Delft University of Technology

Technology, Policy and Management

Management of Technology

Unlocking Cluster Investment Attractiveness: A Multi-Case Study Analysis of Patenting, Publishing, and University Proximity

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Master Thesis

In partial fulfilment of requirements for the degree of:

Master Management of Technology

September 26, 2023

Contents

Preface

This thesis has been a long way coming. I stubbornly persisted in carrying out a research on a topic that fascinated me, viewing it from the lens of an M&A consultant rather than that of a scholar. As time passed, I acknowledged that perhaps I could have chosen a more straightforward topic. Nonetheless, in the end, I'm content to have achieved something closely aligned with my original intention, even though it came with its fair share of challenges and setbacks.

Undertaking this research would not have been possible without the guidance and support of several individuals and institutions. I would like to extend my heartfelt gratitude to my supervisors, Victor Scholten and Aleksandrina Ralcheva, for their guidance and feedback.

I would also like to acknowledge the opportunities and encouragement received from the leadership of Venture IQ, which have supported me in my work and made available precious resources vital to the collection of data necessary for this thesis.

I am incredibly indebted to my family for the enduring support I received throughout my studies. My parents have been able to support me throughout these years, not without being willing to make sacrifices themselves.

My friends, of which I am lucky to say making a full list would fill this page, have provided me with constant advice, encouragement and joyful company. They have made my time spent in academia the brightest years I have ever had.

I want to thank my partner, Jakub, who has been incredibly supportive and patient during these months, and my friend Anastasia, who has been my constant companion during a time filled with anxiety and pressure, yet also hope and excitement for what is to come.

Academia and writing a thesis can feel like a lonely path, and I am thankful to all the people in my life for accompanying me until the very end of it.

Laura Venturi
Delft University of Technology
September 2023

Executive Summary

In a world marked by rapid technological advancements and environmental concerns, clean technology clusters have become hubs of innovation. Attracting investment in these clusters has gained significant attention from scholars and industry professionals, which aim at understanding which activities companies can undertake in order to increase the attractiveness of the cluster and region.

This study explores the factors influencing investment attractiveness in clean technology clusters, focusing on company-level variables like patenting activity, publishing activity, and proximity to universities.

Using a case study approach, the research analyzes four Western European clean technology clusters, aiming to uncover insights and differences in investment attractiveness. The four clusters are Aclima (Basque Country, Spain), CLEAN (Central Region, Denmark), Greenreality (South Karelia, Denmark) and Water Alliance (The Netherlands). The analysis is divided into the single case reports for each cluster, exploring the variables at the company level, and into the cross-case analysis, bring the previous observations together at the cluster level.

The findings highlight the positive impact of patenting activity on cluster attractiveness for the clusters under study. While no distinct relationships were found for publishing activity and university proximity, the cluster-level additional factors in consideration provided useful identifying some potentially meaningful differences between the clusters, such as the approach and recognition of their regions and countries toward sustainability.

However, the study also acknowledges its limitations, mainly stated as the availability and quality of data, as well as some methodological decisions on the assessment of investment attractiveness, suggesting future research opportunities in this dynamic field. From elaborating a more refined iteration of this study to approaching new topics, the findings and limitations of this research invite future researchers to enrich the body of knowledge associated with clean technology clusters, and in particular with their funding dynamics.

The implications of this study mainly concern the positive influence of patenting on the attractiveness of companies and clusters. Pursuing and supporting this kind of intellectual protection activity could prove to be a powerful tool for firms and cluster managers.

Chapter 1

Introduction

1.1 Background and context

In a time defined by rapid technological progress and growing environmental concerns, the drive for innovation has become a crucial component of global economic growth and industrial advancement. Clean technologies, positioned to tackle urgent environmental challenges, are gaining prominence as hubs of innovation in Western European economies. Consequently, the appeal for investment in companies operating within clean technology clusters has captured considerable attention from both academic researchers and industry professionals.

The interplay between innovation, access to knowledge, and investment attractiveness forms a dynamic environment that molds the competitive arena of modern industries. To excel in their sectors, companies need not only innovation capabilities but also connections to knowledge networks that aid in turning ideas into practical solutions. Alongside this, the investment sector is perpetually on the lookout for prospects that offer lasting growth, technological progress, and meaningful societal contributions. Clusters, representing concentrations of expertise, infrastructure, and collaboration, provide fertile grounds for studying the multifaceted relationships that govern innovation-led economic ecosystems.

The phenomenon of regional clusters has fascinated academic researchers since the early 1990s (Porter, 2000; Martin & Sunley, 2003; Malmberg & Maskell, 2002), with the topic seeing significant traction up to this day. One preeminent figure who has left a lasting imprint on the landscape of business strategy and competitive analysis, Michael E. Porter, stands out for his elucidation of clusters (sometimes referred to as business clusters or regional clusters). His interpretation characterizes these clusters as "geographically proximate group of interconnected companies and associated institutions in a specific field, linked by commonalities and complementarities" (Porter, 2000).

Regional concentrations of companies have captured the interest of both domestic and foreign investors due to their technological prowess and the specialized knowledge unique to their locations. This interest has been particularly pronounced as research and development (R&D) and innovation activities have become increasingly globalized. The knowledge nurtured and exchanged within these clusters holds exceptional value for fostering ongoing innovation (Frost, Birkinshaw, & Ensign, 2002; Burger, Karreman, & van Eenennaam, 2015). The manifestation of this interest in clusters can be observed through increased investments flowing towards individual companies operating within these agglomerations. Various defining characteristics contribute to this attraction, encompassing the cluster's geographic location, the intensity of innovative undertakings, and the makeup of its constituent firms.

Starting from the late 2000s, a growing awareness of environmental issues led to the rise of the clean technology industry. This trend gave way to the establishment of clean technology clusters across different parts of the world, including Europe, Asia, and the USA (Caprotti, 2012; Davies, 2013; Marra, Antonelli, Dell'Anna, & Pozzi, 2015). As concerns about the environment gained prominence, industries and economies started shifting towards cleaner alternatives, which, in turn, drove the formation of clusters centered on clean technology innovation. The inclination for industries to cluster arises from the expectation that the advantages associated with clustering—such as sharing knowledge, pooling resources, and collaborating—would also benefit the clean technology industry. This optimism is grounded in the demonstrated success of clusters in fostering entrepreneurship and supporting new ventures across different sectors. By creating an environment that encourages collaboration and innovation, these clusters are not only promoting the growth of the clean technology sector but also laying the groundwork for sustainable economic advancement on a global level.

Clean technologies are comprehensively characterized as "any product, service, or process that delivers value using limited or zero non-renewable resources and/or creates significantly less waste than conventional offerings" (Pernick & Wilder, 2007). This definition therefore encompasses industrial sectors such as clean energy, sustainable food and advanced materials, among others. Clean technologies hold transformative potential across industries, focusing on both economic growth and environmental sustainability. Unlike previous paradigms, they aim to balance these objectives, reshaping how value is generated with an eye on efficient resource use and environmental responsibility.

The concept of clean technology, often referred to as "cleantech," is widely seen as a sector that is growing rapidly and has a focus on sustainability, and is expected to drive both entrepreneurship and innovation (Hart, 1995; Kolk & Pinkse, 2005). Cleantech holds the potential to reshape the economy, emphasizing growth that is environmentally conscious, which is especially important in a world with limited resources. However, it is important to note that the cleantech market is still quite new and uncertain. Amidst this backdrop of potential, there's a sense of uncertainty about how things will play out in the cleantech market. As this sector begins to take shape, there are various paths being explored. Different companies are trying different approaches, from providing renewable energy to creating sustainable materials. Governments are also getting involved, putting policies in place to encourage the growth of cleantech clusters and support their development.

The landscape of contemporary industries is influenced by the intricate interplay between innovation, knowledge access, and investment attractiveness. This symbiotic relationship underscores the critical need for companies to not only cultivate their innovation capabilities but also forge connections with knowledge networks, enabling the transformation of ideas into tangible solutions. Simultaneously, the investment sector remains vigilant in its pursuit of opportunities that promise sustainable growth, technological advancement, and societal contributions. As this study delves into the realm of clean technology clusters, it embraces the promising convergence of innovation and sustainability, where the collaborative power of regional agglomerations fosters progress, transforming environmental challenges into economic opportunities. With the stage set for exploration, this research aims to unravel the nuanced factors that underpin investment attractiveness within the context of Western European clean technology clusters.

1.2 Research objective

1.2.1 Research questions

This study aims to investigate the company level factors influencing investment attractiveness of clean technology clusters. In pursuit of this objective, I set out to address a fundamental research question:

What is the impact of company-level factors on the investment attractiveness of clean technology clusters?

Given the complex nature of the relationships between clusters, companies and the concept of investment attractiveness, the research is guided by a set of sub-questions meant to guide the study

1. *What are company-level factors that may influence the investment attractiveness of clean technology clusters?* Investment attractiveness is a nuanced concept and may be dependent on a series of interesting factors. This question wants to motivate the search for variables warranting further scrutiny, to be taken as the central factors under analysis in this study.
2. *What are the cluster differences that should be taken into account when investigating the attractiveness of clean-technology clusters?* Being mindful that the identified factors will not be only ones at play in defining investment attractiveness of clusters, cluster-level factors are also identified in order to provide a more complete understanding of the differences between the cases under study.
3. *How can the concept of "investment attractiveness" be assessed in the context of clean technology clusters?* By consulting previous academic works, it is necessary to define how this study will approach and measure the concept of investment attractiveness at the cluster and company level.
4. *How do the identified company-level factors influence the investment decisions of investors in clean technology clusters?* Drawing from similar or complementary works on clusters and investment attractiveness, propositions regarding the nature of the relationship between the identified company-level factors and the investment attractiveness of clusters, should be formulated and evaluated.

The scope of this study encompasses four prominent clean technology clusters within Western Europe, where innovation dynamics are distinctive yet collectively representative of the region's commitment to sustainable development. Through a case-study approach, the research aims at offering an in-depth description of the four clusters under analysis and their subsequent comparison, in the hopes of catching differences and similarities able to shine a light on the dynamics of investment attractiveness of clusters. The findings of the study offer a thoroughly analysed set of knowledge into the chosen clusters, as well as some recommendations for cluster actors and organisations in regard to the main results of the analysis. Notably, the discussion introduces a set of possible future research avenues, inspired by the findings and by the limitations found within this research.

Chapter 2

Literature Review

The purpose of the literature review in this study is to provide an understanding of the key concepts related to the research topic. By delving into existing literature, this review intends to establish a solid foundation of knowledge, enabling the researcher to clearly define the fundamental ideas and principles relevant to the study.

Clusters

Academic research on clusters overwhelmingly focuses on the phenomenon's effects on innovation and growth in the regions in which it is observed. Influential authors in the field such as Porter (1990, 1998, 2000) have extensively focused on or mentioned in their works the concept of clusters as drivers of economic development and competition. These works have served as an important basis to justify the focus that subsequent research has put on the formation dynamics of clusters, with researchers hoping to clarify which factors enable the formation of these agglomerations, with the objective of facilitating the creation or development of new clusters. These works have taken the form of descriptive studies aiming to identify existing clusters (Moreno, Paci, & Usai, 2005), or of analyses studying the dynamics of the clustering phenomenon (Dahl, Ostergaard, & Dalum, 2010; Montana & Nenide, 2008). With more knowledge being gathered on the formation dynamics of the phenomenon, researchers moved in different directions in order to complete the necessary knowledge body needed to fully understand clusters and their effects. Gertler et al.'s 2006 paper (Gertler & Wolfe, 2006) observed the local and global dynamics of existing clusters, contributing to studies analysing the knowledge exchange within and outside of the cluster. Similarly, Tallman (2004), Chyi (2012) and many others have contributed to this stream of research.

The sustained fascination with the various aspects of this phenomenon remains warranted due to its unique nature. Even as global economies continue to expand, the significance of location and its implications remain central to the discourse (Cusmano, Morrison, & Pandolfo, 2015; Porter, 2000). Knowing how relevant clusters can become in the economic development of entire regions, academic researchers have steered towards policy studies (Graf & Broekel, 2020; McDonald, Tsagdis, & Huang, 2006), in the hopes of providing useful recommendations to policy makers, both for providing aids to cluster or to promote their creation. Particularly in areas looking for new development strategies, this type of study can provide some useful recommendations on the use of cluster policy as a tool for economic growth (Hernandez-Arzaba et al., 2023).

With such a rich body of research dedicated to the phenomenon, the case of clusters has become quite common, leading to the need to establish methods to evaluate the performance of these agglomerations. Recent works have attempted to create models that are able to evaluate and compare the performance of different clusters, hoping to highlight the activities that matter most in the mechanisms that bring a cluster towards success (Tvaronaviciene & Razminiene, 2017; Monni, Palumbo, & Tvaronaviciene, 2017). With this objective in mind, several other authors have built case studies between clusters in order to properly analyse their characteristics and take away some meaningful observations that may function as comparative material with other studies (Garnsey & Heffernan, 2005; Schepinin, Skhvediani, & Kudryavtseva, 2018). Notably, researchers have often also developed comparative studies analysing clusters in one country or in one technological sector, hoping, in this case, to obtain more generalizable observations (Tvedt, 2019; Sunny & Shu, 2019; He, 2008; Burger et al., 2015). Their insights often focus on the economic performance of firms within the cluster, units of analysis ranging from the single firm for parameters such as entrepreneurial firm formation (Sunny & Shu, 2019), or clusters as a whole for the observation of formation mechanisms and established structures (Iammarino & McCann, 2006; Tvedt, 2019).

Studies on regional clusters have encompassed several focus areas, regions and countries, as well as a great number of technological fields. With the start of this stream of research in the 1990s, most works on clusters focused on established or clearly location-defined markets such as advanced manufacturing, or IT and software. Lately, emergent industries have gained more and more traction for this type of studies, with the markets of biotechnology and clean technology seeing a surge in related publications.

Clean technology

The field of clean technology presents a multitude of research opportunities, primarily due to the relatively young age of these technologies and their tendency to cluster together. In their work on the dynamics of clustering as drivers of sustainable entrepreneurship, Sunny and Shu (2019) shed light on the existing research gap regarding clean and sustainable technology clusters. Their study focuses on addressing this gap from both a policy and cultural perspective.

Sunny and Shu conduct a comprehensive review of the current state of clean technology clusters, offering valuable insights into the factors that hinder the widespread adoption and diffusion of these innovative technologies. Their theoretical framework encompasses several key concepts, including culture, the theory of agglomeration, and specific policy dynamics within the cleantech sector. By examining these aspects, they aim to provide a holistic understanding of the complex dynamics at play in clean technology clusters.

Furthermore, Sunny and Shu (2019) highlight various areas for future research in this field. They emphasize the need for further investigation into the key dynamics of funding for companies within clusters, particularly in relation to private equity (PE) and venture capital (VC). Understanding the intricacies of these funding mechanisms is crucial for supporting the growth and development of clean technology clusters.

Additionally, Sunny and Shu stress the importance of examining the influence of location choice on the accessibility of resources and the legitimacy of clean technology clusters. Investigating how the geographical placement of these companies affects their ability to obtain necessary resources and establish legitimacy within their respective industries will provide valuable guidance for policymakers and entrepreneurs.

Investment attractiveness

Delving into the realm of funding dynamics, various researchers have examined this subject within domains that differ from clean technology. One such instance is the study conducted by Burger et al. (2015), where the authors investigated the impact of cluster organizations on greenfield foreign direct investments (FDI) in life sciences cluster companies. In their research, Burger et al. sought to understand how the presence or absence of cluster organizations within a particular region influences the influx of greenfield foreign direct investments specifically in life sciences clusters. By focusing on this industry, the study aimed to shed light on the intricate relationship between cluster organizations and FDI in a highly specialized sector.

The notion of investment attractiveness is the focus of Burger et al., described as the amount of investments received by companies in a cluster and influenced by various factors such as location, competition, innovation capabilities, and market access. Burger and colleagues' study emphasizes the significance of investment attractiveness as a multidimensional construct. They recognize that potential investors evaluate numerous factors when considering where to direct their investments. In particular by highlighting the importance of location, the study underscores how geographical proximity to resources, markets, and a supportive ecosystem can significantly enhance the attractiveness of an investment opportunity.

The strategic positioning of research universities in close proximity to industrial clusters has been a subject of considerable interest and investigation. The rationale behind this focus lies in the potential synergies that emerge when academia and industry coexist in a spatially concentrated manner. Such proximate relationships foster knowledge exchange, collaborative research initiatives, and the free flow of innovative ideas between academia and the business sector, thereby increasing the perceived innovation capabilities of industrial actors located in close contact with research organisations (Arundel & Geuna, 2004; Abramovsky & Simpson, 2011). Investors are well aware of the inherent advantages that emerge when academia and industry collaborate closely, and they recognize the potential for high returns on investments in companies where such synergistic relationships thrive.

By acknowledging the role of research universities in the vicinity, the academic community has been able to discern the considerable influence they exert on the development and trajectory of clusters (Gradeck, Andrews, & Paytas, 2004). The symbiotic relationship between universities and companies within the cluster cultivates an environment conductive to groundbreaking research, technological advancements, and commercialization of innovative products and services. Although there seems to be a general consensus on the existence of a link between the innovativeness of companies and their interaction with Universities as sources of knowledge (Abramovsky & Simpson, 2011; Ratchukool & Igel, 2018), the influence of distance on such relationship does not find an agreed upon answer. Ratchukool and Igel (2018) state that it is rather organisational proximity which plays a stronger influence, concept which is reinforced by the findings of Garcia et al. (2015), who argue that firms look for academic collaborators by assessing the quality of their research groups rather than merely by proximity.

Coming back to the work by Burger et al. (2015), the authors emphasize the pivotal role of innovation capabilities in investment attractiveness. They argue that life sciences companies, with their focus on cutting-edge research and development, are particularly well-positioned to benefit from cluster organizations. The presence of these organizations facilitates collaboration, knowledge exchange, and the pooling of resources, all of which contribute to enhanced innovation capabilities and, consequently, increased investment attractiveness. To reinforce this point, Burger et al. define the concept of the quality of a cluster, measured as the total output of patents and publications from the region, as a factor influencing its investment attractiveness. Similarly to Burger et al., other studies have employed patenting activity as a method of assessment. Nadeau, in his 2010 study on venture capital investment selection (Nadeau, 2010), proved how firms engaged in patenting activity were able to attract more venture capital (VC) investors at all steps of the investment selection process. Patent activity does not only play a role in VC investments, but seemingly acts as an evaluation factor in merger and acquisition (M&A) selection processes as well (Breitzman & Thomas, 2002).

Analogously to the observations on patent activity, Burger et al.'s study (2015) also mentions publications from a region as a tool for measuring the quality of clusters in the region. Although publication activity is not a commonly used measure for the innovation capabilities of companies in the context of investment attractiveness, the concept of university-industry collaboration is a common subject in research. In particular, a 2000 study by Yong Lee (Lee, 2000) posits that firms participating in research collaboration realise significant benefits. Additionally, the Chinese study by Hsu et al. (2021) posits that publication activity is positively associated with the market valuation of publicly listed firms, with a more pronounced relation when such firms show strong patent records.

Burger et al. further justify their research approach which focuses on Western European clusters. The researchers emphasize the diversity among Western European clusters, highlighting the varying degrees of clustering activity and the nature of cluster organizations across different regions. This diversity provides a rich and nuanced context in which to examine the effects of cluster organizations on investment attractiveness. By studying multiple clusters within Western Europe, the research can capture a wide range of cluster types, organizational structures, and collaborative dynamics, thus enhancing the generalizability of the findings. Furthermore, Burger et al. (2015) underscore the regional disparities in the amount of greenfield investments attracted by different European regions. This disparity provides a unique opportunity to analyze how the presence or absence of cluster organizations influences investment patterns. By examining regions that receive varying levels of greenfield investments, the researchers can discern the extent to which cluster organizations contribute to attracting investments and driving regional economic development. The Western European region therefore is stated as being an appropriate sample for analyses aimed at uncovering the dynamics of clusters, as also supported by numerous other studies focused on the area (Moreno et al., 2005; Corrado, Martin, & Weeks, 2005; Arundel & Geuna, 2004).

