks not only add an additional business avenue but also test the market for a product before they give respective firms a loan. In this way banks lower their risk and promote crowdfunding.

As mentioned previously crowdfunding allows companies to test whether the products and services offered by a business are viable in the market and this can be useful for their future as well. Since opening up a campaign usually does not require large investment, companies can start the crowdfunding campaign and analyze the market value of their business while limiting their financial losses. The success of a crowdfunding campaign can be an indication of how the business will develop afterward, signaling a possible future. Given that participation in crowdfunding is easier than obtaining investment from VCs and other sources, crowdfunding can play an important role to provide business opportunities for early-stage cleantech companies.

This futuristic impact might be more relevant for a B2C business which wants to expose and test out its brand in the market.<sup>15</sup> However, a critical lense is also required when evaluating such functionalities of crowdfunding platforms. We see that significant amounts of money is spent on marketing campaigns and as a result people might be attracted to invest based on superficial factors such as videos. In such a case, it might not be the most accurate way to test the market and may not purely help in testing out future prospects. Overall, these future focused functionalities may push crowdfunding platforms to further collaborate with institutional investors to bridge an existing financial gap while also allowing greater synergy between various funding stages of a cleantech startup.

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<sup>14</sup> Expert F, Swiss crowdfunding developer

<sup>15</sup> Expert C, startup accelerator & incubator

## 5. WHICH INVESTORS ARE MOTIVATED TO INVEST IN CLEANTECH STARTUPS THROUGH CROWDFUNDING?

### Cleantech startup financing challenges

Experts have a positive outlook that the second period of rising cleantech investments is not another cleantech bubble, as it is predicted that SDG themes that define cleantech investments will become the main and permanent theme of the investment landscape.<sup>16</sup> While cleantech startups have the SDG features, the startup nature of the businesses bring various financing challenges.

The main obstacle to startups receiving investments in the initial stages revolves around capital intensity of most cleantech firms and the high risk nature of investments (Gaddy et al., 2016b). This insight was concurred by experts across the cleantech domain. Researcher at Technological University Dublin elaborates that cleantech firms take a significant period of time before they hit commercialization and as a result cleantech firms that require large capital outlay become attractive to institutional investors only three to four years after their founding.<sup>17</sup> Early stage cleantech firms are in the valley of death (Al Natsheh et al., 2021), the risk return ratio is not appealing enough for investors to get involved at an early stage. One of the explanations for such a long wait time is the need for a pre-requisite infrastructure to support some of the offerings of cleantech firms. For example, if a technology aims to make changes to the energy or water systems where already millions of francs have been spent to build an existing infrastructure, sufficient testing is required to prove that it works in the field.

Furthermore, there is a long regulatory path to market because there are a number of regulations, which need to be amended or issued, to ensure those companies can then have their technology used in different geographical markets. An analogy that helps cement this point and was used in several of our

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<sup>16</sup> Expert A, deeptech incubator

<sup>17</sup> Expert E, crowdfunding researcher

interviews is the commercial adoption of solar panels thirty to forty years after it came into existence. This example highlights the significant time buffer required for regulations and infrastructure to catch up with technology and help support its growth.

Furthermore, the cleantech bubble bust of the 2010s is still fresh in the minds of investors along with the hesitation towards new clean technologies. Biggest example is solar panels. Firstly, public finance strategies by governments such as the US and Europe, paved the way to development of solar PV panels and wind energy technologies. However, soon the subsidies from the governments stopped and it became difficult to produce the large number of panels, which were not financially viable nor cheap.<sup>18</sup> Second shock to investors came when the companies with the solar panel technologies outside China got hit by Chinese solar panel competitions.<sup>19</sup> Since China could produce a greater number of panels, at much lower cost, its European counterparts as well as US counterparts like Solyndra that was heavily subsidized by the US administration, went bankrupt. Technological uncertainties, lack of regulatory path, capital requirement and deployment risks are all deemed as risks from the investment perspective.

### Types of investors

Investors are often categorized as institutional and individual investors. However, investors may differ within the categories based on objectives, expertise and resources (CFA Institute, 2014). Most importantly, they differ in terms of whose capital they are investing in, determining their mandate. Retail investors, angels, governments and non-financial companies determine their own investment mandate such as risk, return and liquidity appetites, based on their own motivations. Financial companies hold capital on behalf of its clients, and so their motivation to invest is determined by the extent of the mandate given to them.<sup>20</sup>

**Table 3: Types of investors**

Type	Investor	Investment mandate:
Individual	Retail investors	Own
	High-net-worth individuals e.g. business angels	Own
Institutional	Financial companies: investment companies (mutual, hedge, private equity funds), banks, insurance, pensions	Clients or Fiduciaries <sup>21</sup>
	Non-financial companies E.g. Corporations	Own, based on proportion of revenues

<sup>18</sup> Expert L, impact wealth manager

<sup>19</sup> Expert L, impact wealth manager

<sup>20</sup> Expert K, private equity manager

<sup>21</sup> An individual/company that entrusts their capital to a financial professional to manage

## Financial companies

Traditionally, financial institutions' mandates are purely financial, they maximize returns while minimizing risks as this is the mandate given to them by their fiduciaries. However, there is a new trend of how clients' mandates are changing:

- 1) To invest in ESG related businesses i.e. to prevent stranded assets.<sup>22 23</sup>
- 2) To deliver social and environmental impacts through investments.<sup>24</sup>

Despite the positive trend of investment motivations towards ESG and impact making that is related to cleantech businesses, the startup aspect of cleantech startups adds a layer of complexity. The capital intensity, long commercialization time and regulatory paths are all risks from an investor perspective. According to a private equity manager who specializes in risk management and has previously worked in a large Swiss bank, banks are most unwilling to deal with such risks that come with cleantech startups, despite being in the ESG sphere, because banks' risk appetites are low.<sup>25</sup>

*“Risk calculations of banks are highly formulaic. If you're truly supporting the E in ESG, financial institutions need to factor in a level of losses associated with smaller companies in their formulas.”<sup>26</sup>*

On the other hand, risk appetites of fiduciary investors such as investment managers or private equity are higher than banks.<sup>27</sup> Not only are the clients interested in investing in ESG, but through it, the clients' assets are de-risked and future-proofed from becoming stranded according to the equity manager.<sup>28</sup> However, despite the comparably higher risk appetite, private equity is still unwilling to invest in cleantech

startups as the investment is too risky, despite their expanded risk appetites compared to banks, for their given mandate. The risks include:

- Lacking expertise in cleantech to assess its business model and technologies
- Cleantech startup valuations are too high
- Uncertainty on returns and return period
- Lack of quick exit opportunities due to illiquid and patient capital
- Inability to demonstrate businesses maturity i.e. 5 years of revenue reports<sup>29</sup>

On the other hand, some institutional investors are increasingly being given the explicit mandate to only invest with “impact” or investors are choosing “impact” driven investment managers. Upon an interview with an impact manager at an “impact” wealth management firm, they are mandated to invest in. However, it is important to note that while they focus on “impacts,” financial performance is still relevant although returns aren't demanded to be very high.<sup>30</sup> Therefore, according to the impact investment manager, they prefer to stay in sectors such as solar and wind rather than CCS (carbon capture storage).<sup>31</sup> According to a financial expert working in the renewable energy sector, the solar and wind renewables sector is already considered a mature sector within cleantech, and risks associated with the sector are low.<sup>32</sup> On the other hand, new and disruptive projects with high capital requirements in R&D are early stage cleantech businesses that are considered too risky even if investors are given the mandate to make impactful investments.

Larger investment managers such as Black Rock set aside capital valued at \$4.8 billion just to invest in solar and wind renewables projects (Bloomberg, 2021). When fiduciary investors have such large investments, they are in a better position to provide large and patient capital needed for cleantech businesses compared to smaller fiduciary investors.

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<sup>22</sup> Assets that will no longer be useful or generate economic returns due to low-carbon economy transitions, i.e. coal plants, emission-intensive infrastructure

<sup>23</sup> Expert K, private equity manager

<sup>24</sup> Expert L, impact wealth manager

<sup>25</sup> Expert K, private equity manager

<sup>26</sup> Expert K, private equity manager

<sup>27</sup> Expert K, private equity manager

<sup>28</sup> Expert K, private equity manager

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<sup>29</sup> Expert K, private equity manager

<sup>30</sup> Expert L, impact wealth manager

<sup>31</sup> Expert L, impact wealth manager

<sup>32</sup> Expert J, French crowdfunding developer

However, upon closer look, even the largest investment managers have limited risk appetites since the renewables projects of solar and wind are already deemed by the renewable energy sector representative as a mature business category within cleantech.<sup>33</sup> Moreover, the funds mostly focused on renewables in the developed countries, offering even lower risks to its investors (Reuters, 2021). According to the researcher's sources, large institutional investment companies like BlackRock, approach cleantech startups with caution and as an unlikely field of investment, since the periods of commercialization are too long, could be up to 20 year.<sup>34</sup>

Despite this, the climate topic especially is becoming central to all investments as pressures grow on finance to direct resources towards tackling climate change. So, in November 2021, Black Rock decided to take on more risks by investing in cleantech projects in emerging markets through its \$673 million infrastructure fund with a 20% backing from French, German and Japanese development banks as well as philanthropic institutions, who agreed to take the first losses before other investors (Reuters, 2021). As this fund is new, it is too soon to tell if Black Rock will be investing in the cleantech startups or if they may choose to prioritize shorter exit opportunities and later stage cleantech firms as has been the precedent. The trend seems to be that institutional investors are still reluctant to invest in cleantech startups because of financial considerations of risk and return, unless the government steps in with public financing to take the lead and bear most risks. Such a blended finance<sup>35</sup> approach could be an emerging solution to motivate institutional investors to take on more risks investing in cleantech startups.

### **Motivation to use Crowdfunding**

While financial companies seem to lack motivation to invest in cleantech startups due to high risks, we wanted to understand the perspectives of institutional

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<sup>33</sup> Expert J, French crowdfunding developer

<sup>34</sup> Expert E, crowdfunding researcher

<sup>35</sup> Use of a common investment scheme that utilizes a mix of public and private funds.

investors on crowdfunding and if they have motivations to invest through it. Most of the interviewed financial experts in institutional investment were skeptical of crowdfunding as a viable tool for investment, rather than a charity or a donor tool. Wealth manager described that a fiduciary investment helps its clients to “break emotional link with money,”<sup>36</sup> so that the capital is best allocated by the fiduciary investors, based on facts, calculations, and set of procedures. On the other hand, according to financial experts, crowdfunding instead introduces emotion as a factor because oftentimes, projects on crowdfunding appeal to its investors through its “virality”. For example, the wealth manager takes into account how “viral” project crowdfunding triggers an emotion of missing out in potential investors.<sup>37</sup> Furthermore, financial experts have little motivation to consider crowdfunding as a viable financial tool because:

- Valuation of projects sometimes do not make financial sense as they are too high whilst being new
- Lack of available information on financial reporting and future spending details
- Lack of proper due diligence that is compared to other financial intermediaries
- Platforms lack any duties and responsibilities towards the projects and investors

One possible implication for a crowdfunding platform that improves upon its characteristics mentioned above and emerges as a capable investment tool is whether institutional investors would consider investing through it. Many of the duties such as due diligence, financial reporting, risk and return profilings well as fiduciary obligations are of institutional investor, which may overlap An individual investor has a positive reaction to such prototype as it saves time and resources,<sup>38</sup> whereas it is difficult to predict whether institutional investors would utilize a platform with overlapping duties.

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<sup>36</sup> Expert L, impact wealth manager

<sup>37</sup> Expert L, impact wealth manager

<sup>38</sup> Expert M, angel investor

## Corporations

After the first cleantech burst, where VCs in cleantech lost over half of their \$25 billion investment, there was a move towards focusing on cleantech softwares. Cleantech VC representatives say their industry is mostly choosing to focus on “maybe smaller components that optimize batteries, not someone trying to build a new battery” (Szkutak, 2020). Softwares suited their goal of large payoffs and quick scaling of technology in the market (Gaddy et al., 2016). Nest Labs was the only post-cleantech bubble large corporate acquisition of a cleantech startup from a VC, which also happened to be a software cleantech. From a VC perspective, anything besides cleantech softwares were uncompetitive in the market and unattractive to corporate acquirers (Gaddy et al., 2016).