Cluster characteristics

The previously mentioned studies provide some validation and enlightenment regarding the examination of the impact of patenting and publishing activities, as well as the significance of proximity to universities, on the investment appeal of clusters. Nonetheless, numerous additional factors come into play when investors decide to pursue an investment. From evaluating risks to meeting market demands, the investment selection process is intricate and multifaceted.

It is established that a company's various activities and strategies play a pivotal role in shaping its approach to innovation. Research has demonstrated, notably, that service-oriented and product-oriented enterprises adopt distinct approaches to safeguarding their intellectual capital (Kianto, Hurmelinna-Laukkanen, & Ritala, 2010). Product- and technology-centric firms often lean toward robust protection through patents and licensing, whereas service-based companies may prioritize the development of their human capital, considering the divergent nature of their outputs.

The actions of companies can directly influence their appeal to potential investors. In a complex and multifaceted manner, investors may have distinct preferences when seeking investments, with some favoring service-oriented enterprises while others seek technology-focused companies, potentially those already in advanced stages of development. Additionally, within their pool of potential investments, investors may apply further criteria to evaluate the opportunities available to them. The size of firms has been shown to play a role in their attractiveness with, according to Gala and Julio (2016), small firms having significantly higher investment rates. However, size would appear to positively relate to patenting activity and innovativeness (Rodríguez-Gulías, Fernández-López, & Rodeiro-Pazos, 2020). The influence of firm age on its attractiveness has not often been at the focus of research, but, with different final observations depending on the assumptions and perspective of the authors charged with research on the topic, it is understood that age's contribution to attractiveness is highly dependent on various factors such as size, growth rate and activities. While some papers argue that increasing age signals the possibility of more trust for investors (Susanti & Restiana, 2018), others remark the decreasing growth rate and innovative efforts of older firms (Navaretti, Castellani, & Pieri, 2014; Rodríguez-Gulías et al., 2020). The influence of age and size on innovation activities and attractiveness of firms is a complex issue, and should not be forgotten even during analyses focused on other aspects.

2.1 Research approach

Building upon the foundation laid by previous researchers, with particular attention to the works of Burger et al. and Sunny and Shu, this research seeks to extend the understanding of investment attractiveness of clusters in the highly interesting context of clean technology clusters in Western Europe. By focusing on this region, where clean technology clusters have shown promising growth and development, the study aims to unravel the intricacies and drivers of investment attractiveness in the clean technology industry.

Analyzing the review, it becomes evident that numerous factors at the company level can impact the appeal of clusters for investment. The significance of patenting and publishing activities, as well as the proximity to research universities, remains relatively unexplored within the context of clean technology clusters. The research question aims to explore the impact of this selection of company-level factors on the investment attractiveness of clean technology clusters. Therefore, two main goals are set forth: (1) provide in-depth case studies at the company level of clean technology clusters in Western Europe, and (2) examine the differences and similarities among these clusters, at the cluster level. To accomplish this, clusters with varying sectoral focuses and geographical locations have been selected.

The theoretical framework (depicted in Figure 2.1) comprises independent variables, which are posited to influence the dependent variable of investment attractiveness, and control variables, which have been identified as factors requiring consideration due to their potential influence on the dependent variable. The theoretical framework depicts the proposed relationships between variables at the cluster level, and will serve as the foundation for the cross-case analysis. The three independent variables will be collected at the company level, and then translated at the cluster level to properly assess their influence on the investment attractiveness of the cluster. With the dependent variable "Funding", it is intended that the funding received by each company in the cluster will be assessed to then evaluate the cluster as a whole based on these observations. Company-level funding data will serve as an indicator of the cluster's attractiveness, in a manner explained further in the thesis.

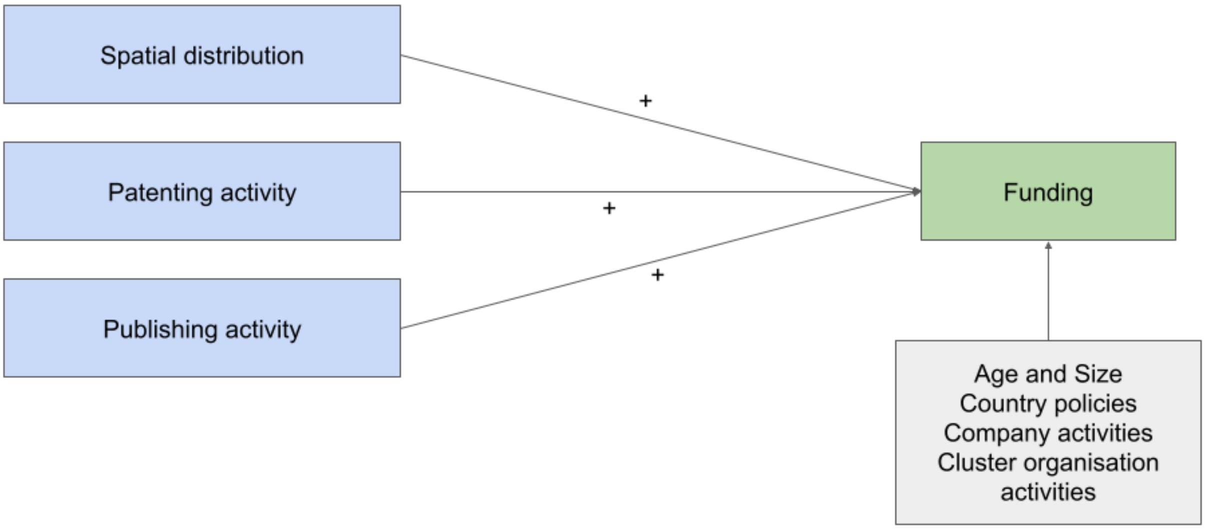


Figure 2.1: Theoretical framework. Independent variables are highlighted in blue, control variables in grey and the dependent variable in green.

Variable	Type	Explanation
Patenting activity	Independent	Patenting activity of individual companies is measured and reported, then translated to the cluster level to compare cases
Publishing activity	Independent	Academic publishing activity of individual companies is measured and reported, then translated to the cluster level to compare cases
Spatial distribution	Independent	Proximity of individual companies to universities is measured and reported, then translated to the cluster level to compare cases
Age and Size Country policies Company activities Cluster organisation activities	Control	Age, size and company acitivities are measured and reported at the company level, then translated to the cluster level Country policies and cluster organisation activities are collected and reported at the cluster level
Funding	Dependent	Funding received by individual companies is measured and reported, then translated to the cluster level to assess investment attractiveness

Figure 2.2: Theoretical framework variables with a short explanation on their measurement and assessment.

Patents serve as a straightforward indicator of the dedication and commitment companies put into their innovative endeavors, showcasing the tangible results of their efforts. Being mindful of previous research on the effect of patenting activity on the attractiveness of companies (Nadeau, 2010; Breitzman & Thomas, 2002), it is proposed that higher patenting activity has a positive influence on the investment attractiveness of clean technology clusters, and that the in-depth observation of the selected clusters will highlight higher frequencies and amounts of investment for those companies which choose to protect their intellectual capital. Similarly, academic publishing has been seen as offering a chance to companies to showcase their expertise and thought leadership, further solidifying their credibility and reputation as key players in the innovation landscape (Hsu et al., 2021). Moreover, the act of publishing in academic journals signifies a willingness to share insights, collaborate with the wider research community, and push the boundaries of what is known. Hence, it is proposed that publishing activity will also have a positive influence on the investment attractiveness of clean technology clusters.

Proposition 1: Clean technology clusters with high patenting activity in the area of cleantech will receive more investments.

Proposition 2: Clean technology clusters with high academic publishing activity in the area of cleantech will receive more investments.

Although research has observed the absence of clear influence of proximity to universities on company attractiveness, this is not the case for cluster research, where geographical location around universities brings forth several benefits and influence on the development trajectory of clusters (Gradeck et al., 2004; Abramovsky & Simpson, 2011; Arundel & Geuna, 2004). The literature seems therefore to be supporting a proposition stating a positive relationship between the two concepts.

Proposition 3: Clean technology clusters located in close proximity to research universities will receive more investments.

The logic behind the case study methodology selection is presented in the following chapter, which then moves to explain the reasons behind the selection of the four case clusters. The continuation of the chapter introduces the methodology choices taken for each of the aforementioned variables, defining proxies and approximations used during the data collection and presenting the main sources of information for the collected data. As the data collection focuses on the company level, gathering company-level information on the three independent variables and their funding received, the Analysis and Results chapter begins by presenting four single-case reports with the obtained data. The cross-case analysis in then in charge of translating this information to the cluster level, in particular by obtaining the cluster-wide frequency of funding from the data collected on the company level.

Chapter 3

Methodology

The methodology adopted in this study builds upon the approaches outlined in the key articles discussed in the literature review and on specific literature collected to build a proper research design. Referring to Konstantynova and Lehmann (2017), a descriptive and exploratory, qualitative approach by the application of a multiple (four) case study method has been followed. This approach has been considered to be the most suitable one, due to giving a structural yet open and flexible framework to learn the specifics of the activities by cluster companies and their influence on the attractiveness of the cluster. Meanwhile, the application of other methods, especially quantitative ones, would restrict and limit the richness of the gathered information, particularly given the limitations in the collection of financial data from publicly available sources.

Methodologically, the logic of the multiple case study expressed by Konstantynova and Lehmann (2017) has been considered. This means that after the developed theory, case selection and designing the data collection protocol, the four case studies have been conducted, and an in-depth individual case report for each case study was written. Afterwards, the key research findings were presented via cross-case conclusions. Case studies offer a unique approach for examining phenomena within their authentic real-world settings, allowing for a comprehensive exploration through the application of various data collection methods and an in-depth examination of these phenomena (Priya, 2021). Descriptive and exploratory case studies, in particular, offer the chance of diving into a topic and gain a better understanding of its dynamics by observing it in its real-world context and by generating fresh observations to be used in subsequent research. Given its ability to provide a structured yet adaptable framework (Konstantynova & Lehmann, 2017) for gaining insights into the specific activities of companies and how they impact the attractiveness of their respective clusters, the case study methodology was considered the most suitable approach for addressing the research questions of this study.

3.1 Case selection

The process of selecting clusters to construct the case studies was carried out by considering several clean technology clusters as potential cases for analysis. However, there exist various approaches to identify clusters, each offering unique perspectives on the concentration and spatial distribution of employment within specific sectors or sub-sectors, as outlined by Komorowski and Stimson (Komorowski, 2020; Stimson, 2014). Komorowski delves into three primary techniques that find frequent application in research, asserting that each technique offers a varying degree of insight. He suggests that combining these techniques in a triangulated manner could result in the most comprehensive outcomes. The three methods he outlines are the stochastic method (employing employment data, for instance), location quotients, and point pattern data analysis.

Given the time restrictions of this study, it was chosen to follow a methodology more closely aligned with Tvedt (2019). Tvedt's approach involved identifying clusters through the member directories of the Global Clean Technology Cluster Association (GCCA) and the International Cleantech Network (ICN). These international associations bring together clean technology cluster organisations from different regions and countries worldwide. These organizations, in turn, list their affiliated member companies and institutions within their directories.

Having decided for this type of approach to identify clusters and their members, both directories of the GCCA and the ICN were consulted. However, the GCCA portal was found to be inaccessible, prompting the compilation of a list of cluster organizations exclusively using the ICN member list. It's essential to highlight that the ICN specifically gathers information about European Clean Technology clusters. For each cluster organization, pertinent data was gathered, including the focal country and region, as well as the overarching technology specialization of the cluster. It's worth mentioning that certain clusters did not make their member lists available on their websites. Due to the perceived lesser reliability of second-hand sources, these clusters were not subjected to further analysis. In contrast, clusters that provided accessible member lists underwent a thorough compilation of their complete member rosters. A strategic decision was made to select four clusters from the entire dataset, over which to collect all information on the dependent and independent variables.

The author acknowledges that this method for identifying clusters may not comprehensively encompass the intricacies of regional clustering, as it doesn't incorporate labor concentration or geographical coordinates data in its cluster identification steps. Nonetheless, it's good to note that this method has been employed in prior research (Tvedt, 2019) and is posited to be sufficiently effective for investigations centered around cluster formation and structural analysis.

The comprehensive data for the thirteen cluster organizations affiliated with the ICN is exhibited in Appendix A, encapsulating crucial information about their respective memberships.

The choice was made to undertake a case study analysis for four distinct clusters: Aclima, CLEAN (Central Denmark Region), Water Alliance, and Greenreality. This selection was motivated by the aim to collect cases presenting differing characteristics, to maximise the potential for useful observations from the cross-analysis. The clusters therefore exhibit variations in their attributes. Specifically, the Danish CLEAN and the Dutch Water Alliance have in common their technology focus, given that both clusters are dedicated to water management and sustainable development. Whilst the Spanish Aclima shares part of this focus, it also encompasses other fields such as waste, eco-efficient production and eco-design. Starkly different is instead the Finnish Greenreality, which is made up of companies mainly dedicated to the mechanical industry focused on materials such as cements, concrete and ceramics.

Aside from their technological focuses, the clusters in the sample also diverge in terms of geography, composition, and the number of constituent companies. The geographical disparities encompass the distinct approaches to sustainability within the countries where these clusters are situated. Clean innovation notably benefits from a positive public consensus and supportive policy structures, as evidenced by studies (Sunny & Shu, 2019; Veugelers, 2012), which indicate laws designed to promote sustainable development, as well as grants and funding for firms embracing this direction. In the case of the examined sample, the clusters' diverse locations contribute to varying contextual backgrounds and sustainability policies.

The four clusters also differ in their member count, with Water Alliance presenting 173 members, Aclima showing 126, Greenreality listing 46 and CLEAN (Central region) giving a list of 45 entities. The composition of the clusters varies between them, with some listing several governmental entities and universities between their members.

Cluster	Country	Region	Members	Sectors
Aclima	Spain	Basque Country	126	Waste, contaminated soils; Integrated water cycle; Air and climate change; Ecosystems; Eco-efficient production, eco-design
CLEAN	Denmark	Central Denmark Region	45	Separating solids from solids, sorting; Disposal of solid waste, reclamation of contaminated soil; Working of plastics, working of substances in a plastic state in general; Treatment of water, waste water, sewage, or sludge; Water supply, sewerage.
Greenreality	Finland	South Karelia	46	Machine tools, metal-working not otherwise provided for; Working cement, clay, or stone; Cements, concrete, artificial stone, ceramics, refractories
Water Alliance	The Netherlands	National	173	Physical or chemical processes or apparatus in general; Treatment of water, waste water, sewage, or sludge; Water supply, sewerage

Figure 3.1: Table overview of the four selected cases

To effectively analyze each case, comprehensive information about all member companies was systematically gathered and meticulously organized using the Catalist software, a platform developed by the Dutch company Venture IQ (Venture IQ BV, n.d.). This software facilitates the creation of company collections and automates the process of aggregating crucial information such as website links, LinkedIn profiles, and Crunchbase data. These elements collectively contribute to the construction of comprehensive company profiles, encapsulating succinct descriptions of the company, its year of establishment, country of operation, and employee count as gleaned from LinkedIn and/or Crunchbase sources.

Having completed this first data gathering step, with the full lists of member companies per cluster having been added to the corresponding Catalist collections, the next step was to collect data on the dependent, independent and control variables, as defined in the theoretical framework.

3.2 Data collection

Data is collected for the individual cluster companies from secondary sources such as Crunchbase and the European Patent Office. This company-level data, to be employed within the single-case reports, is joined by cluster-level data on country policies and population, to carry out the cross-case analysis meant to compare the different clusters. Information on investment attractiveness is first collected for the single companies, by gathering data on funding, and then translated to the cluster-level during the analysis, by exploring the frequency of funding across the full samples and by diving into the main observations on funding amounts and types, gathered from the companies which have received funding.

3.2.1 Investment attractiveness

The investment attractiveness of a cluster can be quantified by examining the historical investments made by external companies and institutions into its constituent firms (Burger et al., 2015). To gather this data, financial databases such as Pitchbook and Crunchbase serve as valuable resources.

Pitchbook and Crunchbase are prominent databases that offer comprehensive datasets encompassing various investment activities, such as venture capital, private equity, and other forms of financing. These platforms serve as valuable resources for researchers seeking insights into the landscape of investments. Within these databases, researchers can access detailed information on funding rounds, including investment amounts, the identity of investors involved, and the recipient companies that have received investments.

The Catalist software enhances its profiles through data sourced platforms like LinkedIn and Crunchbase. Additionally, Pitchbook links and funding details were manually incorporated into the profiles. However, funding data isn't consistently accessible due to the absence of Crunchbase or Pitchbook profiles for some companies, and even when present, not all companies input their data on these platforms. Upon reviewing the available information, I observed the limited disclosure of funding amounts by companies within the clusters. Furthermore, it became evident that each cluster included several multinational companies, whose investment attractiveness can't be solely attributed to the factors being analyzed. Therefore, the dependent variable is measured on the cluster level by observing the investment frequency across local companies of each cluster. This therefore excludes any universities, governmental agencies or multinational companies not based in the country, which were listed as members by the cluster organisations. A full list of the companies included in the analysis of each case can be found in Appendix A.

Investment round dates and amounts were only collected for those companies which made such data available on Crunchbase or Pitchbook, and it was decided to provide a more in-depth analysis for these companies within the single-case reports. The aim of these deep-dives is, given the limited data available, to collect as much information and observations as possible on the proposed relationships.

3.2.2 Patents, publications and distance from universities

Patenting activity To gather the required patent data, the methodology involves sourcing information directly from the European Patent Office. This resource, as highlighted in the research by Burger et al. (2015), has gained significant traction in comparable studies. Serving as an invaluable repository, the European Patent Office houses an extensive collection of granted patents. This repository enables the identification of patents associated with entities operating within the clean technology cluster. The information encapsulated in these patents reflects the extent of technological advancement and innovation capabilities within the cluster.

The approach taken to identify relevant patents centers on analyzing the patent applicants. This process involves cross-referencing the legal designations of companies or their parent entities with the names of patent applicants. This ensures accurate identification of patents linked to the listed companies, thereby providing a nuanced understanding of the technological endeavors woven into the cluster's ecosystem.

Within the complete roster of cluster members for each selected sample cluster, patent information was exclusively gathered for corporate entities. Universities, due to their distinct patenting and publication dynamics, were excluded from this data collection process. However, the influence of universities on the clusters' investment attractiveness is alternatively assessed by quantifying the proximity of companies to research-oriented universities situated within the region, as well as by the measurement of the publication activity of companies, which implies collaborations with educational and research institutions.

Additional information on the issuing years of the identified patents was only collected for those companies for which dates and/or funding amounts were found. Given the availability of more financial information for these companies, it was deemed important to provide additional information on their patenting activity and how it relates to their funding history.

Academic publishing activity The utilization of Web of Science, a widely recognized and reputable platform known for its repository of academic publications, played a crucial role in sourcing scholarly articles originating from the targeted clusters. In this context, an article is deemed relevant to the company being analyzed when the company's legal identification is detectable among the addresses of the authors associated with the publication. This discerning criterion ensures that the article's content corresponds to the pursuits and associations of the company under investigation.

Similarly to the approach employed for gathering patent information, universities were omitted from this data collection phase due to their extensive publication activity. In line with the aforementioned rationale, publishing dates were only collected for the companies subject to the deep-dive analysis.

Spatial distribution Sunny and Shu (2019) posited that the proximity of research-oriented universities from a reference point within the cluster provides valuable insight. Identification of local universities involved a thorough search for institutions in the cluster's vicinity, followed by a comparison based on the QS World University Ranking (*QS World University Rankings 2021*, 2020) and the Times Higher Education Ranking (*World University Rankings 2021*, 2020). This selection process was influenced by earlier research (Garcia et al., 2015) demonstrating that firms place high importance on the quality of research groups when considering collaborations. Hence, the inclusion of recognized institutions aimed to mitigate confounding factors, such as the international reputation of the institutions, ensuring that only reputable establishments were considered for analysis.

This comparison allowed to filter the identified institutions, and from the initial list were removed those universities which did not figure in either ranking or that, upon further analysis, did not offer any programs related to clean technologies, sustainability or engineering.

In order to conduct the analysis, it was first essential to collect all the addresses of the listed members of the sample clusters and of the identified universities. The process of gathering addresses for each individual firm followed a systematic approach. Primary emphasis was placed on extracting addresses directly from the firms' official websites. In instances where a functional website was lacking, recourse was taken to the address provided on the respective firm's LinkedIn profile. In scenarios where both of these avenues proved unfruitful, or in the context of corporations presenting multiple offices within the region of analysis, the address furnished on the cluster organization's official website or on the company's Google Maps profile was adopted as a substitute. It's worth acknowledging that while these address sources are frequently relied upon, their accuracy is not infallible. The inherent limitation is further exacerbated by the broader reality that even addresses extracted directly from a company's own website might not consistently reflect the most current information. Therefore, it is imperative to acknowledge and accommodate the potential for a certain margin of error within the study due to the variable accuracy of addresses. Firms for which it was impossible to collect any address or coordinates were excluded from further analysis.

Coordinates can be easily extracted from address information using a geocoding request in Python (see Appendix B), and this was done for all local companies of the sample clusters for all the identified Universities. The distance between the companies and the Universities was computed using the Haversine formula (see Appendix B).

Distances were considered from the single unit of analysis of the company within the single case reports, whilst a computation for the average distance of the cluster companies from their closest universities was employed within the cross-case analysis.

3.2.3 Age and size, activities, policies and cluster organisations

The theoretical framework presented in Chapter 2 presents a series of additional factors to be taken into account during the analysis.

Age and size The factors of age and size are particularly important within the single case reports, in that these company traits have been shown to influence their investment attractiveness and activities (Susanti & Restiana, 2018; Navaretti et al., 2014; Rodríguez-Gulías et al., 2020). The founding year of each company is automatically collected by the Catalist platform through sources such as LinkedIn and Pitchbook. Analogously, the software is able to gather information on the FTE (Full-Time Equivalent) brackets of the companies. However, precise headcounts are not always available or reliable. It was therefore chosen to report the FTE brackets for all companies (where available) and to look for more information on the precise headcount for the companies the report deep-dive, in order to account in more detail for the influence of age and size on their investment rounds.

Company activities The activities undertaken by a company can influence its attractiveness to investors and play a strong role in its approach to innovation strategy (Kianto et al., 2010). To account for the differing intellectual protection strategies of the companies in each cluster, within the single case study reports is included a qualitative assessment of the central activities of each firm. The description and websites of each company were analysed to decide whether the firm was product-/technology-centric, or service-centric. The product and technology based firms were grouped given their similar approaches to intellectual protection, which is usuall pursued by means of patenting or licensing of their products and novel technologies.

Country policies As mentioned within the Literature Review, policy studies on clusters have been a common topic amongst researchers. Most findings have not found a strong influence from public policies on the development and attractiveness of clusters (Burger et al., 2015; McDonald et al., 2006), but previous cross-case studies have remarked the important of highlighting the different institutional environments in which clusters and cluster organisations act (Konstantynova & Lehmann, 2017). Therefore, as an additional factor to compare the different cases, any available information on regional policies towards the development of clean technologies and clean technology clusters was qualitatively reported and assessed. The collection of this data is highly qualitative in nature and aims to gather information on the extent to which countries and regions are supporting sustainable development, by looking into their strategies and objectives for the upcoming years. This information can be sourced from reports issued by the concerned governmental entities, as well as from country profiles by the European Union, which periodically reports the performance and plans of members states toward sustainability. Additionally, some high-level information on the countries and regions in which the clusters act are also collected, including population count and density and the main cities in the area.

Cluster organisation activities Driven by the works of Burger et al. (2015) and Konstantynova and Lehman (2017), qualitative information on the activities of the corresponding cluster organisations for each cluster was reported. Such "cluster activity bundles" (Konstantynova & Lehmann, 2017) can include activities spanning from training and qualification and co-operation, to access to financing and protection of property rights. Cluster organisations are a precious tool in the development and support of clusters, providing structures and instruments to enhance collaboration and aid the success of their member companies. Cluster organisation activity bundles are reported on their website and the information was therefore collected via their consultation.

Chapter 4

Analysis and Results

The process of examining the gathered data involves two distinct phases. Initially, individual case reports are created for each cluster, presenting company-level data. Within these individual case reports, an in-depth qualitative analysis is conducted for companies that reported funding, encompassing the types and amounts of funding rounds. This analysis also involves connecting the dots between patent filing, academic publication and distances from universities. The second phase of the analysis involves amalgamating the findings from the individual case reports to construct a cross-case analysis that could illuminate the primary distinctions among the four cases. In this stage, the additional cluster-level factors of age, size, policies and cluster organisation activities are taken into account.

Data preparation The data collected for each cluster underwent a process of refinement and organization. This involved generating the ultimate lists of companies to be taken into account in the single case reports (presented in Appendix A), achieved by removing any multinational corporations, universities, and government entities that were initially included as members of the cluster organizations. Having obtained such lists, the calculated distances from universities were condensed into one column, taking as the final value for each company that which showed the smallest distance from the identified universities.

Structure of single case reports Each single case report begins with the distribution of company types for the purpose of data cleaning. This is succeeded by the primary subsection, which is dedicated to establishing connections between the collected data for the three primary variables and the observed funding frequencies within the sample. Then, the subsection that reports the ages and sizes of the companies within the cluster serves as the initial point for examining these variables at the cluster level. The averages and common values provided in this subsection are utilized in the cross-case analysis to facilitate comparisons among the different cases. Lastly, the deep dive subsection gives a full report of the data obtained for the companies that have received funding. Observations on funding amounts, deal types and investor types are made, relating the variation in the sample to the main variables of patents, publications and distance from the closest university.

4.1 Single case reports

4.1.1 Aclima - Basque Country, Spain

The Aclima cluster organization, also known as the Basque Environment Cluster, is situated in Bilbao and gathers companies operating within the clean technology sector in the Basque Country, an autonomous region in Northern Spain. The Basque Country is composed of the three provinces Biscay, Gipuzkoa, and Álava, with capitals Bilbao, Donostia-San Sebastián and Vitoria-Gasteiz, respectively. With a population of 2.2 million people and a density of 310/km2, the Basque Country presents a strong and diversified economy with a focus on manufacturing, industry and services. The main city for size and economic activity is Bilbao, whose port is one of the largest in northern Spain. The Basque Country closely follows the targets set out by the European Union in terms of emission reduction and energy strategy. Through instruments such as the Basque Green Deal (Public Agency Ihobe, 2021), the Environmental Framework Program of the Basque Country (Ihobe, n.d.) and the Basque Energy Strategy (Basque Government, 2015), the autonomous community has declared a series of sustainability goals to be reached by the year 2030. At the national level, Spain's key focus areas, related to their corresponding Sustainable Development Goals (SDG) include mitigating urban environmental challenges to enhance sustainability within cities (SDG 11), addressing air quality concerns (SDG 3), improving waste management practices (SDG 12), bolstering resilience against the impacts of disasters (SDG 13), and preserving both cultural and natural heritage (SDG 15) (European Environmental Agency, 2020).

The Aclima cluster is a key element in the sustainability strategy of the Basque Country. This organization's primary areas of emphasis lie within various sectors of the environmental industry, specifically concentrating on Waste, contaminated soils; Integrated water cycle; Air and climate change; Ecosystems; Eco-efficient production, eco-design. The services offered by the Aclima organisation encompass three distinct areas (Aclima, n.d.): Co-operation, Information and communication and Marketing and PR. Aclima promotes co-operation by the institution of working groups aimed at collaboration between companies interested in the development of similar technologies of applications. While membership to the cluster ensures a constant flow of information on available funding opportunities and new projects, the companies can also benefit from the cluster's efforts in internationalisation and participation in European projects. The 2023-2026 strategic plan of the Aclima organisation focuses on three of the seventeen Sustainable Development Goals: SDG8 Decent Work and Economic Growth, SDG9 Industry, Innovation and Infrastructure and SDG17 Partnership for the Goals.

Aclima lists 126 members on its directory, including several universities and governmental agencies (Figure 4.1). Amongst its companies, there are several members that represent multinational corporations with local offices in the region which, as previously noted, these have been omitted from the analysis. Additionally, while searching for company addresses, it was discovered that five companies did not disclose their address on their website or any other publicly accessible data source. Consequently, these particular companies have been omitted from the ultimate list of companies for the analysis.

Patents, publications and distance from universities

The conclusive roster of companies for the individual case report encompasses a total of 84 firms. In the evaluation of the funding acquired by these companies, the absence of links to

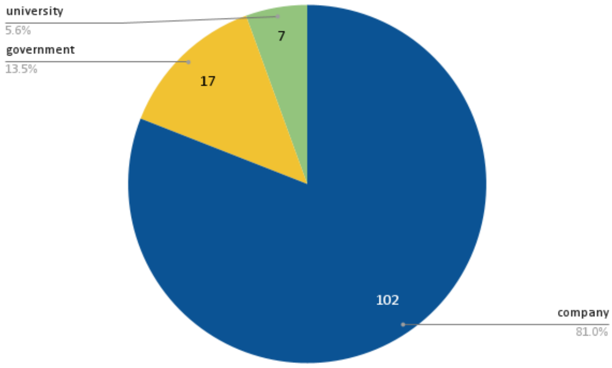


Figure 4.1: Distribution of company types across the full member list of the cluster Aclima

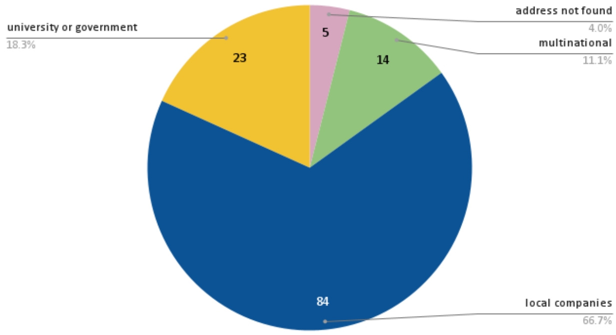


Figure 4.2: Distribution of company types for the purpose of data cleaning for the cluster Aclima

Crunchbase and Pitchbook served as an indicator of potential non-funding status. Moreover, it's worth noting that companies featuring these links might not necessarily disclose any funding rounds in their profiles. Consequently, the ultimate count of companies that have received funding throughout the entire sample amounts to 13 (Figure 4.3).

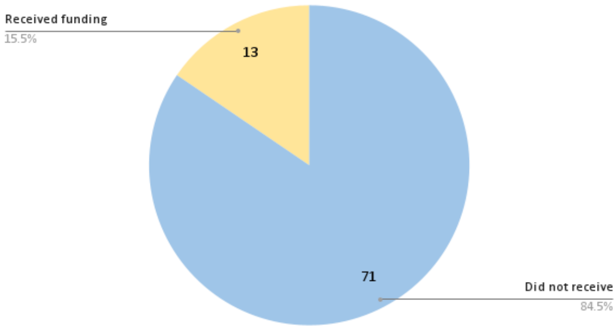


Figure 4.3: Funding frequency across the Aclima sample

Within the two distinct categories of companies, those that have secured funding and those that haven't, the distribution of firms engaged in publishing varies to some extent. Among the 71 companies lacking reported funding, a substantial majority, exceeding 84% (60 out of 71), have not pursued any patent activities. Similarly, among the 13 companies documented to have received funding, 77% (10 out of 13) lack any patent records associated with their operations.

Comparable patterns to those noticed in patent-related activities are likewise evident in the publishing endeavors of the companies within the dataset. Merely 10 out of the 71 companies without reported funding (14%) are identified as actively engaged in academic publishing. Similarly, among the companies with reported funding, the proportion of firms having evidence of scholarly publications amounts to just over 15% of the 13 firms (2 out of 13).

Among the companies that have received funding, the calculated average distance is 37.34 km. However, upon examining a visual representation of the data (refer to Figure 4.6), as well as considering the notably different median value of 17.52 km and the distribution of values between 0.94 and 90.11 km, it becomes apparent that there is a considerable amount of variation among the data points. Similarly, for companies without funding, the average distance measures 25.78 km. Nevertheless, subsequent analysis reveals substantial variability

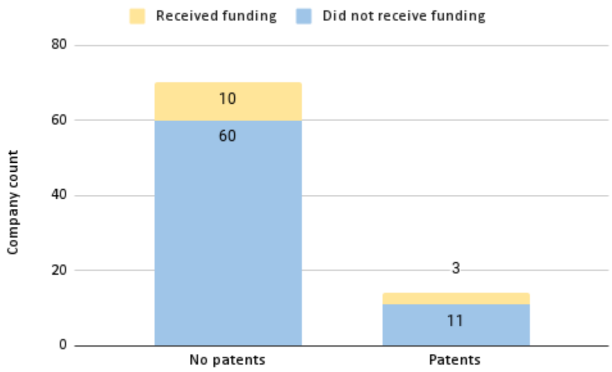


Figure 4.4: Distribution of companies with and without patents between companies with and without funding for the cluster Aclima

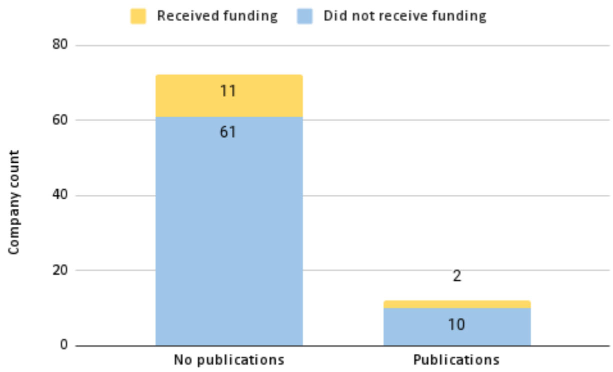


Figure 4.5: Distribution of companies with and without publications between companies with and without funding for the cluster Aclima

within this sample as well. Figure 4.7 illustrates the distribution of the collected data, and the median is found at 11.9 km. Given these observations, at first glance, it may appear that the average distance for funded companies is higher than for those without funding. However, the substantial degree of dispersion within the data prevents from making a definitive statement regarding this assertion.

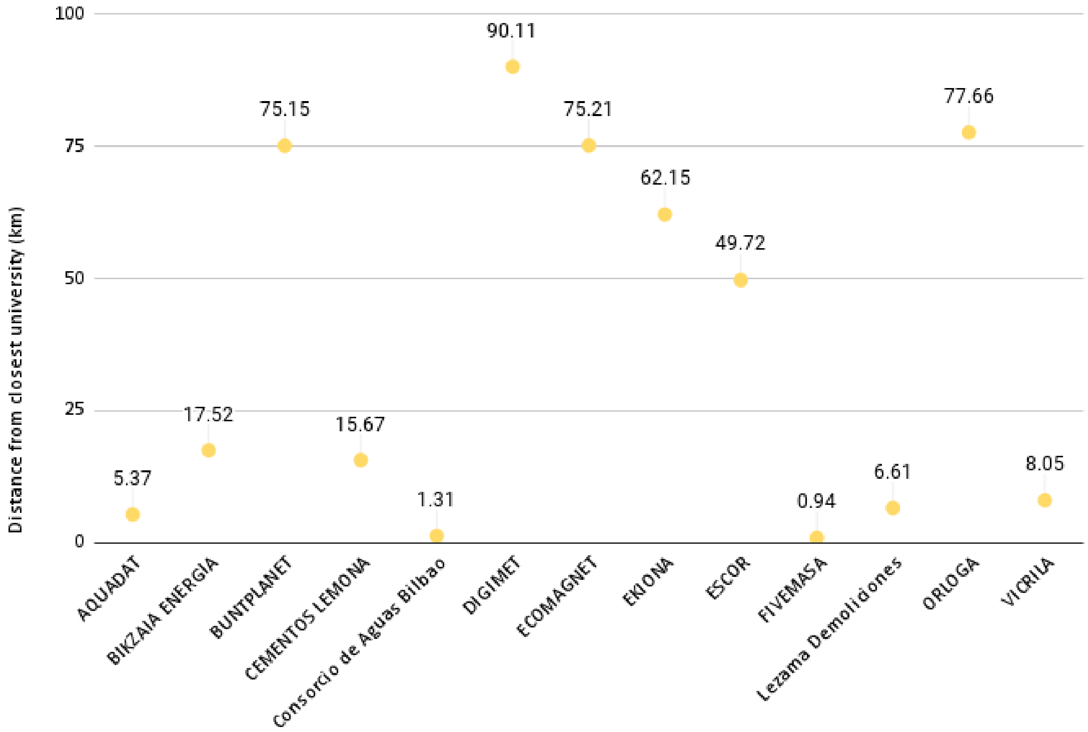


Figure 4.6: Recorded distance values from the closest university of companies having received funding, measured in km, for the cluster Aclima

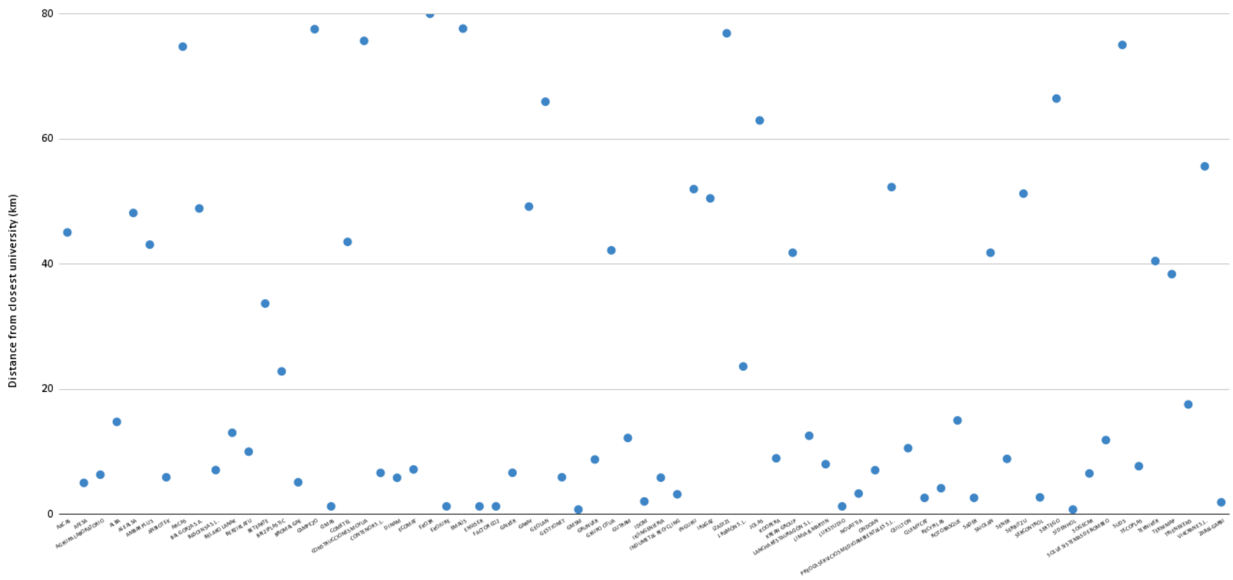


Figure 4.7: Recorded distance values from the closest university of companies not having received funding, measured in km, for the cluster Aclima

Age, size and activities

The theoretical framework elaborated in Chapter 2 asks to consider, as additional factors influencing the investment attractiveness of clusters, variables such as the age and size of its constituent companies, as well as the activities undertaken by these companies from a business perspective. In the context of the individual case analysis for the Aclima cluster, the distribution of this data concerning two distinct groups, companies that have received funding and those that have not received funding, is presented.