However, the recent decade showed that corporations themselves have stepped in to form their own corporate venture capitals (CVCs) as part of their corporate strategy. Only in the first half of 2021, corporate VC investors participated in \$78.7 billion of funding in 2099 deals globally (CB Insights, 2021). The deeptech incubator representative revealed that the funding from corporate VC investors in deeptech, which includes the long development period of cleantech hardwares, have also been seeing increase.<sup>39</sup> In the Swiss landscape, corporations can dedicate up to 200 million francs of patient capital to their CVC funds.<sup>40</sup> According to the incubator expert, having a CVC is a good way for corporations to support creativity without having to disrupt their main model of their businesses.<sup>41</sup> For example, the expert has named the best VC specializing in cleantech startups in Switzerland as Emerald Ventures.<sup>42</sup> Emerald ventures’ biggest co-investors include large corporate VC investors such as Caterpillar Ventures, BMW iVentures and Microsoft. So, these corporations

mostly have strategic objectives when investing in cleantech startups:

- invest in innovation in their ecosystems
- gain knowledge on new technologies
- understand where markets are developing
- form corporate strategy on how to develop technologically in the future
- de-risk their core businesses<sup>43</sup>

According to the expert, CVCs tend to come at earlier stage than traditional VCs,<sup>44</sup> entailing higher risk from an institutional investor’s perspective. However, they’re able to bear the risks of an investment because they have the advantage of having “domain expertise”<sup>45</sup> related to the startup, to understand the risks and values of the business models, moreover, they are less concerned about making “huge financial results”<sup>46</sup> than pursuing its strategic objectives. Thus, large corporations are well suited and also motivated to invest in cleantech startups that exist in the ecosystems of their domain.

### Motivation to use Crowdfunding

The interviews have highlighted a trend that large or small corporations are becoming crowdfunding platform developers, with a mix of strategic and financial objectives. In Switzerland, a large utility provider has developed its own reward-based platform with the objective to make an impact on the community, by supporting local businesses and local startups to come to their platform.<sup>47</sup> In this case, the platform achieves corporations’ strategic objectives for the community rather than any financial objectives, given that it does not receive any fees from investors and businesses when they make exchanges through the platform.<sup>48</sup>

Another type of crowdfunding that a renewable energy corporation develops is for both

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<sup>39</sup> Expert A, deeptech incubator

<sup>40</sup> Expert A, deeptech incubator

<sup>41</sup> Expert A, deeptech incubator

<sup>42</sup> Expert A, deeptech incubator

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<sup>43</sup> Expert A, deeptech incubator

<sup>44</sup> Expert A, deeptech incubator

<sup>45</sup> Expert A, deeptech incubator

<sup>46</sup> Expert A, deeptech incubator

<sup>47</sup> Expert F, Swiss crowdfunding developer

<sup>48</sup> Expert F, Swiss crowdfunding developer

financial and strategic objectives.<sup>49</sup> The renewable energy company in France developed a platform that issues bonds for its investors, when they invest in new cleantech projects or technologies that are owned and operated by the renewable energy corporation itself.<sup>50</sup> There's the advantage of the company being able to get funding for the project without having to go public.<sup>51</sup> Strategic objectives include the ability to gain acceptance of the technologies within communities. For example, renewable energy projects such as wind receive an overall positive public opinion, until the moment that this wind project will be developed in your own backyard.<sup>52</sup> Through crowdfunding, the public is able to access the projects and invest, so the local acceptance is improved.<sup>53</sup> According to the expert, this is a way to not only improve public opinion but also allow the public to access economic and financial benefits of green transition, rather than simply making them end users of its environmental and societal impacts. Unlike institutional investors, the aim of the corporations when developing crowdfunding platforms seem to re-introduce emotional or personal connection factors into investment decision making.

*"We don't have to go to the public to get funding for our projects. It's a way for these investors to access these real assets. Assets that are near their homes. There's some pride in investing near wherever I live."<sup>54</sup>*

Furthermore, as mentioned in Section 3: Future Prospects, corporate strategy for using crowdfunding can involve market testing their products and marketing their product or companies, according to a great way to market their companies and products according to a researcher in crowdfunding.<sup>55</sup> On the issue of equity financing their projects, the renewable energy expert says the success

was low despite putting out low risk projects.<sup>56</sup> The experts' reasons may include:

- Public wants a simple and easy to understand investment method *i.e. bonds*.
- Mature sectors like renewable energy do not fit the aims of an "equity investment," to invest small but gain large returns.
- Complexity of equity funding differs depending on the market location *i.e. UK and US have more mature crowdfunding markets and friendly legal frameworks which may attract more equity crowdfunders compared to Switzerland<sup>57</sup>*

In terms of platform characteristics, the corporation had done thorough due diligence and risk assessments of their projects, to guarantee a lack of project development risks. Such entry barriers for projects, due diligence and risk assessments, coupled with the corporation's established reputation, may be useful for crowdfunders seeking to make informed and less risky investments.

So far, large corporations have been motivated to invest in cleantech startups using CVCs, and corporations are also developing their own crowdfunding platforms. However, there are no cases where large corporations have invested in projects through existing platforms yet, let alone cleantech startups. On a closer look, the corporations seem to have a preference to get involved directly with development and investment of new projects and technologies when they have strategic objectives. Rather than using financial intermediaries like VCs or existing crowdfunding platforms, they choose to either develop their own platforms or set up their corporate ventures. Given crowdfunding is another financial intermediary to finance cleantech startups, it may be a tool that complements the financing of cleantech startups rather than being a main vehicle of investment.

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<sup>49</sup> Expert J, French crowdfunding developer

<sup>50</sup> Expert J, French crowdfunding developer

<sup>51</sup> Expert J, French crowdfunding developer

<sup>52</sup> Expert J, French crowdfunding developer

<sup>53</sup> Expert J, French crowdfunding developer

<sup>54</sup> Expert J, French crowdfunding developer

<sup>55</sup> Expert E, crowdfunding researcher

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<sup>56</sup> Expert J, French crowdfunding developer

<sup>57</sup> Expert M, angel investor



## Individual investors

Although the financial world has various categorizations of individual investors, the most common one is based on the amount of financial resources and the extent of business, financial or investment knowledge an investor has. Business angels have more resources and expertise, whereas retail investors tend to have less. According to the financial expert in the renewable energy sector, cleantech startups are unlikely to fit an average retail investor's motivations, in France.<sup>58</sup> These are:

- short-term liquidity dates
- some sort of annual coupons or returns
- minimal risk

However, these motivations are in opposition with the nature of cleantech startups, which are high risk, long development and commercialization assets.