The computed average age in respect to the year 2023 for the companies without funding is found to be lower than the one for those who have received funding, with respective values of 29 and 40 years. Companies without funding exhibit a consistent distribution, with age values spanning from 96 years to 1 year and a median age of 26 years. Conversely, companies with funding display a higher degree of variability, as evidenced by founding year values ranging from 1890 to 2021 and a median age of 28 years, with the two companies Vicrila and Cementos Lemona showing the most out-of-line values.

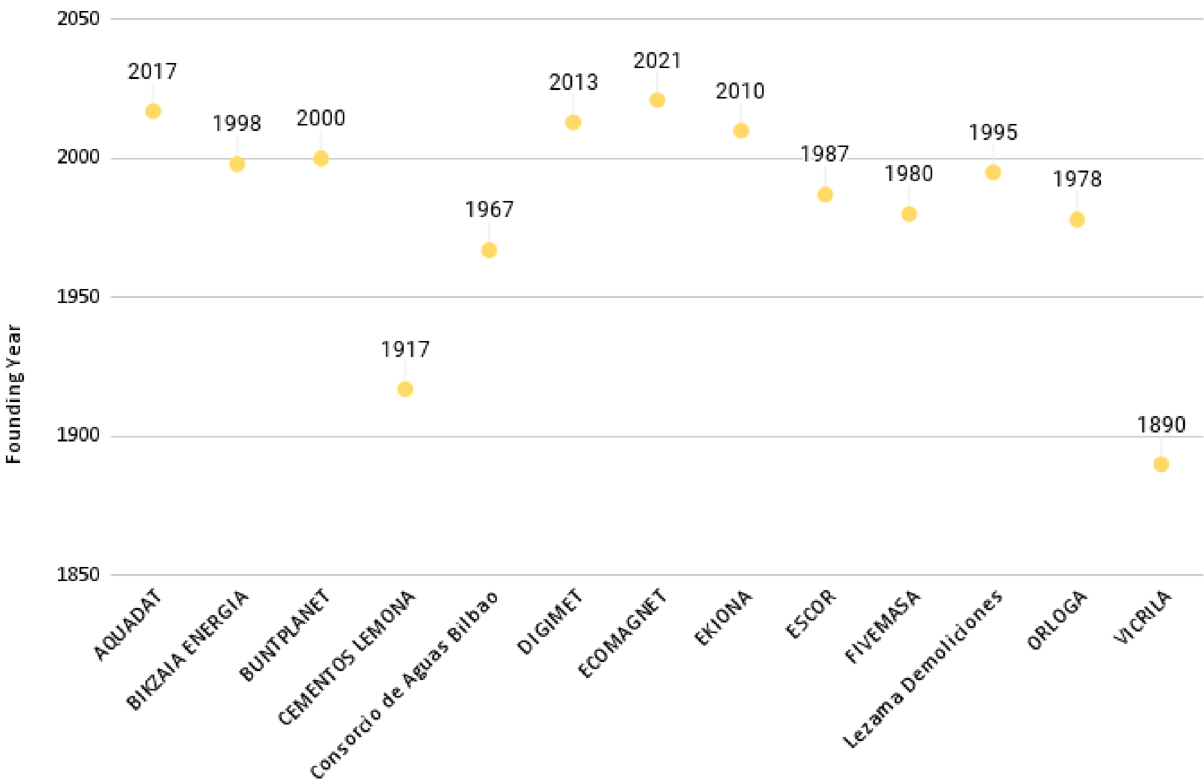


Figure 4.8: Recorded founding years of companies having received funding for the cluster Aclima

For the entire sample, the company headcounts are evaluated using Full-Time Equivalent (FTE) ranges. These ranges do not offer a precise headcount of employees but provide a broad estimate of a company's size, which can be valuable in this initial, high-level assessment. Exact company headcounts were researched in more detail for those companies which have received funding, as reported in the deep dive analysis.

As depicted in Figure 4.9, among the companies that did not secure funding, the most common headcount range falls within 11 to 50 FTEs. The sample exhibits a distribution across various ranges, including three companies with headcounts surpassing 1000, while the remaining 68 companies have fewer than 500 FTEs. For the companies wich secured funding, there appears to be less diversity, with companies distributed over the four lower ranges. The primary beneficiaries of funding seem to be small-sized companies, particularly those with 1-10 and 11-50 Full-Time Equivalents (FTEs), with eight out of the 13 companies falling within these ranges.

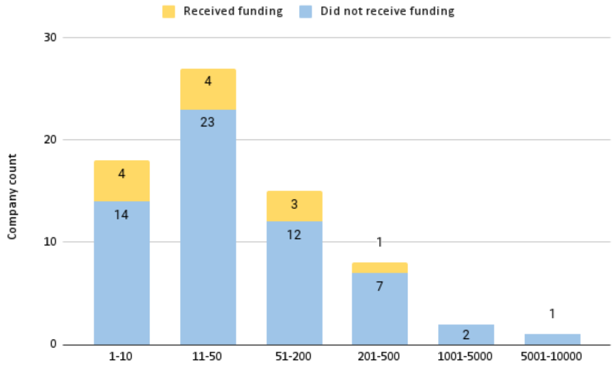


Figure 4.9: Recorded FTE ranges of companies in the cluster Aclima

Drawing from the literature examined in Chapter 2, it is understood that a company's activities and business orientation can significantly impact its appeal to investors. Consequently, it becomes intriguing to investigate the distribution of firms based on their business focus, which has been categorized into three groups: service-centric, product- or technology-centric, and a combination of both. As an additional point of observation, although not central to the analysis carried out in this study, Figures showing the frequency of patenting and publishing for companies across the three categories are also provided.

In the Aclima cluster, it is evident that 52 companies primarily emphasize services, and among them, 4 have secured funding, accounting for 31% of the total funded companies. Furthermore, 23 companies seem to be involved in a combination of service-centric and product or technology focused activities, with 5 of them having received funding, representing 38% of the total funded companies. Among the 9 companies with a primary focus on products or technology, 4 have obtained funding, making up 31% of the total funded companies.

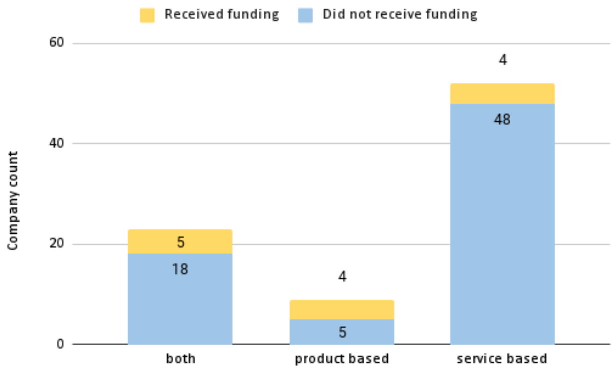


Figure 4.10: Company activity types for the companies in the cluster Aclima

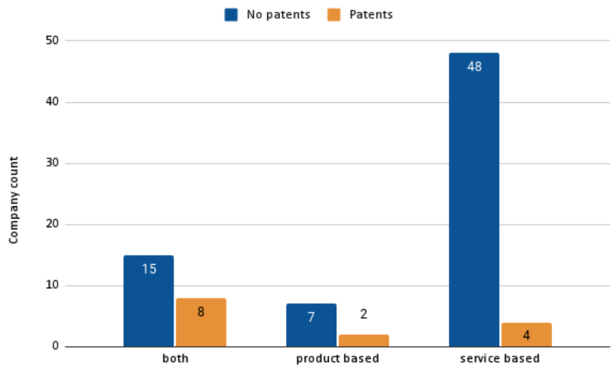


Figure 4.11: Patenting activity across company activity types for the companies in the cluster Aclima

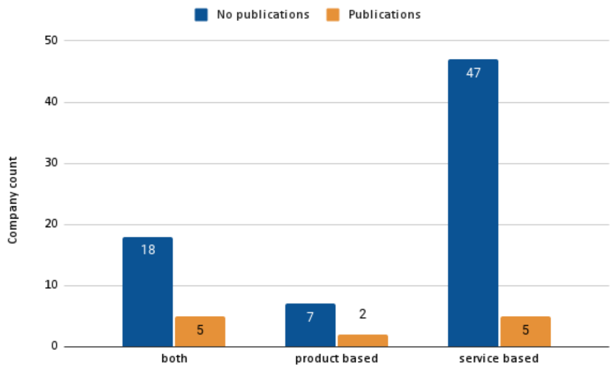


Figure 4.12: Publishing activity across company activity types for the companies in the cluster Aclima

Deep dive into companies with funding

Across the whole Aclima sample, only 13 companies have reported funding on either Crunchbase or Pitchbook. Information of the several funding rounds that these companies have received is sometimes incomplete, as visible from the table pictured in Figure X. The table shows a complete account of the collected information for these companies, including precise headcounts where this number was possible to find. This information was mainly sourced from LinkedIn, which reflects the current count of user accounts that have specified the company as their current place of employment. It's important to note that such data can be somewhat unreliable, as it relies on user-provided information. However, considering that this data is not a central aspect of the analysis, the impact of this limitation on the final results is relatively minimal. Alternatively, Pitchbook also provides headcount information within their company profiles. It's worth noting, though, that this data might not always be up to date, as these profiles are not continuously updated in real time to reflect changes within the company.

Names	Patents	Publications	Distance from nearest university (km)	Founding Year	FTE	Employee Count	Business model	Dates of deals	Type of deal	Amounts for each deal	Investor types
AQUADAT	0	0	5.37	2017	1-10	8	service based	29-May-2020	Early stage VC	€0.30 M	-
								19-Sep-2019	Accelerator/incubator	€0.03 M	Accelerator
								1-Jan-2017	Accelerator/incubator	-	Corporation
								15-Dec-2016	Early stage VC	€0.15 M	Corporation
BIKZAIA ENERGIA	0	0	17.52	1998	11-50	40	product based	12-Nov-2019	Merger/Acquisition	-	Corporation
								27-Feb-2013	Buyout/LBO	€180 M	Private Equity
								1-Jan-2004	Merger/Acquisition	-	Corporation
								10-Mar-2003	Debt - General	€440 M	Bank
BUNTPLANET	2	1	75.15	2000	11-50	18	product based	31-Jul-2020	Grant	€1.51 M	Government
CEMENTOS LEMONA	2	3	15.67	1917	11-50	-	both	25-Feb-2013	Merger/Acquisition	-	Corporation
Consorcio de Aguas Bilbao Bizkaia	0	0	1.31	1967	201-500	99	service based	1-Aug-2021	Secondary Transaction - Private	-	-
								11-May-2000	Corporate	-	Corporation
								1-Jan-2000	PE Growth/Expansion	€3.12 M	Venture Capital
DIGIMET	2	0	90.11	2013	1-10	2	both	1-May-2021	Later stage VC	-	Venture Capital
								1-Jan-2013	Early stage VC	-	Venture Capital, Accelerator/Incubator
ECOMAGNET	0	0	75.21	2021	1-10	4	product based	4-Apr-2022	Seed round	€0.85 M	Corporation, Goverment, Venture Capital
								14-Dec-2021	Early stage VC	€0.70 M	Venture Capital
								24-Sep-2021	Early stage VC	€0.35 M	Government, Not-for-Profit Venture Capital, Venture Capital
EKIONA	0	0	62.15	2010	1-10	12	both	1-Apr-2018	Grant	€71.4 K	Government
ESCOR	0	0	49.72	1987	-	-	service based	30-Jul-2008	Buyout/LBO	-	PE/Buyout, Corporation
FIVEMASA	0	0	0.94	1980	51-200	22	both	21-May-2015	Merger/Acquisition	-	PEBuyout, Corporation
Lezama Demoliciones	0	0	6.61	1995	51-200	-	service based	4-Oct-2022	Merger/Acquisition	-	PE/Buyout
ORLOGA	0	0	77.66	1978	11-50	8	both	29-Feb-2020	Grant	€0.05 M	Government
VICRILA	0	0	8.05	1890	51-200	153	product based	12-Sep-2016	Buyout/LBO	-	PE/Buyout, Corporation, Sovereign Investment Fund
								31-Jul-2012	Later stage VC	€5 M	Corporate Venture Capital, Venture Capital, PE/Buyout
								17-Mar-2010	Later stage VC	€19 M	Venture Capital
								1-Jan-2009	Merger/Acquisition	-	Own management

Figure 4.13: Table presenting the collected data for the companies having received funding in the Aclima cluster

As noted earlier, there are only 3 companies (BUNTPLANET, CEMENTOS LEMONA and DIGIMET) that have obtained patents, and their total patent count stands at 2 for all of them. Likewise, only 2 companies (BUNTPLANET and CEMENTOS LEMONA) have engaged in academic paper publications, with counts of 1 and 3. It is challenging to discern notable distinctions between the investment amounts received by these companies and the remaining ones, primarily because only one of them, specifically BUNTPLANET, has disclosed the details of its funding round.

Venture capital emerges as a commonly observed investment type among the full list, appearing in 8 out of the 27 deals. However, the most prevalent type of investor appears to be corporate entities, contributing, at least partially, to 9 out of the 27 deals. In a similar vein, 9 out of the 27 deals involve some form of merger or acquisition transaction, encompassing both Merger/Acquisition and Buyout/LBO deals. Unfortunately, it is yet again impossible to notice any differentiating traits between companies with and without patents, given that the investors participating in the multiple funding rounds and the investment types for the three active companies exhibit a diverse array and do not introduce any new or unusual categories when compared to the rest of the company list.

Looking instead at distances form the closest university, as previously mentioned the data is quite scattered, with an average value of 37.34 km and a median of 17.52 km. It is interesting to see that the companies with the most funding (BIZKAIA ENERGIA and VICRILA, in increasing order) are located at or under the median value. The furthest companies (DIGIMET, ORLOGA, BUNTPLANET, EKIONA and ESCOR, in decreasing order) do not appear, in comparison, to have received particularly substantial investment amounts, with the highest round equaling €1.51 M for BUNTPLANET. It would therefore appear that companies located under the median value of 17.52 km are able to collect higher amounts of funding, and this funding is interestingly not dependent on university accelerators or other university aids, given that investment types and investors are quite varied among these companies and accelerator investors are rarely encountered.

The companies in the subset are equally distributed across the three business models, and remain small-medium sized. Founding years vary considerably, and no unique points of observation can be established for younger or smaller companies, nor for a particular business model. The only distinct observation is the realisation that the two companies with the highest funding amounts are both product based.

4.1.2 CLEAN - Central Region, Denmark

The Danish cleantech cluster, known as CLEAN, operates across the entire country of Denmark, encompassing member companies from all five regions: Capital, Central, North, South, and Zealand. The cluster, as a whole, covers a broad spectrum of activities, including but not limited to: Separating solids from solids, sorting; Disposal of solid waste, reclamation of contaminated soil; Working of plastics, working of substances in a plastic state in general; Treatment of water, waste water, sewage, or sludge; Water supply, sewerage. Given the extensive geographical and sectoral diversity within CLEAN, a decision was made to narrow the focus to a single region, namely the Central Denmark region. This choice provides a sample of comparable size but with a distinct focus when compared to the Greenreality cluster, thereby introducing another unique case into the study.

The Central Denmark Region is one of the country's five administrative regions. The population is of approximately 1.3 million people, with a density of 100/km2. The region encompasses a mixture of urban and rural areas, with the main city for size and economic activity being Aarhus, famous for its growing tech industry and innovation and sustainable development. The region's economy is diversified in several sectors such as manufacturing, technology, helthcare, education and agriculture. Denmark as a whole is known for its commitment to sustainability and renewable energy, holding a strong position on several Sustainable Development Goals and setting out goals through Action Plans and Agendas aimed at the year 2030 (European Environment Agency, 2020a). In particular for the Central Denmark region, the Regional Council generally follows the goals set by the government, with a particular focus on reducing the footprint of public institutions such as hospitals, education and administrative offices (Central Denmark Region Regional Council, 2021).

The CLEAN cluster organisation focuses on four areas of action within its activities: Co-operation, through projects aimed at collaboration and exchange of knowledge; Information and communication, by keeping its members updated on available projects and resources; Political lobbying, by participating in projects aimed at enabling political anchoring of knowledge; Training and qualification, promoting projects clearly aimed at educating institutions and firms on clean technologies and their applications. The organization's website does not display a strategic plan, but it does highlight its efforts across various domains to support the United Nations' Sustainable Development Goals. Additionally, it proudly mentions its achievement of the "Gold Cluster" designation, which signifies its consistent excellence in cluster structure, governance, financing, strategy, services, and recognition (CLEAN, n.d.).

The CLEAN - Central Region group lists 45 members, including a number of governmental institutions and universities. Additionally, one multinational entity was identified and for one of the remaining firms it was impossible to find an address within the central region, hence it is excluded from further analysis. The final rooster of companies, henceforth referred to as the cluster CLEAN, counts 40 companies.

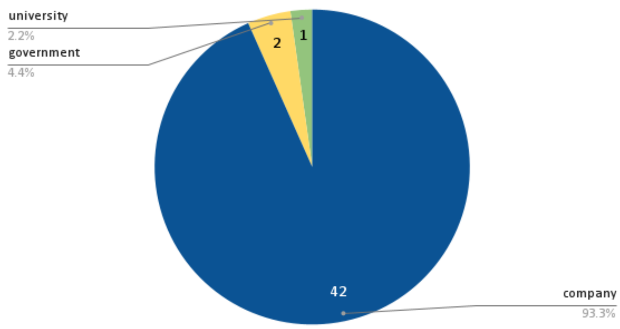


Figure 4.14: Distribution of company types across the full member list of the cluster CLEAN

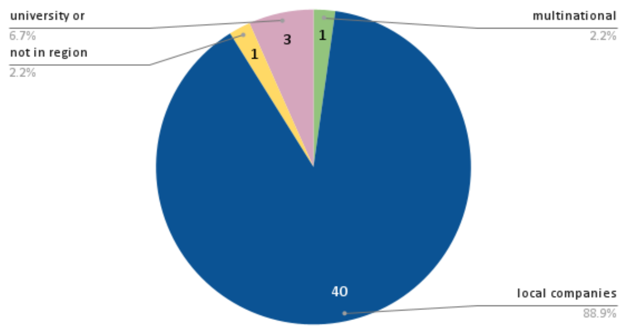


Figure 4.15: Distribution of company types for the purpose of data cleaning for the cluster CLEAN

Patents, publications and distance from universities

Within the CLEAN cluster, it appears that 9 companies have received funding, accounting for just 22.5% of the entire sample. When examining patenting and publishing activity between the two groups, there are some variations. Among the companies that have secured funding, 3 out of 9 firms (33%) are found to have acquired patents, while this number decreases to 19% for companies that have not received any funding.

Likewise, the distribution of academic publishing activity appears different between the two groups, but the pattern is reversed. Among companies without documented funding, 16% of them engage in academic publishing. In contrast, only one company among those with funding shows any academic works, making up 11% of its group.