An insight offered was that retail investors would be more keen to invest in cleantech software or gadgets, which not only have lesser risks compared to hardware or deep/disruptive cleantech because it is easy to capitalize on their clean appeals.<sup>59</sup> The expert gives an analogy of a clean straw and a nanomaterial.<sup>60</sup> If there is a "clean straw," a gadget that helps to save turtles in the ocean and also a nanomaterial to make batteries cleaner, the public will be more likely to invest in the gadget since it captures "clean" imaginations and is easy for the public that lacks the technical expertise to understand.

On the other hand, an angel investor says there are certain business angels that are willing to take on the cleantech startup risks, which even the institutional investors with large capitals are less willing to. If the startup deals with capital requirements, for their new and disruptive clean technologies, then the most suitable angel investors are those with technical expertise around IP, hardware and different technologies.<sup>61</sup> Such investors with technical

expertise can understand the value of the cleantech's IP early on and make investments accordingly. In a sense, the expertise of investors decreases the information asymmetry between investors and entrepreneurs, which makes investment easier for cleantech startups.

Climeworks is a successful example of a disruptive new clean technology gaining large capital from investors, thanks to its proper assessment of its technological value. It has raised \$125 million as of 2020 from private investors, becoming the world's most funded direct air capture technology (S&P Global, 2020). On a closer look, Climeworks had both its first 2 deals before 2012, amounting to \$126 thousand in the first and \$1 million each, while they were at an accelerator/incubator ("Climeworks Overview," 2009). The role of incubators and accelerators is to help startups to mature their business models. If the businesses pass the early survival stage of their development, then it gives some credibility for investors.<sup>62</sup> The literature review mentioned that the information asymmetry is large to invest in cleantech startups and that an intermediary with specialized knowledge could contribute to alleviating the asymmetry (Bergse, 2015). The realistic examples of such specialized intermediaries could be accelerators and incubators for cleantech startups, and they have demonstrated successes like Climeorks.

It seems that retail investors' risk appetite is a barrier to investing in cleantech startups whereas angel investors are more motivated to invest in these businesses in case they are equipped with the technical expertise. However, incubators and accelerators that are largely significant in developing the investors' knowledge about business models, and are helping to solve information asymmetries that may play a barrier to investments in cleantech.

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<sup>58</sup> Expert J, French crowdfunding developer

<sup>59</sup> Expert A, deeptech incubator

<sup>60</sup> Expert A, deeptech incubator

<sup>61</sup> Expert M, angel investor

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<sup>62</sup> Expert I, Swiss crowdfunding communications expert

## Motivation to use crowdfunding

In many countries, certain types of investments such as hedge funds are restricted to retail investors. To become accredited, in the US for example, an individual must have at least earned an income of \$200,000 annually prior two years and expects to earn the same the current accreditation year (CFA Institute). The remaining investment opportunities for retail investors are limited to stocks & bonds, mutual funds, real estate or crowdfunding. Investing in private equity was only limited to the accredited investors that may take about 5% of the US population whereas the rest were unable to invest in startups, which changed with crowdfunding platforms and the May 2016 regulations to allow for equity crowdfunding by the public.<sup>63</sup> According to equity and bond crowdfunding experts based in US and France, the reasons why retail investors choose crowdfunding are:

- Offers alternative investment opportunity
- Allows access to real and diverse assets, rather than bonds, stocks, funds (France)
- Addresses income and wealth inequality concerns of the public (in US case)
- Makes impact on the businesses of the community

As to the potential of retail investors using crowdfunding to invest in cleantech startups, the US equity crowdfunding platform developer has a theory that the more you break up capital requirements of the businesses to smaller chunks on the platforms, the more risk tolerant they become because they're injecting smaller capitals.<sup>64</sup> Smaller investments, especially into real assets, expands investment decision making beyond financial motivations.<sup>65</sup> An institutional investor's view differs from crowdfunding developers, as they see that emotional connection to the money makes optimal investment decisions difficult.<sup>66</sup> The argument for lack of finance

mobilisation into the green economy always highlights that modern finance only focuses on optimizing financial returns of investments, without also optimizing for ESG factors. Therefore, crowdfunding platforms, through introduction of non-financial motivations in investment decision making, makes for a suitable tool for green investments. An analogy would be that if a company is considered a risky investment, it would be more likely that retail investors would choose to invest in it through crowdfunding rather than through funds or stocks, as crowdfunding allows more non-financial motivations into the investment mix. However, retail investors' overall risk appetite to invest in cleantech startups, despite their other non-financial motivations to invest in cleantech startups, may be determined through their savings and market knowledge. As an example, the financial expert within a french crowdfunding platform explains that

*“Investors in France may be more risk averse than those in the US, where people are more heavily invested in the market and have got their retirement savings to invest.”<sup>67</sup>*

Investors with professional investment experiences express that the current platforms allow for too much emotion, leading to irrational decision making.<sup>68</sup> They say that they have enough experience to know the pros and cons of crowdfunding. Pros are it allows investors to diversify their profiles and gives opportunity to explore and choose from a large number of projects on the platform.<sup>69</sup> Cons are that when the platform doesn't do proper due diligence and has a low barrier to entry for projects, it doubles the load of having to conduct their own due diligence procedures for investors.<sup>70</sup> However, according to the financial professional, most retail investors do not have such expertise, which encourages them to make irrational investment decisions.<sup>71</sup> For example, many retail investors on crowdfunding platforms invest in

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<sup>63</sup> Expert G, US crowdfunding developer.