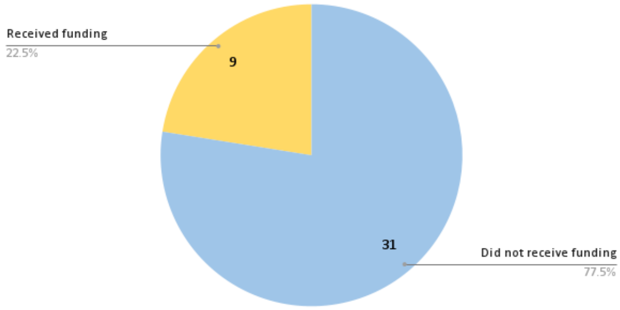


Figure 4.16: Funding frequency across the CLEAN sample

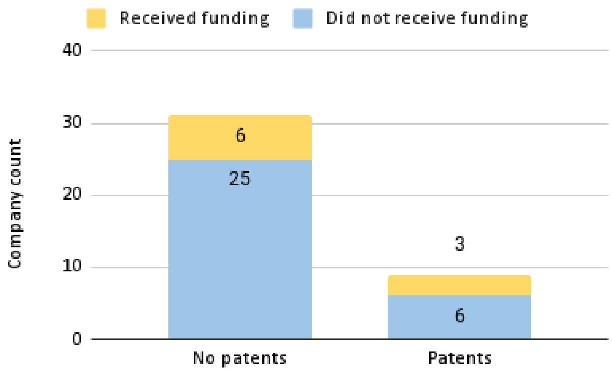


Figure 4.17: Distribution of companies with and without patents between companies with and without funding for the cluster CLEAN

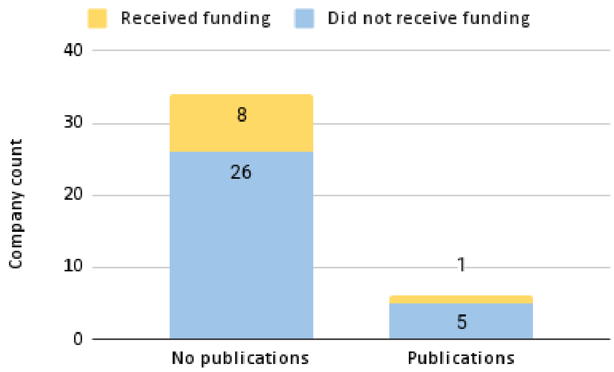


Figure 4.18: Distribution of companies with and without publications between companies with and without funding for the cluster CLEAN

When looking at the calculated distances for the two groups, it becomes apparent that the average distance from the nearest university is lower for companies that have received funding (15.26 km) and slightly higher for those that haven't (21.63 km). However, upon visually examining the distribution of values within the "Received funding" group (Figure 4.19), a notable lack of uniformity becomes evident. The values in this group range from 55.58 km to as little as 1.41 km, with a median of 4.28 km. Therefore, any observations made in relation to comparing the averages between the two groups are constrained by the considerable variability within the sample. Figure 4.20 also presents the distribution of distance values for the companies that did not receive funding. These values also show a notable dispersion, although it is somewhat less pronounced compared to the previous group. In this case, the median value for this group is 14.25 km.

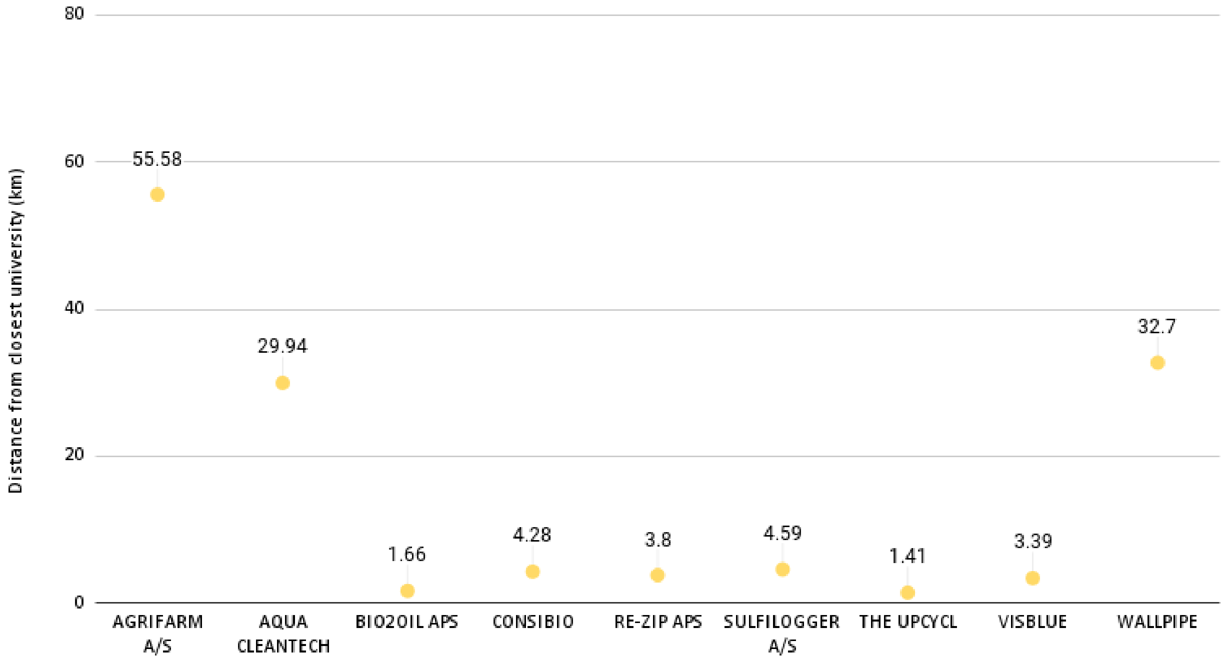


Figure 4.19: Recorded distance values from the closest university of companies having received funding, measured in km, for the cluster CLEAN

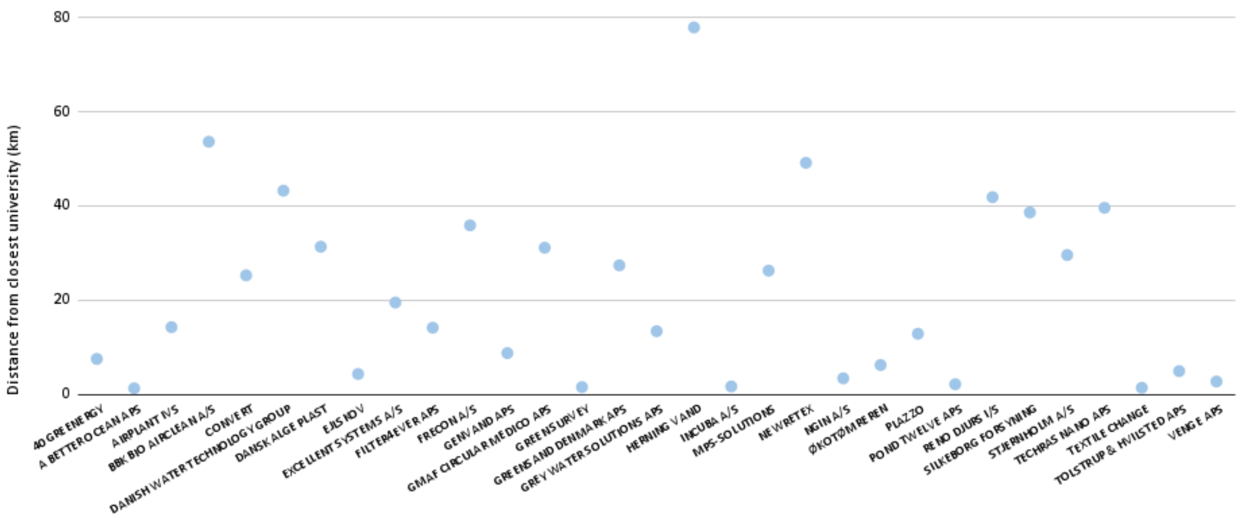


Figure 4.20: Recorded distance values from the closest university of companies not having received funding, measured in km, for the cluster CLEAN

Age, size and activities

The calculated average firm age for the two groups, those that received funding and those that did not, shows a slightly lower value for the funded firms, with an average of 7 years compared to the 13.5 years calculated for the unfunded firms. The first group exhibits a relatively uniform distribution, as indicated by ranges between 16 and 5 years and a median value of 6. For companies without values range between 47 and 1, with a median value of 9.5

years. Figure 4.21 illustrates the distribution of founding year values for the funded companies, and a visual examination confirms the previous observation of consistency within the dataset.

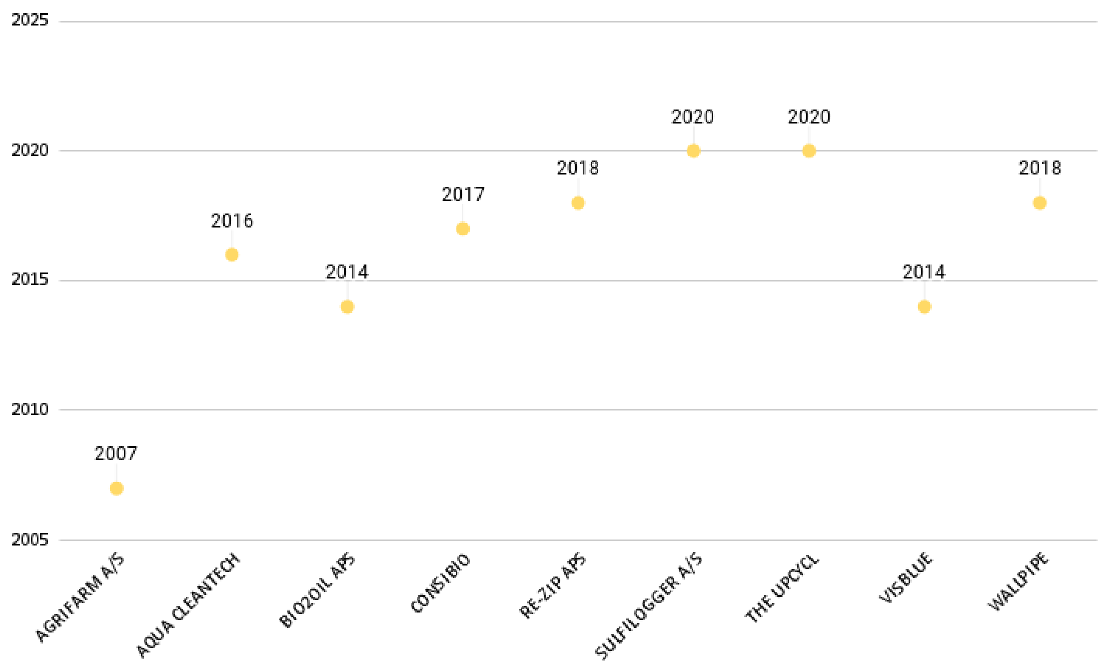


Figure 4.21: Recorded founding years of companies having received funding for the cluster CLEAN

Turning our attention to the size of the sample firms, this aspect is once again examined by considering the FTE ranges associated with each company. It appears that companies that have received funding are exclusively distributed among the two lower ranges of 1-10 and 11-50 FTEs. In contrast, companies without reported funding exhibit higher frequencies in these same two groups, but they also report values in the range of 51-200 FTEs for 3 firms and 201-500 FTEs for one firm. Notably, one company within the sample stands out as a very large-sized entity, employing over 10,000 FTEs.

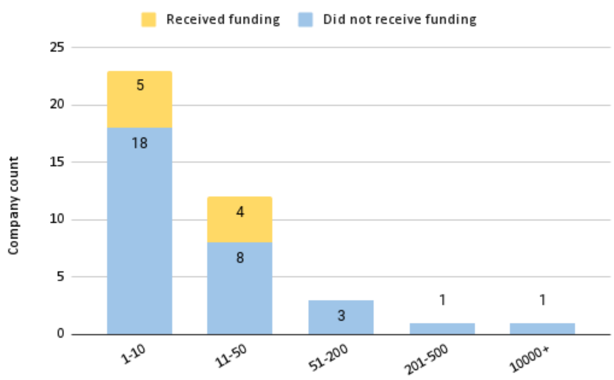


Figure 4.22: Recorded FTE ranges of companies in the cluster CLEAN

Within the entire cluster, it appears that the most prevalent focus of company activity is centered around being product- or technology-centric, with 18 out of 31 companies dedicated to this type of activity, representing 45% of the sample. Following closely behind are service-centric companies, accounting for 43%, while the remaining small fraction (12%) appears to be involved in both types of activities. Companies that have received funding are distributed across these three activity types, with 4 companies being product- or technology-centric, 3 being dedicated to both activities, and 2 being service-centric. For the sake of comprehensiveness, figures illustrating the frequency of patenting and publishing activities across these business models are also provided.

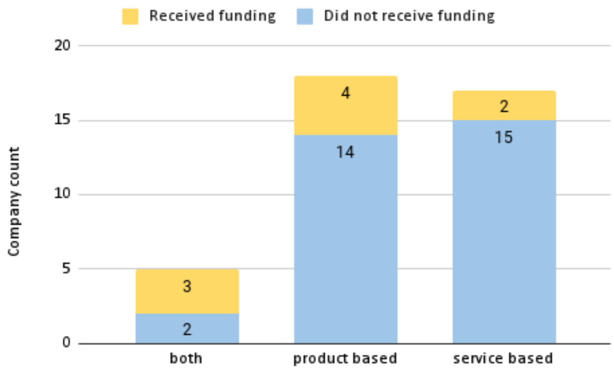


Figure 4.23: Company activity types for the companies in the cluster CLEAN

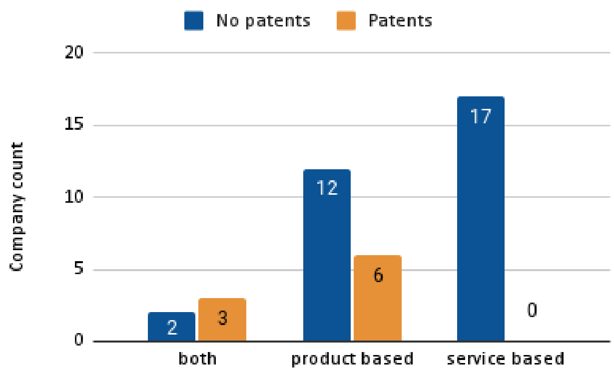


Figure 4.24: Patenting activity across company activity types for the companies in the cluster CLEAN

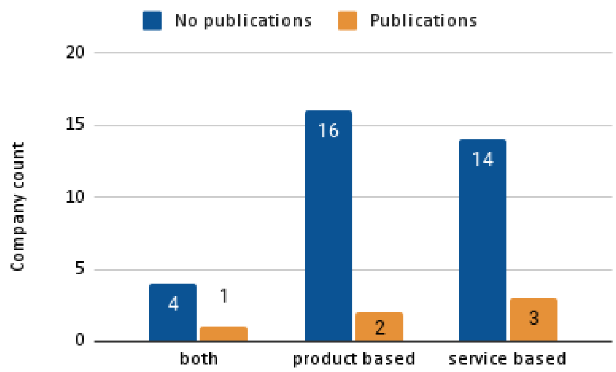


Figure 4.25: Publishing activity across company activity types for the companies in the cluster CLEAN

Deep dive into companies with funding

Within the CLEAN cluster, it has been discovered that 9 out of the 40 companies have secured funding. This information, sourced from Crunchbase and/or Pitchbook, is presented in Figure 4.26, which includes a comprehensive table containing all the data gathered for these 9 companies. The table encompasses counts of patents and publications, distances from the nearest university measured in kilometers, founding years, headcounts (where available), business models, and details regarding the dates, amounts, and types of each reported deal.

Name	Patents	Publications	Distance from nearest university (km)	Founding Year	FTE	Employee Count	Business model	Dates of deals	Type of deal	Amounts for each deal	Investor types
AGRIFARM A/S	2	3	55.58	2007	1-10	11	product based	20-Mar-2015	Grant	€1.43 M	Government
AQUA CLEANTECH	0	0	29.94	2016	1-10	6	service based	1-May-2018	Grant	€71.4 K	Government
BIO2OIL APS	0	0	1.66	2014	1-10	1	product based	21-Oct-2020	Non-equity assistance	-	Crowdfunding
CONSIBIO	0	0	4.28	2017	11-50	13	product based	6-Feb-2019	Grant	€0.02 M	Impact investing
RE-ZIP APS	1	0	3.8	2018	11-50	13	both	30-Mar-2022	Early stage VC (Series 1)	€0.34 M	Venture Capital, Corporate Venture Capital, Impact Investing
								13-Jul-2021	Early stage VC	€0.27 M	Impact Investing
SULFILOGGER A/S	1	0	4.59	2020	11-50	25	product based	30-Sep-2020	Grant	€1.53 M	Government
THE UPCYCL	0	0	1.41	2020	1-10	9	service based	1-Jan-2022	Accelerator/Incubator	€0.10 M	Accelerator/Incubator
VISBLUE	0	0	3.39	2014	11-50	15	both	9-Jul-2020	Secondary Transaction - Private	-	-
								14-Dec-2017	Early Stage VC	-	Angel (individual)
								16-Oct-2017	Grant	€0.05 M	Government
								1-Jan-2016	Grant	-	Government
								1-Jun-2015	Seed round	-	Accelerator/Incubator
WALLPIPE	0	0	32.7	2018	1-10	2	both	1-Mar-2023	Bankruptcy: Liquidation	-	-
								20-Jan-2020	Early stage VC	€0.04 M	Venture Capital, Angel (individual)

Figure 4.26: Table presenting the collected data for the companies having received funding in the CLEAN cluster

Among this selection of companies, only three firms have been found to be active in patenting (Agrifarm, Re-Zip and Sulfilogger), and only for one it was possible to find academic publications to its name (Agrifarm). Interestingly, the firms with reported patenting activity also appear to be those that have received the most amount of funding, with Sulfilogger having received €1.53 M, Agrifarm with €1.43 M and Re-Zip counting a total of €0.61 M. Additionally, the publishing activity of Agrifarm does not seem to play a strong role in its financing, with its investment amounts remaining similar to the other two mentioned companies.

Deal and investor types for patenting active companies do not present any particular differences from the rest of the sample, with Agrifarm and Sulfilogger receiving funding in the form of grants from government entities (European funds) and Re-Zip relying on Venture Capital and Impact Investing. However, across the whole sample, Government investor funding seems to be the most frequent, with 5 out of 15 deals seeing its participation. Given the small size of the companies in the sample, it is unsurprising to see no Merger/Acquisition type deals, and instead see a higher frequency of Grant and Early stage VC deal types.

The three most funded companies present differing distance values, with Agrifarm located at 55.58 km from the nearest university, while the other two firms are much closer, with values of 3.8 km and 4.59 for Re-Zip and Sulfilogger, respectively. The companies with the highest distance values (Agrifarm, Aqua Cleantech and Wallpipe, in descending order) do not show any further similarities. They have different deal amounts and types, which, in addition, do not introduce any unique characteristics compared to the rest of the sample. It's worth noting that Wallpipe filed for bankruptcy in March 2023. However, this event cannot be directly attributed to any of the factors under analysis, and the reasons for its failure could stem from various other aspects that fall outside the scope of this study. Curiously, it is two of the three companies with the smallest distance values (VisBlue, Bio2Oil and The Upcycl, in decresing order) that are the sole receivers of Accelerator/Incubator deal type funding, namely VisBlue and The Upcycl. Additionally, Bio2Oil stands out as the only company in the sample to have received non-equity assistance through crowdfunding. Nevertheless, especially in the case of VisBlue, the difference in distance values compared to the next companies in increasing order of distance is not significant enough to draw strong conclusions in this regard. Thus, these unique observations are limited to the specific companies under examination.

The distribution of age and sizes is quite uniform among companies in the sample, with founding years ranging from 2020 to 2014 and with observed FTE ranges varying only between 1-10 FTEs and 11-50 FTEs. The highest funded companies do not show any commonalities for these aspects, with Agrifarm having founded in 2007 and presenting an FTE range of 1-10, while Re-Zip and Sulfilogger both present a found year of 2020 and an FTE range of 11-50. All highly funded companies do present product-centric activites, at least to some extent, with Agrifarm and Sulfilogger being fully product based and Re-Zip dedicating its activities to both product or technology development and services.

4.1.3 Greenreality - South Karelia, Finland

The Greenreality Network is a Finnish cluster organisation coordinated by the city of Lappeenranta. The network collects companies from the South Karelia region, which is in turn divided into two sub-regions headed by the region's two cities, Imatra and Lappeenranta. The region counts approximately 130 thousand inhabitants with a density of 19/km2, mostly located in Lappeenranta, the largest city and administrative center of the region. The economy of the region is mainly dedicated to the sectors of manufacturing, forstry, tourism and education. Sustainable development in the region is partially focused on tourism (goSaimaa, n.d.), with networks in place to boost the collaboration of municipal and private actors. Additionally, South Karelia presents its own circular economy roadmap, which lists its main objetcives as: sustainable wellbeing, no emissions, no waste, or excessive consumption; More jobs and business activity in the field of environment; Strengthening of knowledge and training in environmental and circular economy issues (European Union, 2019). On the state level, Finland aims at enacting concrete changes and contributing toward the UN's Sustainable Development Goals, with a particular focus on its challenges, corresponding to goals N.13 (high carbon dioxide emissions relative to the population) and N.15 (protection of biodiversity and sustainable, fair and efficient use of natural resources) (European Environment Agency, 2020b).

The Greenreality Network is coordinated by and puts emphasis on the city of Laappeenranta and its green development. The city aims at reaching carbon neutrality by 2030 (Greenreality Network, n.d.-a), and the Greenreality Network is a powerful instrument toward this goal. The network is dedicated to a set of activities including enhancing Co-operation, Information and Communications and Access to Financing. Its members can benefit from chances of collaboration within the network's project, as well as from the constant flow of information published on the organisation's portal. Greenreality often collaborates in EU-funded or Finnish state-wide projects, hence increasing the access of members to capital and financing opportunities (Greenreality Network, n.d.-b).

The Greenreality Network member rooster encompasses firms active in the spaces of Machine tools, metal-working not otherwise provided for; Working cement, clay, or stone; Cements, concrete, artificial stone, ceramics, refractories, and dedicated to making these sectors more sustainable. Within its member list, Greenreality counts 46 companies, of which a number is classified as government entities, universities and multinational companies with offices in the area. For one of the companies, it is was not possible to find an address on any publicly available platform, hence the company is removed from further analysis. This makes for a final sample of 33 companies.

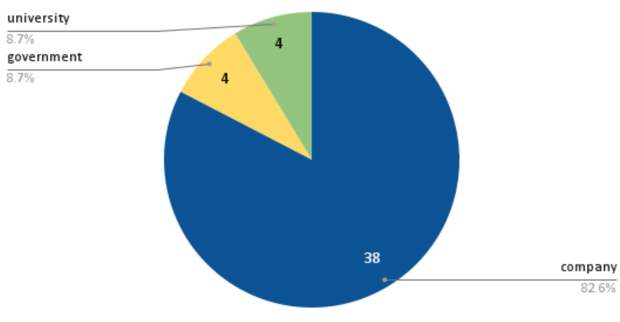


Figure 4.27: Distribution of company types across the full member list of the cluster Greenreality

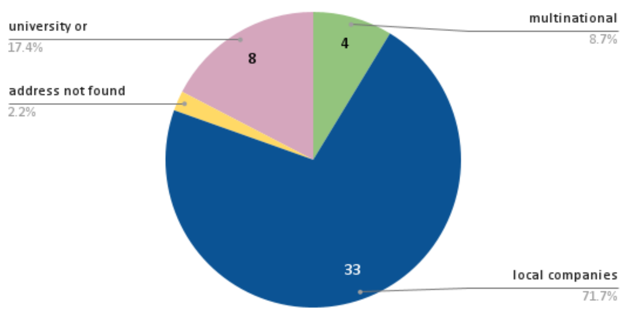


Figure 4.28: Distribution of company types for the purpose of data cleaning for the cluster Greenreality

Patents, publications and distance from universities

Among the 33 companies in the Greenreality cluster, 7 have been found to have received funding, amounting to 21.2% of the total.

Within the subset of companies that have reported receiving funding, it is observed that

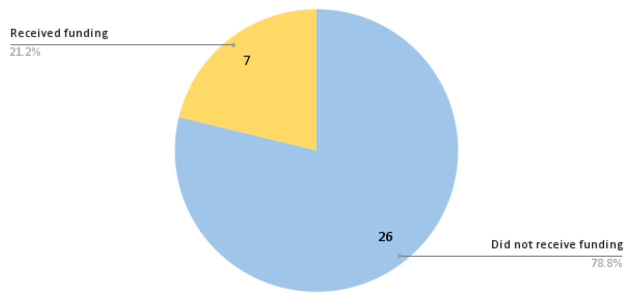


Figure 4.29: Funding frequency across the Greenreality sample

5 of them are actively engaged in patenting activities, constituting approximately 71% of the total count within this group. Conversely, among companies for which no funding information is available, 69% do not exhibit any patenting activity.

In a similar manner, companies which have not received funding are also mostly shown to not have been active in academic publishing, with 77% of firms showing no publication records. However, the trend observed for the patenting activity of companies with funding is reversed in respect to their publishing activity, with only one of 7 firms (14%) showing records of this kind.

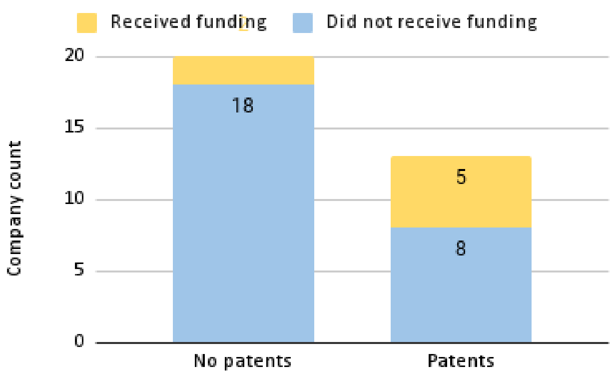


Figure 4.30: Distribution of companies with and without patents between companies with and without funding for the cluster Greenreality

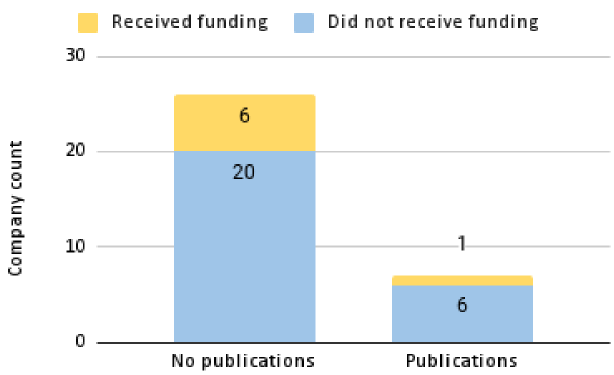


Figure 4.31: Distribution of companies with and without publications between companies with and without funding for the cluster Greenreality

The average distance from the closest university for companies without funding appears substantially higher than the one for companies with funding, with values of 36.83 and 5.36 kilometers, respectively. The subset of companies having received funding shows some level of variation between the distances values associated with each company, with values ranging from 18.37 km to 0.37 km and a median of 2.67 km (Figure4.32). Nevertheless, these values remain quite low, bringing about the observation that companies with funding are located in proximity to their closest university. The group of companies without funding sees a substantially higher amount of variation within its data, with values ranging from 200.3 km to 0,32 km (Figure 4.33). Therefore, companies without funding appear to be located at various level of distance from their closest university.

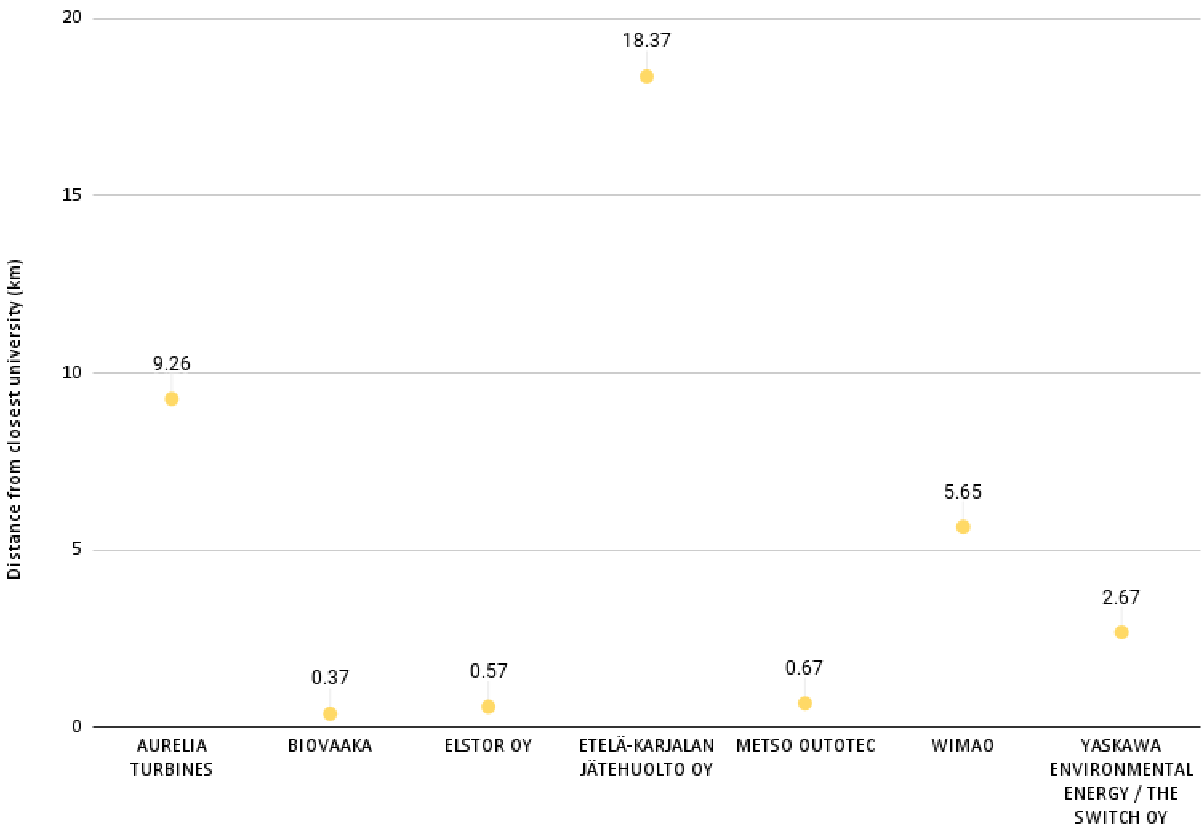


Figure 4.32: Recorded distance values from the closest university of companies having received funding, measured in km, for the cluster Greenreality

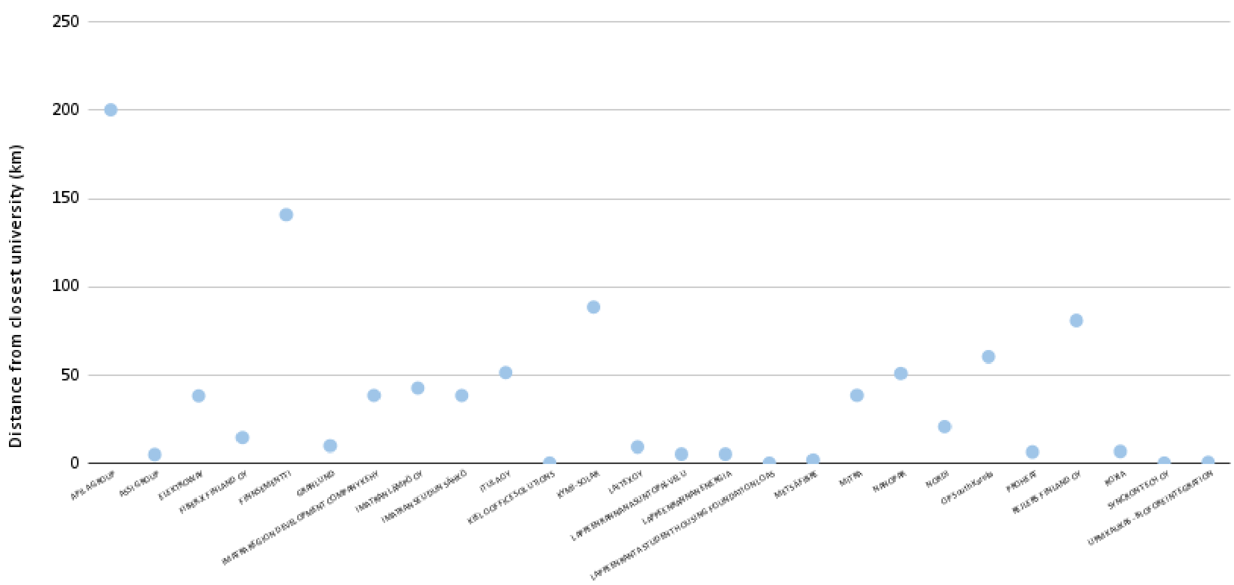


Figure 4.33: Recorded distance values from the closest university of companies not having received funding, measured in km, for the cluster Greenreality

Age, size and activities

The firm ages recorded for the subset of companies having received funding show 4 out of 7 companies having been founded between the year 2013 and the year 2018. Three companies report values outside of this range, with founding years equal to 1990, 1996 and 2006. Nevertheless, the average firm age of this subset is found to be equal to 15 years, a substantially lower value than the one found for the group of companies without funding, equal to 38 years. This subset, however, also shows a high degree of variation, with founding years ranging from 1901 to 2021 and a median value of 1991.

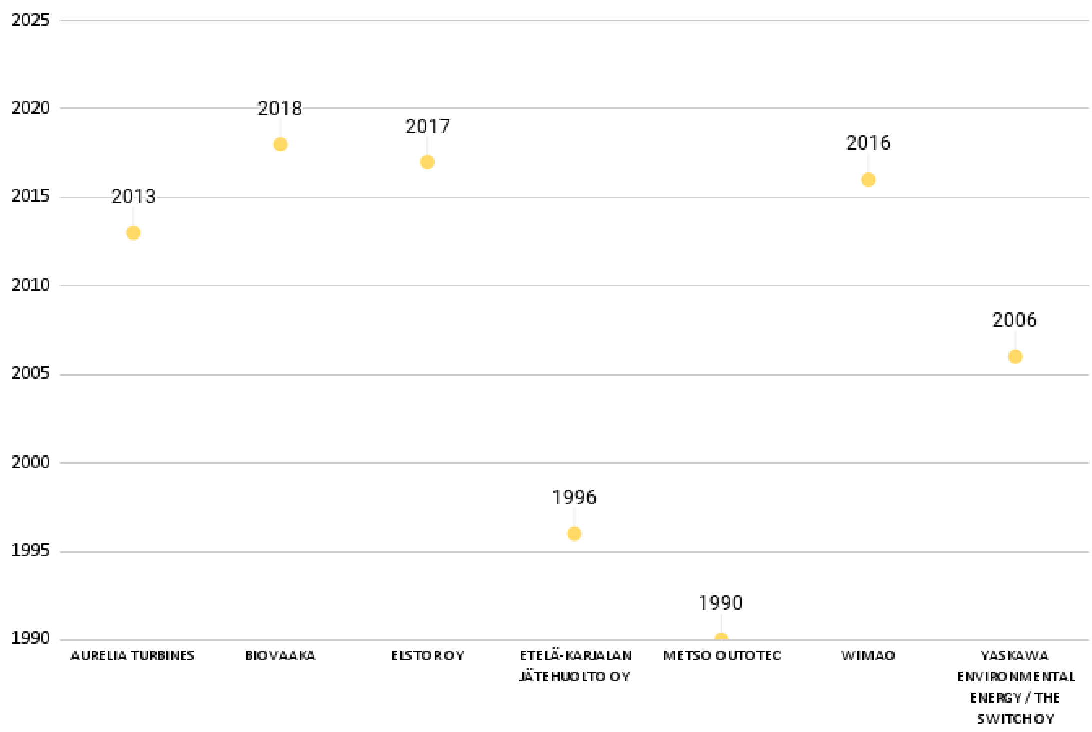


Figure 4.34: Recorded founding years of companies having received funding for the cluster Greenreality

The most frequent FTE ranges across the whole sample are found to be the smallest ones, 1-10 and 11-50 FTEs. Both company subsets of received funding and did not received funding see higher frequencies within these groups, with 71% of companies with funding belonging to these ranges. However, this subset presents a unique data point for the firm Metso Outotec, due to the Finnish public company's headcount report of over 10000 FTEs. For the companies without funding, the highest frequency for ranges is measured for the smaller ranges, but the companies are distributed across the higher ranges, including two companies with over 10000 employees.

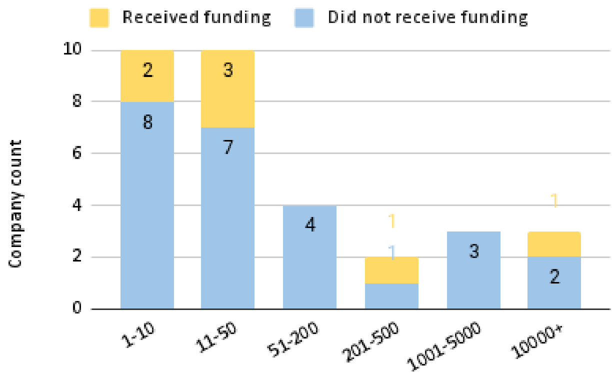


Figure 4.35: Recorded FTE ranges of companies in the cluster Greenreality

The business model distribution within this sample sees most companies being dedicated to service-centric activities, with 54.5% of firms falling in this category. Less frequent are companies dedicated to both types of activities, with 9 out of 33 companies belonging to this group. The last category for frequency is product- or technology-centric labelled companies, with only 6 out of 33 companies appearing to employ this business model. Companies with funding are quite evenly distributed across the three groups, while companies without funding mainly fall in the service-based category, with 16 out of 26 companies being labelled as such. Yet again, for completeness, Figures X and XX show the distribution of patenting and publishing activity across the three business models.