<sup>64</sup> Expert G, US crowdfunding developer

<sup>65</sup> Expert G, US crowdfunding developer

<sup>66</sup> Expert L, impact wealth manager

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<sup>67</sup> Expert J, French crowdfunding developer

<sup>68</sup> Expert L, impact wealth manager

<sup>69</sup> Expert M, angel investor

<sup>70</sup> Expert M, angel investor

<sup>71</sup> Expert L, impact wealth manager

viral or popular projects, motivated by fear of missing out and often develop a skewed perception that investment resembles gambling.<sup>72</sup> According to the wealth manager, investments should rather be long-term with realistic expectations of risk and returns.<sup>73</sup> In this sense, financial professionals imply few possible ways for platforms to help individual investors:

- Set barriers and requirements for projects entering crowdfunding to avoid large risks for investors without financial expertise
- Increase investment knowledge of the retail investors that exist on their platforms
- Set up some due diligence procedures to save time and resources of professional investors who are motivated to use crowdfunding platforms
- Increase transparency behind project spending goals

Overall the financial professionals suggest that all the factors above are a way for platforms to assume some responsibilities towards its investors, rather than being a passive intermediary.<sup>74</sup> The bond-based platform in France, whose experts we have interviewed, apply a large portion of these suggestions to guarantee low risk for its investors. However, cleantech startups do not exist in the space of low risk investments. A possible development in the future would be that such platforms, which assume high responsibility towards its investors, include cleantech startups on its platforms after actively assessing its risks but also communicating it to the individual investors. Depending on the risk appetites of the individual investors, which are likely to be high for business angels and lower for investors, cleantech startups can be funded through crowdfunding since the platform allows non-financial motivations to be factored into investment decision making formulas.

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<sup>72</sup> Expert L, impact wealth manager

<sup>73</sup> Expert L, impact wealth manager

<sup>74</sup> Expert L, impact wealth manager

## How does COVID pandemic factor into cleantech investment through crowdfunding?

Impact of covid pandemic on crowdfunding seems to be mostly positive. An angel investor says that the lockdown period during the pandemic pushed them to discover more projects, given that the only active sphere was the digital spheres.<sup>75</sup> The US-based equity crowdfunding platform developer confirms that the number of investors as well as number of project founders increased on their platform, especially a rise in the number of projects in the early pandemic period as founders found it difficult to raise capital through other means.<sup>76</sup> Additionally, according to the crowdfunding developer in France, they have also experienced more investments going into their projects, which continues from early pandemic days to late 2021.<sup>77</sup> The suggestion was that the more people stay home due to the pandemic, the more savings they accumulate as they spend less than average and therefore, investors accumulate a huge “glut of savings” to be invested.<sup>78</sup> However, the US developer’s view is that it is too early to tell if the growth of the crowdfunding market during the pandemic was purely out of COVID effects or if there was an overall linear growth in the market or was due to regulatory changes.<sup>79</sup> Moreover, O’Brien (2021) points out that charitable action has been increasing in the United States since the outbreak, and this tendency could be another driver to motivate people into crowdfunding investments. Similarly, the interviewee from the crowdfunding platform in France says that 2020 and 2021 saw substantial increase in donations to their renewable energy projects.<sup>80</sup>

Similarly, a Swiss cleantech platform that witnessed a peak in the creation of new cleantech-oriented projects, says the increase in such projects may not be due to pandemic, but may be due to an evolving political context. The expert gives

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<sup>75</sup> Expert M, angel investor

<sup>76</sup> Expert G, US crowdfunding developer

<sup>77</sup> Expert J, French crowdfunding developer

<sup>78</sup> Expert J, French crowdfunding developer

<sup>79</sup> Expert G, US crowdfunding developer

<sup>80</sup> Expert J, French crowdfunding developer

several examples of such political shifts such as the Fukushima nuclear accident and its effect on Switzerland, of accepting a new energy law, arguing that the political driver is most important in boosting cleantech sector development whereas COVID could be a concurrent event with lesser effects.<sup>81</sup>

Interviewees were mostly uncertain about the effects of pandemic on cleantech startups specifically. However, a financial expert offers the view that the pandemic may have made investors more cautious about investment risks, especially with large capitals, since the pandemic created many uncertainties.<sup>82</sup> In the CrowdfundingHub (2021) study, even in mature markets like the UK, investors tended to prefer low-risk and low-return investments, by retreating to safer assets. A longitudinal 2016-2020 study by Manganeillo and Dragulanesu (2021) on the Italian equity crowdfunding market finds that the most successful “green” campaigns were the projects that had highest local level-environmental performances. Therefore, cleantech startup investments being risky and taking considerably longer than conventional green projects to produce any environmental effect in the shorter term, it is difficult to estimate that pandemic had any positive impact on cleantech startup investments. Moreover, there is uncertainty whether pandemic has shifted the cleantech industry to crowdfunding.

Regardless, the pandemic had a definite impact on the increase in crowdfunding due to its digital nature and ability to capture the digital crowd, but the extent of the impact is less known. However, it should be noted that the pandemic is still ongoing, so the impacts of pandemic on cleantech investments through crowdfunding are early to tell and more research is needed to understand and quantify each of the different impacts each factors: regulations, savings, risk appetites, environmental objectives, charitability and more are playing into crowdfunding and cleantech investments.

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<sup>81</sup> Expert D, cleantech expert

<sup>82</sup> Expert C, startup accelerator & incubator

## 6. WHAT ARE THE FACTORS THAT SYNERGIZE CROWDFUNDED PROJECTS AND INVESTOR MOTIVATIONS?

### Crowdfunding policy & regulations

The government support plays an important part in both cleantech and crowdfunding industries. Crowdfunding platforms who were interviewed often mention that the UK has the most mature and large crowdfunding market due to its favorable regulations. US is also catching up by increasing their crowdfunding equity offerings from \$1.07 to \$5 million in November (CrowdfundingHub, 2021). As investment ticket sizes are getting larger, platforms are likely to get bigger, so, it is likely to gain the attention of big ticket investors like business angels. Crowdfunding researchers mentioned that recent years saw the Irish market growing as the corporate taxes are low.<sup>83</sup> In 2020 alone, UK equity-based platforms raised £332 million and lend-based raised €5.1 billion (CrowdfundingHub, 2021). Landscape with such large capital capacity, is an attractive field for cleantech startups that require large capitals.