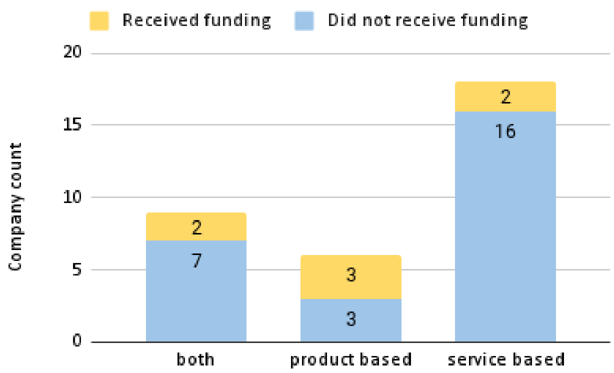


Figure 4.36: Company activity types for the companies in the cluster Greenreality

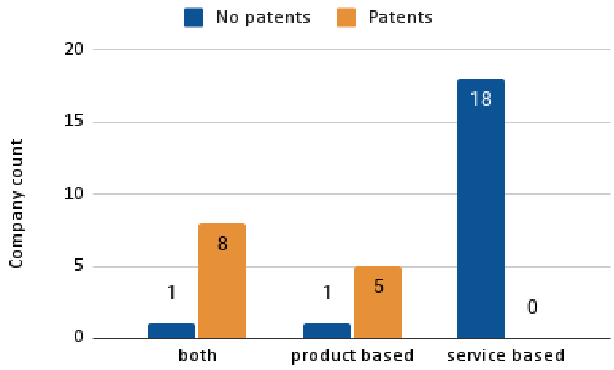


Figure 4.37: Patenting activity across company activity types for the companies in the cluster Greenreality

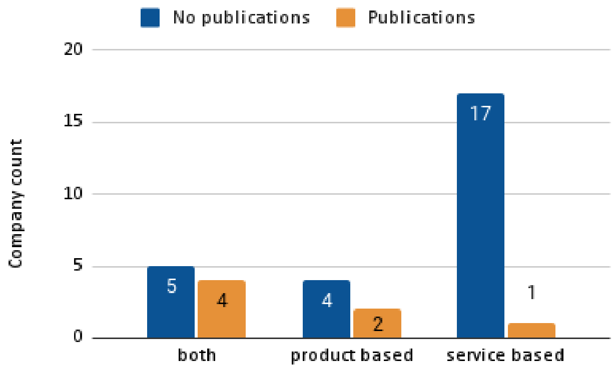


Figure 4.38: Publishing activity across company activity types for the companies in the cluster Greenreality

Deep dive into companies with funding

The 7 companies within the Greenreality cluster that have been found to have received funding are reported in the table pictured in Figure 4.39. To their data on the described variables, details on dates, types and amounts for each recorded funding deal have been added, as well as the investor types involved in each deal. Precise headcounts are also reported, where available, as sourced from LinkedIn or Pitchbook.

Names	Patents	Publications	Distance from nearest university (km)	Founding Year	FTE	Employee Count	Business model	Dates of deals	Type of deal	Amounts for each deal	Investor types
AURELIA TURBINES	3	6	9.26	2013	11-50	21	product based	2-Dec-2021	Debt - General	€5.00 M	Impact Investing
								1-Oct-2020	Grant	€8.37 M	Government
								5-May-2020	Later stage VC	-	Impact Investing
								28-Jun-2019	Later stage VC	€2.92 M	-
								1-Oct-2018	Later stage VC	€3.70 M	Venture Capital
								11-Sep-2017	Early stage VC	€2.13 M	-
								1-Jul-2015	Early stage VC	€0.90 M	Family Office, Venture Capital
								1-Oct-2014	Grant	€0.05 M	Government
								26-Feb-2014	Early stage VC	-	Corporation (University), Venture Capital
								8-Jan-2014	Grant	€0.05 M	Government
								1-Jan-2014	Seed round	-	Corporation (University)
BIOVAAKA	1	0	0.37	2018	1-10	2	both	23-Sep-2022	Accelerator/incubator	€0.01 M	Accelerator/Incubator
ELSTOR OY	1	0	0.57	2017	1-10	4	product based	1-Jan-2021	Debt - General	€4.00 M	Accelerator/Incubator
ETELÄ-KARJALAN JÄTEHUOLTO OY	0	0	18.37	1996	11-50	27	service based	31-Aug-2022	Merger/Acquisition	-	Corporation
METSO OUTOTEC	167	0	0.67	1990	10000+	9930	both			Public company	
								15-Dec-2022	Post-IPO Debt	€50 M	Bank
								28-Jul-2017	PIPE - Individual	€0.04 M	Individuals
								31-Oct-2016	PIPE - Individual	€9 K	Individuals
								21-Mar-2013	PIPE	-	Government, Real Estate
								7-Mar-2012	PIPE	€91 M	Government
								10-Oct-2006	IPO (and Spin-off)	€462 M	Public placement
WIMAO	1	0	5.65	2016	11-50	4	product based	9-Oct-2019	Early stage VC	-	Venture Capital
								1-Apr-2019	Grant	€2.4 M	Venture Capital
								1-Jan-2019	Grant	€71.4 K	Government
YASKAWA ENVIRONMENTAL ENERGY / THE SWITCH OY	0	0	2.67	2006	201-500	146	service based	11-Jul-2014	Merger/Acquisition	-	Corporation
								15-Dec-2008	Early stage VC	-	Angel (individual), Venture Capital
								30-Jun-2006	Early stage VC	-	Fund of Funds
								15-May-2003	Early stage VC	-	Venture Capital

Figure 4.39: Table presenting the collected data for the companies having received funding in the Greenreality cluster

Among the sample, 5 out of 7 companies present patenting activity. Before diving deeper into their characteristics, however, it has to be recognised that the previously highlighted firm Metso Outtotec is once again a very unique case. Firstly, being a public company, its funding amounts are very skewed from the ones observable for the other companies, due to the initial public offering of €462 M. Additionally, the company is the biggest one and oldest in the subset, and it therefore does not surprise to see that it has collected, through the years, a considerable amount of patents. Metso Outotec counts 167 patents, while the next company in desceding order counts only 3. Therefore, it is decided to consider this company as an outlier, whose characteristics can not directly speak for any trends or observations within this table.

The remaining four companies with patenting activity show values equal to 1 (Biovaaka, Elstor and Wimao) or 3 (Aurelia Turbines). Interestingly, these companies are also the ones presenting the smallest founding years within the subset. It would appear that these companies are the ones that have been able to secure the most funding, with Aurelia Turbines leading with a total of €23.12 M. It is interesting to notice that Aurelia Turbines is also the company with the highest amount of patents and the only company active in academic publishing. However, the remaining two companies, Etelä-Karjalan Jätehuolto and The Switch OY, do not offer any deal amounts within their financial profiles. Hence it is not possible to build a complete observation for the differences between the two groups of "patents" and "no patents". The deal and investment types within the group of companies with patents, once again excluding Metso Outotec, presents a variety of categories. Biovaaka and Elstor stand out as the sole receivers of funding from Accelerator/Incubator type investors, but this can probably be more strongly associated to their proximity to a university rather than their patenting activity.

In fact, the two companies figure as the ones located in the closest proximity to their nearest university, with values of 0.37 and 0.57 km, respectively. Also at a distance lower than a kilometer is located Metso Outotec, showing a value of 0.67 km. As an additional point of observation, it is noticed that the recipients of the Accelerator funding deals are also the smallest companies within the subset, as well as the youngest companies in the sample. The two mostly funded companies present differing values for founding years and size, but are both product based. The next two companies in order of total funding are also involved in product or technology centered activities, with Biovaaka showing both product and service based activity and Elstor being fully product-centric.

4.1.4 Water Alliance - The Netherlands

Water Alliance is the Dutch cleantech cluster for the development of innovative and sustainable water technologies. Its members are located within the whole country, without focusing on one specific Dutch region.

The Netherlands, owing to its flat topography, boasts a rich heritage of water management. It has earned international acclaim for its proficiency in flood prevention, land reclamation, and water infrastructure development. The nation is unwavering in its dedication to sustainability, evident through the adoption of numerous measures aimed at improving water quality, curbing water consumption, and fostering eco-conscious behaviors. The Netherlands takes a comprehensive approach to achieving all 17 Sustainable Development Goals (SDGs), ensuring an integrated strategy. In terms of environmental concerns, the country's top priorities encompass transitioning to renewable energy, combating climate change, fortifying environmental conservation efforts, and safeguarding biodiversity against current and future environmental challenges (European Environment Agency, 2020c). The nation's Energy Agenda plans to make 16% of all energy used in the Netherlands sustainable by 2023 and to reduce the Netherlands' emissions of greenhouse gases to zero by the year 2050 (Government of the Netherlands, n.d.). The country's main cities are Amsterdam, Rotterdam, The Hague, Utrecht and Groningen. The country counts a total population of approximately 18 million people, with a high density of 520/km2.

The Water Alliance organization is dedicated to establishing the Netherlands as the leading European Water Technology Hub, centered around the WaterCampus Leeuwarden. The primary areas of focus for Water Alliance activities revolve around Co-operation and Information and Communication, aiming to facilitate projects and initiatives that stimulate collaboration and networking among its members (Water Alliance, n.d.-a). The organization's strategic approach is geared toward motivating various stakeholders to contribute value to innovative water technologies, ultimately promoting job creation and transforming innovative water technology into a driver of sustainable economic growth (Water Alliance, n.d.-b).

Water Alliance describes the sectors to which its dedicates its activities as: Physical or chemical processes or apparatus in general; Treatment of water, waste water, sewage, or sludge; Water supply, sewerage. The organisation lists 173 members, of which none were found to be governmental entities or universities. These types of entities are mentioned within the Water Alliance website as collaborators with the organisation, but they do not retain membership. Among these 173 firms, 28 were identified as multinationals and any address information was not found for one company (Figure 4.40).

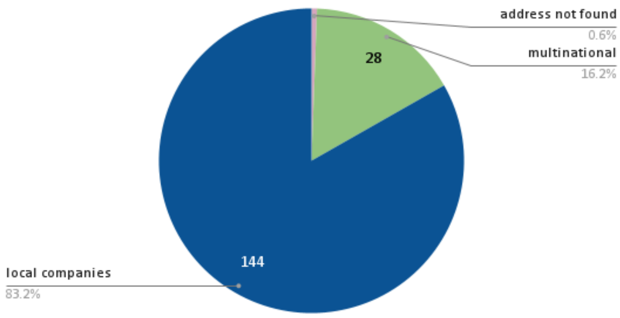


Figure 4.40: Distribution of company types for the purpose of data cleaning for the cluster Water Alliance

Patents, publications and distance from universities

The final sample for the Water Alliance cluster counts 144 companies, of which 35 have been found to have received funding, amounting to 24.3% of the total (refer to Figure 4.41).

Among the 35 companies which have received funding, 46% have also been found to have been engaged in patenting activities, leaving 19 companies with no patent records. The proportion is somewhat lower for the companies with no recorded funding, with 25% of the subset showing active engagement in patenting activities.

The proportions between companies active in academic publishing and those which aren't, distributed across the subsets of received funding and did not receive funding, are instead somewhat similar to each other. 26% of funded companies are also engaged in publishing, and the number equals 20% for the companies which have not received funding.

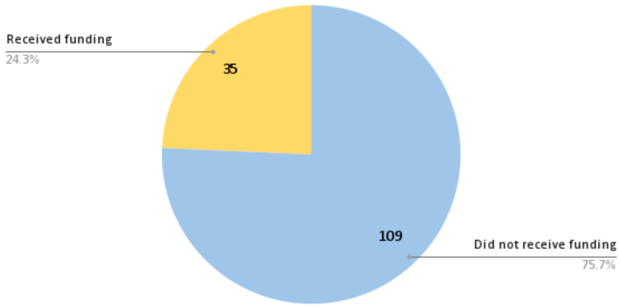
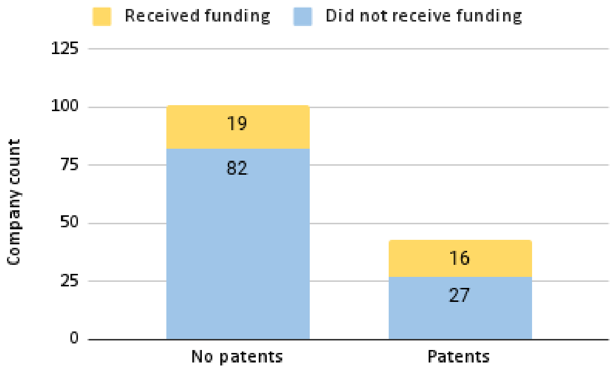


Figure 4.41: Funding frequency across the Water Alliance sample



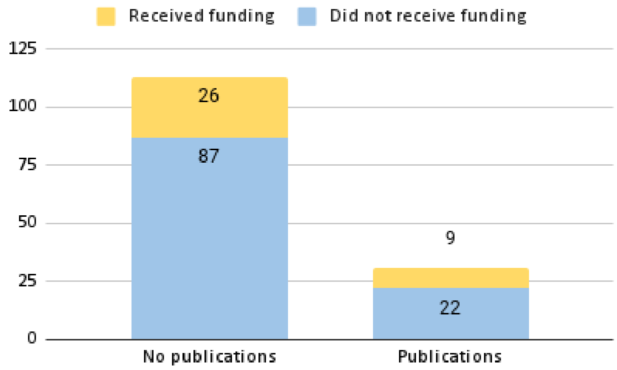


Figure 4.42: Distribution of companies with and without patents between companies with and without funding for the cluster Water Alliance

Figure 4.43: Distribution of companies with and without publications between companies with and without funding for the cluster Water Alliance

The distance from the closest university values appear quite varied for the companies which have received funding. The average distance is calculated as equal to 39.78 km, but the values in the subset range from 1.86 to 84.2 km (Figure 4.44). The values are quite uniformly distributed, also considering the median set at 44.33 km, but it is not possible to infer much about the influence of proximity on the odds of receiving funding for the single companies given the wide range of values. Withing the subset of companies without funding, similar observations can be made. The average distance is calculated as 45.22 km, but values range from 108.77 km to 0.62 km, with the median at 50.63 km. It would therefore appear that the average distance for companies with funding is slightly lower to the one for companies without funding, but given the wide ranges shown by both dataset, it is hard to make any proper conclusions in regard to the comparision between the two groups.

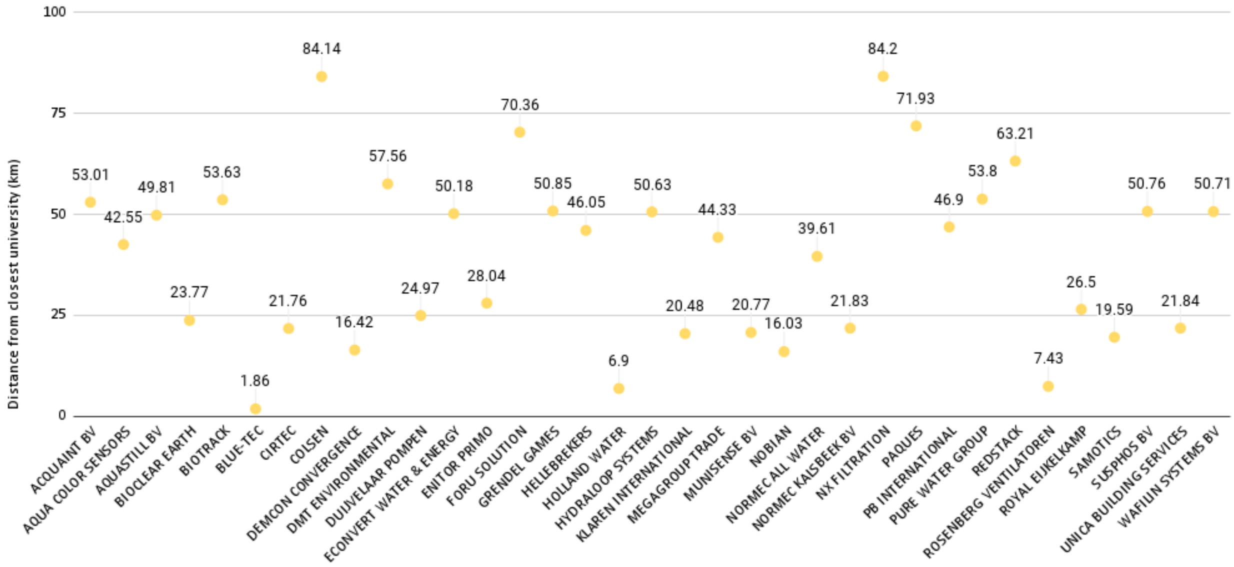


Figure 4.44: Recorded distance values from the closest university of companies having received funding, measured in km, for the cluster Water Alliance

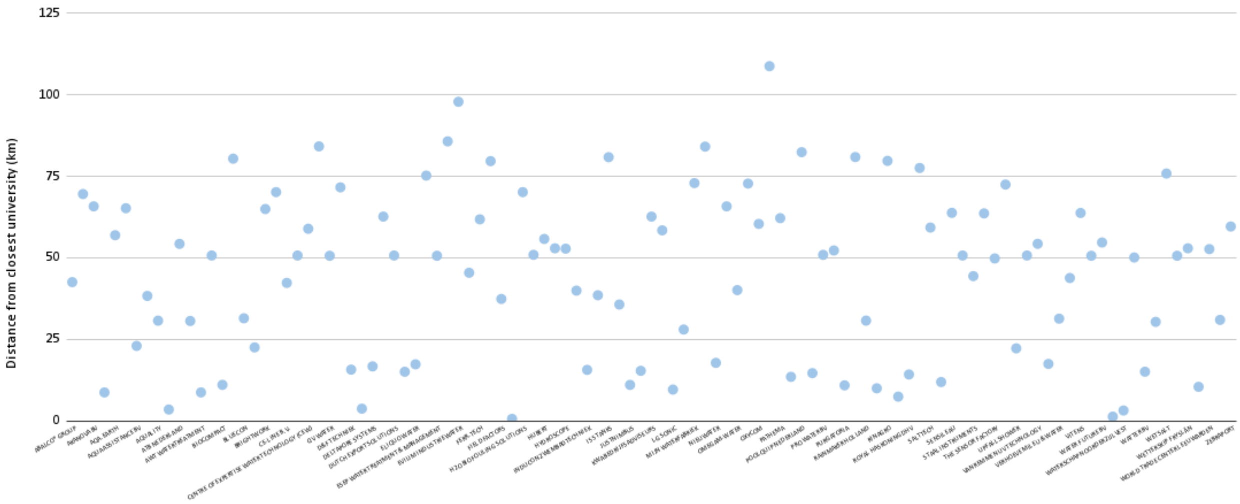


Figure 4.45: Recorded distance values from the closest university of companies not having received funding, measured in km, for the cluster Water Alliance

Age, size and activities

The average age of companies having received funding is found equal to 34 years, calculated for the year 2023. The average age of companies without funding is instead approximately equal to 28 years, hence slightly lower. However, both subsets show ranges of values that span quite widely. In particular, for companies which have received funding, founding years have been reported to span from 1911 to 2019.

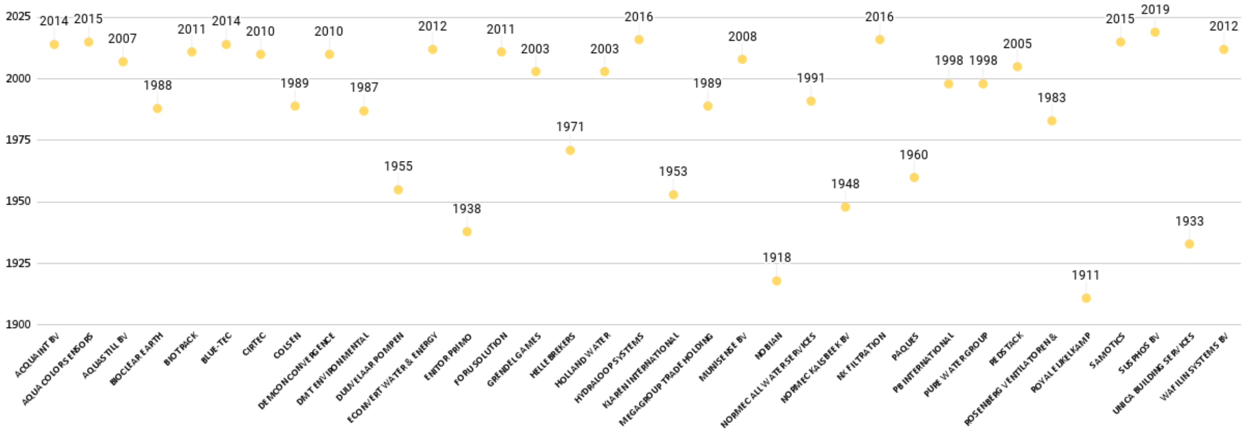


Figure 4.46: Recorded founding years of companies having received funding for the cluster Water Alliance

The companies with no reported funding appear to be distributed across all the available FTE ranges, concentrating in particular in the 1-10 FTEs range, with 49 out of 109 companies belonging to this group. Firms with reported funding are instead concentrated within the 11-50 FTEs range (15 out of 35 firms), with presence in the immediately higher and lower ranges, as well as 6 companies in the 201-500 FTE range and 3 companies in the 1001-5000 FTE range.