Moreover favorable policies by the government helps to mature the market and bring in investor confidence to crowdfunding markets. The UK gives many benefits to its crowdfunders including favorable tax rates, Enterprise Investment Scheme (EIS) and Seed Enterprise Investment Scheme (SEIS). These financial incentive schemes are designed by the UK government to offer generous tax reliefs to investors who purchase new shares of small companies which fulfill certain requirements (Crowdcube, 2016). Public finance schemes seem to largely encourage risk appetites of investors, and in turn, investment into cleantech startups. Since cleantech business tends to be capital intensive, it is important for governments to promote regulations that particularly focus on the niches of cleantech investments.<sup>84</sup>

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<sup>83</sup> Expert E, crowdfunding researcher

<sup>84</sup> Expert D, cleantech expert

## Investors' personal connections to the projects

### Proximity to the project

The proximity to the project is an important synergy between crowdfunded projects and investors' motivations. Not only are investors more willing to invest in more local projects,<sup>85</sup> experts often mentioned making an impact on the local community as a large motivation for people to invest.

Having a local cleantech startup project means proximity to local connections, that could be potential investors. Entrepreneurs can have the advantage of accessing their own direct and indirect local networks to ensure successful funding. There were even cases where investors became active participants in communication campaigns of projects they have invested in and became valuable ambassadors to the project.<sup>86</sup> Some platforms such as the one we interviewed in Switzerland, leverage such investor proximity motivations and developed platforms that limit itself to a specific community, its projects and investors. As a result, they built local engagement, trust and credibility of the platform. The synergy of all things 'local' is likely to play important roles in attracting investments to projects that speak to non-financial motivations of an investor.

### Community mobilisation

Community mobilisation is a key factor in synergising crowdfunded projects and investors' motivations, to find support from the community. Projects have to reach for and engage the community, and according to an expert, communications to investors are key to crowdfunding successes.<sup>87</sup> This also addresses the problem of information asymmetry that may exist between entrepreneurs and investors, which often acts as a barrier to investment according to the literature review. When it comes to cleantech startups,

information asymmetry about the technologies is even larger. So, to develop an effective communication strategy, projects need to define its target audience and formulate strategies of communications based on each audience's motivations. Audiences in crowdfunding are diverse: friends and family, indirect contacts, wider local community, and the rest of the world<sup>88</sup> The entrepreneur's friends & family connections are the audience layer that plays a central role in the project's early stages of funding and information spreading, as they can be the first set of investors and first set of ambassadors.<sup>89</sup> The engagement with the second layer of entrepreneur's indirect contacts also helps with gaining visibility, when approaching the rest of the community.<sup>90</sup>

### Financial transparency and patent

Projects financial transparency and securing of tech patents are synergizing factors between businesses and investors. Projects need to disclose sufficient financial information about the project, so that the investors may understand the risks & returns and most importantly, the financial plans of the company. Investors want an understanding of how investments received through crowdfunding will be spent.<sup>91</sup> From a financial expert's perspective, overshooting a funding goal more than what the project needs, by over 30% or more on the crowdfunding platforms, is not encouraged. It creates skepticism and mistrust around the financial transparency of the projects and also their ability to absorb such large capital initially, given it's a new company.<sup>92</sup> So, clear communications about financial activities, strategy and goals are key to secure investor's trust. Additional factor to gain investor confidence is patents. A deeptech expert says projects that have a patent, or one that is pending, tend to be more successful in raising money than those that

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<sup>85</sup> Expert J, French crowdfunding developer

<sup>86</sup> Expert F, Swiss crowdfunding developer and Expert B, business development expert

<sup>87</sup> Expert F, Swiss crowdfunding developer and Expert I, Swiss crowdfunding communications expert

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<sup>88</sup> Expert I, Swiss crowdfunding communications expert

<sup>89</sup> Expert I, Swiss crowdfunding communications expert

<sup>90</sup> Expert I, Swiss crowdfunding communications expert

<sup>91</sup> Expert L, impact wealth manager

<sup>92</sup> Expert L, impact wealth manager

do not own a patent<sup>93</sup>. Patents not only a sign of reliability but given that cleantech are inherently risky and uncertain investments to a certain extent, patents may decrease perceived risks.

### **Tangibility of the project**

The tangibility of the project is an important element when investors are considering crowdfunding. When the concept and possible impacts of the project is tangible, in a way that is understandable and relatable, it creates a positive synergy for investment. Many non-experts in technology exist in the crowdfunding space and unless the project aspects are communicated and conceptualized well to the public, it is difficult to appeal to the investors interest and non-financial motivations.. Firstly, some projects are inherently easier for crowdfunders to relate to, such as the “clean turtle straw” analogy introduced by the deeptech expert.<sup>94</sup> When a straw is a gadget that helps to save turtles, then it is a concept that is easier to grasp for the public compared to highly technological concepts. There are two options to increase tangibility of cleantech and increase chances of crowdfunding. One would be to conduct campaigns that largely focus on making technology more relatable and accessible to public understanding. Another option is to increase crowdfunders’ awareness and capacity to grasp clean technologies and impacts, to increase public appreciation of clean technology values to green transition.

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<sup>93</sup> Expert E, crowdfunding researcher

<sup>94</sup> Expert A, deeptech incubator

### **Limitations when using crowdfunding:**

#### **Communication challenges**

Although we have seen some of the advantages that crowdfunding can provide with cleantech firms, an exploration of its limitations can help us keep a critical lens on this budding financing tool. In the context of equity crowdfunding platforms, communication with investors might pose a challenge.<sup>95</sup> Since equity crowdfunding tends to gather many small ticket investors that have a small percentage of ownership, it is difficult to communicate with all the investors and reach a consensus if needed. In contrast to this, in the case of VC investment, companies need to simply communicate with the investment firm and hence communication tends to be easier, especially in situations where time sensitive decisions need to be made. Varying stakeholders with diverse motivations might be a strength when it comes to attracting funding at an early stage however the same can prove to be a drawback when it comes to communicating with stakeholders at a later stage. Perhaps cleantech companies need to have a strategy right at the outset to overcome this. Furthermore, when it comes to the cleantech or tech industry in general, it is difficult to translate their projects into words for the general public. Since most cleantech projects include a certain level of technical knowledge, it is common that most investors are not familiar with specific terms and technologies. In this case, startups need to work on the communication campaign to gain understanding of the general public. Additionally, gaining support (including financial support) from their close network such as family and friends is important especially when launching crowdfunding projects. For some startup owners, however, there are psychological barriers to asking their family or friends for support since people might not always be comfortable with providing financial support.

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<sup>95</sup> Expert E, crowdfunding researcher

### **Limited consumer appeal for B2B businesses**

When we look at B2B businesses such as startups focused on building smart grid technologies, their consumers are other businesses who are unlikely to participate in crowdfunding as an investor. Crowdfunding usually attracts retail investors who tend to invest in companies whose products or services they can understand and also utilize in their daily life. In this sense we see that it is not as easy for B2B businesses to attract public interest due to the technical nature of its products and lack of relevance to retail investors.<sup>96</sup> As a result, B2C campaigns, whose products are more relevant to retail investors, tend to attract more investments. Example would be that of a company selling environmentally friendly straws that are usable by consumers.<sup>97</sup> To succeed in crowdfunding, it is necessary for cleantech companies to consider if their product/business is appealing to average consumer investors, not only from a B2B but also a B2C perspective. This seems to be the critical limitation of crowdfunding platforms but also highlights an important scope for future expansion. Crowdfunding can try to improve its appeal to attract investors that are businesses, and not only individual investors.

### **Limited appeal for professional investors**

As covered in the institutional and individual investors' sections extensively, investors with professional financial experiences find that crowdfunding platforms fall short of their expectations. Platforms could have been a potential tool that saves time and resources in researching each project. However, investors mention such 'investment intermediary' potential is not reached as most platforms lack due diligence, have unclear communication of risk and returns, and lack of transparency behind the capital requirements demanded on the platforms for the projects. Therefore, there may be a need to develop

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<sup>96</sup> Expert B, business development expert

<sup>97</sup> Expert A, deeptech incubator

crowdfunding platforms that address not only the retail investors' but professional investors' motivations for crowdfunding.

### **Significant time commitment**

Marketing of a crowdfunding project is an important factor to its success. Research analyzing campaigns on platforms like Indiegogo show that communication strategies such as framing and presenting quantitative goals and having a "green" emphasis markedly increased campaign successes (Rossolini et al., 2021). According to a communications expert of a crowdfunding platform, the marketing has to target different levels of potential investors through many different channels such as news outlets and social media.<sup>98</sup> The target audiences are family & friends, local communities and indirect contacts, and the larger community on the platforms and beyond.<sup>99</sup> Other forms of financing such as VCs, mostly require that the business pitches are catered to only one set of audience, whereas crowdfunding campaigns have to understand and target each investor level. In some cases, marketing can even be superficial rather than focused on business strategy and models, to capture attention of the audiences. The implication is that marketing and communications are time-consuming processes,<sup>100</sup> but essential in funding success. Startups' own limited resources in terms of capital and human resources also adds another level of challenge. In case of reward based crowdfunding, startup companies also need to decide the rewards and proceed with the fulfillment process when the project reaches its funding goal (Entrepreneur Media Inc, 2017; Kickstarter, n.d.,.). An impressive marketing strategy alone, does not guarantee crowdfunding success alone. Functionalities and willingness of the investors to use the platform can also determine investors' decisions to utilize the platform and to invest.

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<sup>98</sup> Expert I, Swiss crowdfunding communications expert

<sup>99</sup> Expert I, Swiss crowdfunding communications expert

<sup>100</sup> Expert C, startup accelerator & incubator

## 7. LIMITATIONS OF THE RESEARCH

### **Difficulty in accessing investor community for surveys**

Original research approach included the dissemination of a survey directly to a crowdfunding platform's user or investors with the help of platforms themselves. Survey's objective was to identify the motivations of crowdfunding investors, through an analysis of motivations that may be common between them and also, identify differences between cleantech and non-cleantech investors. The survey benchmarked investors across the location of firms, risk preferences, demographic and types of project they chose to invest in, just to name a few. However, five months of communications with various platforms that exist in Europe and the US have given us the insight that most platforms were reluctant to give external parties access to their user bases citing that it could violate users' privacy. Therefore, there is a difficulty in identifying crowdfunding investors in general to conduct micro level behavioral studies on investors.

### **Limited representation of locations**

The scope of the research only focused on a few countries with relatively mature crowdfunding markets. Since our project was part of the Swiss National Research Foundation and the researchers were based in Switzerland, we focused on interviewing investors, crowdfunding platforms within the country, to draw out country-specific insights. Researchers' personal networks were also based in Switzerland, which made access easier to potential interviewees. Our research focuses on mature markets like France, UK, and US which have seen cleantech investment in crowdfunding rising for several years, allowing us to generate sufficient data. This implies that the extent of our research to generalize crowdfunding investors is limited and there may be more research needed in less mature crowdfunding markets.

### **Time constraint for Case Studies**

Our research aimed to conduct a behavioral study to highlight motivations of investors, cleantech startups and crowdfunding platforms. As a result of the breadth of topics explored, there was limited avenue for case studies where we delve deeper into a specific case of a cleantech startup that may have successfully or unsuccessfully used crowdfunding. Case study would enable us to deepen our understanding of the differences in the business models of cleantech companies and its impacts on the success of the company in crowdfunding. However, it is to be noted that time and resources were the biggest constraints from including such an approach for our study.

### **Methodology limitation**

We structured the research around 13 semi-structured interviews with experts within the domain of cleantech startups, crowdfunding and investment. Despite the interview questions being adapted in order to extract structured answers to our research questions, this method contained limitations. The interviews were built on the essential approach to expert interviews, which are human interaction and communication. Interviews are therefore subject to inevitable subjective views on topics, impacted by both the interviewees' and interviewers' backgrounds, experiences and interpretations. We kept such potential bias in mind throughout the research to minimize its influence on our findings.



## 8. POLICY RECOMMENDATIONS

**Increasing crowdfunding credibility:** Currently we see a minimal involvement of the government in providing support for crowdfunding and we believe there is scope for policy to lend credibility and awareness among the general public. Governments should associate themselves with crowdfunding platforms. This is already happening, like in the case of the Dubai Government which launched DubaiNext, a digital crowdfunding platform to support SMEs (The United Arab Emirate's Government Portal, 2021). Government projects that have public support but lack existing funding can be funded through crowdfunding, where governments can go as far as say that they will fund a percentage of their projects through crowdfunding. Overall, this can improve public awareness about crowdfunding and specific issues the projects are aiming to tackle and increase the reputation of crowdfunding.

**Progressive regulations:** Governments play a key role in maturing the crowdfunding market through its policies, which leads to more investor confidence in it. Policies that would positively affect cleantech startup investments would progressively allow for more capital injection from crowdfunders to equity and lending based platforms. This can also be supported by supportive financial policies like tax reliefs and financial incentives for crowdfunding investors to invest in new companies as the UK example showed. The increased capital flow of confident investors can support cleantech startups's need for large capital.

**Risk limiting:** From a financial risk perspective, crowdfunding platforms operate with a lack of obligations towards their investors. In the French crowdfunding platform we interviewed, they do the due diligence and risk assessments voluntarily. Governments can introduce some benchmark of

obligations for platforms in order to filter out potential fraudulent or extremely risky investments, and limit financial risks for non-financially expert investors.

**Funding guarantee:** B2B cleantech startups find it challenging to attract investment due to their high capital requirements and long-time development periods. So, governments can make funding available to crowdfunding platforms, with a criteria for funding B2B companies spurring innovation. Such funding can be a guarantee for all crowdfunders that invest in the B2B project, so that in case of failure, primary investment would be returned. Government's own "skin in the game" which would incentivise other investors' risk appetites and alleviate the financing challenges of capital intensive B2B companies.

**Recommendations for platforms to attract investors into cleantech startups:** Investors with larger capital and financial expertise suggested that current crowdfunding mostly functions as passive platforms. Better development of due diligence, risk & return assessments and improved financial transparency are likely to attract investors besides retail investors.

Corporations are motivated to get directly involved in development of cleantech startups, so instead of aiming to attract investment from corporate investors through crowdfunding, it is better to collaborate with corporations to develop joint-platforms. They have indicated their motivations to try developing their own platforms for strategic objectives while also possessing large technical expertise and corporate resources.

## 9. CONCLUSION

In light of accelerating international dialogues to address climate change, clean technologies play an important role in limiting environmental impacts. It contributes in making climate change mitigation and adaptation possible, and as a result, the cleantech sector requires large financing. However, these new technologies face significant financing challenges, which traditional models are insufficient to address, bringing us to consider the potential of crowdfunding to support investments into cleantech startups. To assess the crowdfunding potential for cleantech startups, the research assessed financing challenges, appropriateness of the model for cleantech financing and crowdfunding model for cleantech investments through our literature reviews and semi-structured interviews with thirteen experts.

The research has highlighted that crowdfunding as it exists now, is a complementary tool rather than an alternative financing tool for cleantech startups. Crowdfunding has brought various benefits to investors and cleantech startups, such as, compared to traditional investment methods such as VCs, startups can easily start their crowdfunding campaign and attract investors. This helps to test the market to see if the business is feasible, with a relatively low risk. For investors, crowdfunding allows them to consider their non-financial motivations in their investment decisions and also gives them access to real assets. Overall, the rise in crowdfunding investments provides a positive outlook on the maturing of the crowdfunding market.

However, challenges still remain to utilize crowdfunding, especially to invest in cleantech startups. Firstly, the type of business might affect the outcome of a startup's funding campaign, where B2B businesses tend to struggle with attracting

investments compared to B2C businesses. Hardware and deep technology investments also often find it hard to raise compared to software, due to its long development times that increases illiquidity of investments and lack of tangibility to investors. To successfully crowdfund, communication is a key element to success but it is highly time and resource intensive for startups. Crowdfunding also receives skepticism from financial professionals as the platforms often lack the features to be considered a financial intermediary, such as due diligence, risk assessments and financial transparency. The most important aspect overall is a need for government intervention through more regulations and policies that not only allow markets to capture the value of clean technologies but also to increase investors confidence in the crowdfunding market, such as through tax reliefs or financial incentives for crowdfunders that invest in new companies. They can also undertake some of the risks associated with crowdfunding through public funding schemes directed at cleantech startups on the platform, to incentivize more risk averse investors.

The limitations need to be addressed to realize the true potential of crowdfunding to support cleantech startup investments, which it currently lacks. Despite this, corporate and angel investors have expressed their motivations to invest in cleantech startups and willingness to try crowdfunding if their limitations are mitigated. It is essential that investors with larger capital, that can sustain cleantech startup investments, exist on these platforms. In turn, crowdfunding platforms can fulfill investors' strategic objectives such as market testing, marketing and making an impact. Future research should focus on deepening some of the insights brought out through this report.

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## APPENDIX 1: SEMI-STRUCTURED INTERVIEW QUESTIONS

The questions below have been sent to the interviewees before the interview for general brainstorming.

**Prior to the interview, we wanted to clarify a couple of terms that will be central to our discussion to ensure that there is clarity.**

### **Our working definitions:**

1. Cleantech firms: for-profit firms with an aim to develop and adopt innovative technologies to reduce carbon dioxide emissions in their products and processes e.g. Waste Management, Mobility, Renewable Energy.

Scope: early stage firms that are less than 5 years old, that often need large capital and longer return time on investments to commercialize their use

2. Crowdfunding: is the practice of getting a large number of people on the crowdfunding platforms to each certain amounts of money in order to provide the financing for a project, typically using the internet platforms

Scope: Equity crowdfunding and (Peer-to-Peer) Crowd-Lending

**General questions for brainstorming, which you may choose to answer from both/either one of the following perspectives based on your experiences:**

### **From investment perspective:**

- 1) What might be financially interesting and difficult to invest in early stage clean technology firms?  
What are its financing options?
- 2) What are the differences in motivations and behaviours between those who invest in cleantech startups/ those that don't?
- 3) Why might investors choose to/choose not to use crowdfunding over other financing mechanisms (e.g. Venture Capitals)?
- 4) What might be the advantages and disadvantages of raising funds through equity or debt crowdfunding for investors? And for early-stage cleantech firms?  
(e.g risks, reporting, profits, regulations)
- 5) Do firms that use crowdfunding have characteristics or motivations in common?

### **From cleantech firm perspective:**

- 1) What might be the biggest obstacle to getting investment in the initial stages for an early stage clean technology firm?
- 2) How could crowdfunding potentially overcome some of the financing challenges that cleantech startups may face?
- 3) Does crowdfunding offer new opportunities that are not offered by other investment methods (e.g. Venture Capitals and Institutional investors)?
- 4) What factors might drive a cleantech firm's preference for a particular crowdfunding platform?
- 5) Based on your experience and knowledge, are there any difficulties in using crowdfunding? What might be the obstacles?