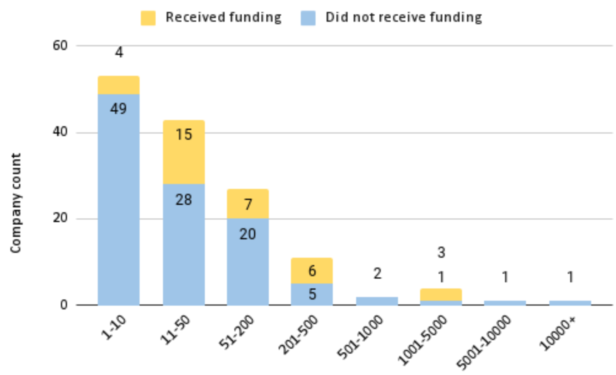


Figure 4.47: Recorded FTE ranges of companies in the cluster Water Alliance

A total of 58 firms, amounting to 40% of the companies in the Water Alliance Cluster, have been labelled as service-centric. Product- or technology-centric firms amount to 27%, while firms involved in both kinds of activities make up 33% of the sample. Firms which have received funding are mainly labelled as active in both categories, with 17 out of 35 companies belonging to this group (49% of the total). Also in this report, figures showing the distribution of patenting and publishing activity across the three business models are given, in order to at least partly account for the influence of a company's focus on its IP protection activities.

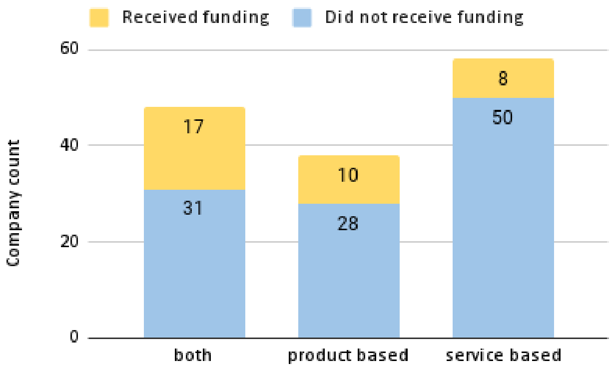


Figure 4.48: Company activity types for the companies in the cluster Water Alliance

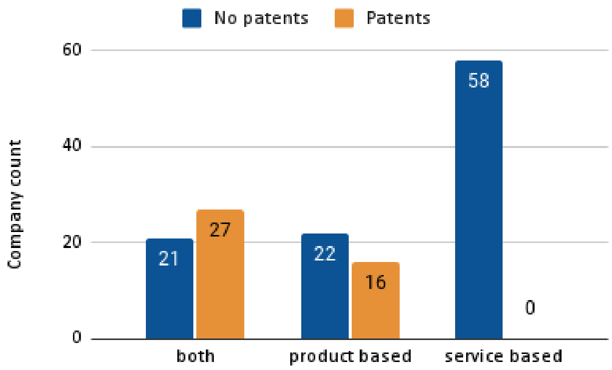


Figure 4.49: Patenting activity across company activity types for the companies in the cluster Water Alliance

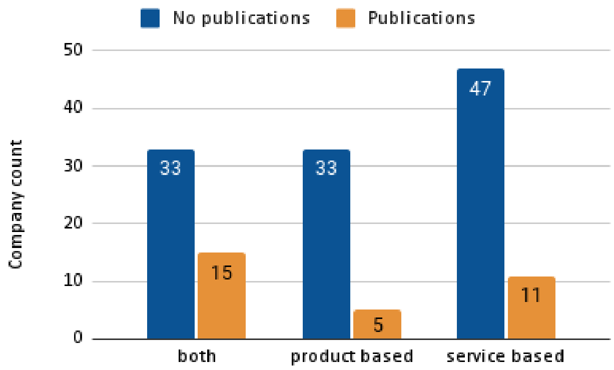


Figure 4.50: Publishing activity across company activity types for the companies in the cluster Water Alliance

Deep dive into companies with funding

Figures 4.51 and 4.52 show the table presenting all collected values relative to the 35 Water Alliance cluster companies having received funding. As mentioned in the previous reports, employee counts are reported, where available, as obtained from LinkedIn of Pitchbook. Additionally, information on the dates, amounts and types for the deals that were found for each company are also reported.

Names	Patents	Publications	Distance from nearest university (km)	Founding Year	FTE	Employee Count	Business model	Dates of deals	Type of deal	Amounts for each deal	Investor types
ACQUAINT BV	0	0	53.01	2014	11-50	22	both	11-Nov-2019	Grant	€0.05 M	Corporation
AQUA COLOR SENSORS	2	0	42.55	2015	1-10	2	product based	1-Jan-2016	Early stage VC	-	Venture Capital
AQUASTILL BV	0	0	49.81	2007	1-10	2	product based	-	Later stage VC	-	Venture Capital
BIOCLEAR EARTH	0	2	23.77	1988	11-50	27	service based	1-Jan-2016	PE Growth/Exp:	-	Venture Capital
BIOTRACK	3	2	53.63	2011	11-50	10	both	-	Later stage VC	-	Venture Capital
BLUE-TEC	0	0	1.86	2014	1-10	5	product based	1-Mar-2022	Merger/Acquisi	-	Corporation
								29-Oct-2015	Early stage VC	-	Venture Capital
CIRTEC	0	0	21.76	2010	11-50	7	both	20-Jan-2017	Later stage VC	€0.42 M	Venture Capital, Investment Bank
COLSEN	2	3	84.14	1989	11-50	32	both	1-Oct-2014	Grant	€0.05 M	Government
DEMCON CONVERGENCE	7	61	16.42	2010	11-50	39	product based	13-Jun-2022	Merger/Acquisi	-	Corporation
								16-Jul-2020	Debt - General	-	Venture Capital
								13-Jun-2017	Grant	€4.5 K	Other
								1-Jan-2010	Accelerator/Inc	€0.02 M	Accelerator/Incubator
DMT ENVIRONMENTAL TECHNOLOGY	0	0	57.56	1987	51-200	15	both	19-May-2021	Buyout/LBO	-	Corporation
								1-Jan-2005	PE Growth/Exp:	-	Venture Capital
DUIJVELAAR POMPEN	1	0	24.97	1955	201-500	156	both	21-May-2003	Merger/Acquisi	-	Corporation
ECONVERT WATER & ENERGY	0	0	50.18	2012	51-200	56	both	22-Apr-2020	Buyout/LBO	-	PE-Backed Company
ENITOR PRIMO	0	0	28.04	1938	201-500	75	service based	11-Jun-2019	Merger/Acquisi	€16.2 M	Corporation
FORU SOLUTION	0	0	70.36	2011	11-50	12	service based	20-Jun-2022	Buyout/LBO	-	PE-Backed Company
								1-Jan-2016	Debt - General	-	Lender
								-	Grant	€0.05 M	Not-for-Profit Venture Capital
								-	Angel (Individu:	-	Angel (individual)
GRENDEL GAMES	0	0	50.85	2003	11-50	13	service based	1-Jun-2022	Secondary Tran	-	-
								19-Feb-2014	Later stage VC	-	Venture Capital (University)
								15-Feb-2014	Later stage VC	-	Venture Capital
								-	Early stage VC	-	Invetsment Bank, Venture Capital
HELLEBREKERS	13	4	46.05	1971	201-500	201	both	11-Jul-2021	PE Growth/Exp:	-	PE/Buyout
HOLLAND WATER	1	1	6.9	2003	51-200	35	both	9-Nov-2020	Buyout/LBO	-	PE/Buyout
HYDRALOOP SYSTEMS	1	0	50.63	2016	11-50	35	product based	31-May-2023	Later stage VC	€2.74 M	Venture Capital
								29-Apr-2022	Later stage VC	€4.5 M	Venture Capital
								1-Feb-2022	Equity crowdfu	€3.99 M	Crowdfunding (via Lead manager/Arranger)
								15-Oct-2020	Later stage VC	€4 M	-
KLAREN INTERNATIONAL	1	0	20.48	1953	201-500	10	product based	1-Mar-2022	Secondary Tran	-	-
								17-Apr-2014	Early stage VC (	€2.5 M	Corporate Venture Capital
MEGAGROUP TRADE HOLDING	0	0	44.33	1989	201-500	111	service based	3-May-2023	Buyout/LBO	-	PE/Buyout
								17-Mar-2015	Buyout/LBO	-	PE/Buyout
								16-feb-2015	Bankruptcy: Ad	-	-
								30-Sep-2010	Buyout/LBO	-	PE/Buyout
								31-Mar-2005	Merger/Acquisi	-	-
MUNISENSE BV	1	0	20.77	2008	11-50	21	both	4-Sep-2015	Later stage VC	€2.5 M	Venture Capital
NOBIAN	0	0	16.03	1918	1001-5000		product based	9-May-2018	Merger/Acquisi	-	PE/Buyout
NORMEC ALL WATER SERVICES	0	0	39.61	1991	11-50	3	service based	24-Jun-2020	Merger/Acquisi	€350 M	PE/Buyout
								1-Jan-2017	Buyout/LBO	-	PE/Buyout
NORMEC KALSBEEK BV	0	0	21.83	1948	51-200	61	service based	24-Jun-2020	Merger/Acquisi	€350 M	PE/Buyout
								1-Jan-2017	Buyout/LBO	-	PE/Buyout

Figure 4.51: Part 1 of the table presenting the collected data for the companies having received funding in the Water Alliance cluster

Names	Patents	Publications	Distance from nearest university (km)	Founding Year	FTE	Employee Count	Business model	Dates of deals	Type of deal	Amounts for each deal	Investor types
NX FILTRATION	4	0	84.2	2016	51-200	114	product based			Public	
								11-Jun-2021	IPO	€165 M	Public offering
								1-Jan-2016	Buyout/LBO	-	PE/Buyout
PAQUES	285	87	71.93	1960	201-500	206	both	1-Feb-2019	Secondary tran:	-	-
								11-Jan-2012	Secondary tran:	-	Growth/Expansion
								5-Jul-2006	Merger/Acquisi	-	Corporation
								-	Merger/Acquisi	-	Corporation
								-	PE Growth/Exp:	-	Impact Investing
PB INTERNATIONAL	2	0	46.9	1998	11-50	39	both	1-Jan-2018	Later stage VC	-	Venture Capital
PURE WATER GROUP	0	0	53.8	1998	11-50	33	both	25-Jan-2021	Merger/Acquisi	-	Corporation
REDSTACK	14	15	63.21	2005	11-50	12	product based	-	Early stage VC	€4.5 M	Venture Capital
ROSENBERG VENTILATOREN & KLIMAATTECHNIEK	29	0	7.43	1983	1001-5000	96	both	2-Dec-2022	Buyout/LBO	-	PE-Backed Company
ROYAL EIJKELKAMP	0	1	26.5	1911	51-200	92	both	1-Apr-2023	Debt - General	-	Other
								7-May-2014	Debt - General	-	Venture Capital
SAMOTICS	0	0	19.59	2015	51-200	105	both	22-Sep-2022	Later stage VC (	€20.10 M	Coporate Venture Capital
								13-Dec-2021	Later stage VC (	€14.5 M	Venture Capital
								2-Mar-2021	Later stage VC	€5 M	-
								15-Oct-2019	Venture round	€6.4 M	-
								7-Jun-2018	Series A	€2.1 M	-
								12-Jan-2017	Seed round	€0.6 M	Corporation, Venture Capital, Lender
SUSPHOS BV	0	0	50.76	2019	1-10	16	product based	1-Mar-2023	Grant	€12.5 M	Venture Capital (Government)
								1-Feb-2022	Later stage VC	-	Venture Capital, Impact Investing, Accelerator/Incubator
								15-Jun-2022	Venture round	-	-
								15-Jun-2022	Grant	€2.5 M	Venture Capital (Government)
								1-Jun-2021	Later stage VC	-	Venture Capital
								7-Dec-2020	Grant	€0.05 M	Venture Capital
								26-Nov-2020	Grant	€0.02 M	Investment Bank
								13-Dec-2019	Grant	€0.03 M	Venture Capital
								27-Nov-2019	Grant	€7.5 K	Corporation
								19-Nov-2019	Pre Seed round	€0.3 M	-
								14-Nov-2019	Debt- General	€0.3 M	Venture Capital
								1-Feb-2013	Grant	€3.68 M	Government
UNICA BUILDING SERVICES	0	0	21.84	1933	1001-5000	3246	service based	4-May-2023	Buyout/LBO	-	PE/Buyout
								10-Oct-2017	Buyout/LBO	€61.6 MM	PE/Buyout
WAFILIN SYSTEMS BV	2	0	50.71	2012	11-50	24	both	17-Mar-2017	Merger/Acquisi	-	Corporation

Figure 4.52: Part 2 of the table presenting the collected data for the companies having received funding in the Water Alliance cluster

Examining the 16 companies which have been found to have one or more patents to their name, no particular distinctions can be seen from the rest of the sample. Excluding NX Filtration, which as a public company can benefit from higher funding amounts due to its stock offering, the remaining 15 companies show various levels of investment amounts, and do not belong to the subsection of most-funded companies. Analogously, there are unique trends within these companies for investor or deal types, which can encompass Venture Capital deals just as much Corporation-led rounds. Likewise, the 9 companies active in academic publication do not show any distinguishing traits from the rest of the sample, with funding amount information often missing and investor and deal types varying within the subset.

The four furthest companies from their nearest universities, meaning in this case companies with distance values exceeding 70 km, also show a high degree of variability in their investment deals details. NX Filtration, counting 114 employees and located at 84.2 km from the nearest university, is a public company reporting a Buyout/LBO round in 2016, followed by its Initial Public Offering in 2021, with a deal amount of €165 M. Colsen is a small private firm that has only reported receiving a grant of €0.05 M in 2014 from a European Union instrument. Paques counts 206 employees, is located at 71.93 km and does not make available any funding deal amounts. The recorded deal types vary through its history from PE Growth/Expansion, to Merger/Acquisitions and finally Private Secondary Transactions. Finally, Foru Solutions is another small firm located at 70.36 km from the closest University and reporting several types of funding deals and investors. The three firms with the smallest distance values, Rosenberg with 7.43 km, Holland Water with 6.9 km and Blue-Tec with 1.86 km, also do not show any unique traits. They present differing size, founding years, deal amounts and types.

Excluding the publicly traded company NX Filtration, the companies with the highest total funding amounts are Normec (€350 million), Unica (€61.6 million), and Samotics (€48.7 million). Normec is represented by two entries in the data due to its different entities, "All Water Services" and "Kalsbeek BV," which are presented as distinct entities on the company's website but fall under the same financial profile. However, no unique characteristics or commonalities are discernible among all three companies. Shareholders of Normec and Unica have achieved these deal amounts primarily through Merger/Acquisition type deals, whereas Samotics stands out for relying exclusively on Venture Capital investors and deal types. Additionally, there are no similarities in the founding years, FTE ranges, patenting, publishing or distances corresponding to these companies. Between the companies relying mainly on Venture Capital and other forms of funding different from Mergers/Acquisitions or Buyot/LBOs, the companies standing out for total funding amounts are Samotics (€48.7 M), Susphos (€19.38 M) and Hydraloop (€15.23 M). The three companies show different sizes, but comparable founding years, all located in the range between 2015 and 2019. Only Hydraloop shows patenting activity records, and none of the three entities show any sign of academic publishing activity. All companies are to some extent product- or technology-centric, but distances vary within the selection, with Susphos and Hydraloop being located at approximately 50 km from the nearest university, and Samotics falling short with a value of 19.59 km.

4.2 Cross-case analysis

The cross-case analysis consolidates the outcomes derived from individual companies within each cluster case and assesses these findings at the cluster level. This phase of the analysis aims to highlight certain observations documented within the four clusters, with the purpose of assisting the evaluation, conducted in the Discussion, of the propositions introduced in Chapter 4.

The section is organized as follows. To begin, I compare the four clusters based on their total count of funded companies, which serves as an indicator for assessing their investment attractiveness. I then juxtapose this data to the frequency of companies with patents and publications within each sample, considering companies with and without funding. Additionally, I examine the average distances between companies and the nearest university, distinguishing between firms with funding and those without.

The next subsection brings together the collected information on the additional factors introduced in the theoretical framework. Average company ages, FTE ranges and business model are given, as well as some high-level considerations on each region and country's environmental strategies and their populations. Lastly, cluster activities categorised as per Konstantynova and Lehman's paper (2017) are presented and discussed.

The final subsection build a comparison between the cases based on their deep dives into companies which received funding, and aims at identifying differences and similarities between the clusters. Firstly, the subsection presents and discusses observations relative to the main variables of patenting and publishing activity and distance from the closest university. Then, it concludes with a brief consideration of the considerations made about the control variables within each deep dive.

4.2.1 Patents, publications, distances and investment attractiveness of the cluster

Figure 4.53 presents a full summary of the information obtained for each cluster on investment attractiveness, patents, publications and distances. A first assessment of the data shows the cluster Water Alliance as that which appears to have received the most attention from investors, with 24.3% of companies within the sample having received funding. The cluster is closely followed by CLEAN (23%) and Greenreality (21.2%). The Spanish Aclima lags slightly behind, with only 15.5% of companies being the receptors of investments.

The Water Alliance cluster, which is considered the most attractive, also boasts the highest proportion of companies with publications and the greatest average distance. However, this pattern doesn't hold true for its patenting activity, as it ranks second overall in this regard. When examining the entire table, it becomes apparent that the frequencies of patenting, publishing, and average distances do not consistently align with the attractiveness ranking, resulting in different cluster rankings across the various total count categories. Nonetheless, when looking at the distribution of these independent variables across the two groups, those that have received funding and those that haven't, a distinct trend emerges. Companies with funding tend to exhibit patenting activity more frequently across all clusters. While the results for publications vary, the data for distances consistently indicates that three out of the four clusters—CLEAN, Greenreality, and Water Alliance—have shorter distances for companies that have secured funding, with Aclima displaying a different pattern and showing the opposite trend.

			Companies with patents			Companies with publications			Average distance from closest university (km)		
Cluster	Companies in the sample	Companies with funding	Total	Received funding	Did not receive funding	Total	Received funding	Did not receive funding	Total	Received funding	Did not receive funding
Aclima	84	15.5%	16.7%	33%	16%	14.3%	15%	14%	27.57	37.34	25.78
CLEAN	40	23%	22.5%	33%	19%	15%	11%	16%	20.20	15.26	21.63
Greenreality	33	21.2%	39.4%	71%	31%	21.2%	14%	23%	30.16	5.36	36.83
Water Alliance	144	24.3%	29.9%	46%	25%	21.5%	26%	20%	43.90	39.78	45.22

Figure 4.53: Table reporting the results of each case report, on the cluster level, for investment attractiveness, patents, publications and distances

4.2.2 Cluster-level additional factors

The results pertaining to each case's control or additional cluster-level factors are depicted in Figure 4.54. While the average ages of companies within the clusters do not follow the same ranking as investment attractiveness, it is noteworthy that the two most appealing clusters, CLEAN and Water Alliance, are also the ones proportionally reporting the highest counts of small firms belonging to the 1-10 FTEs range.

All clusters demonstrate support from their respective regions and countries, with established policies and plans aimed at achieving European sustainability goals. However, it is worth mentioning that Spain, particularly the Basque Country, appears to lag slightly behind when compared to the other clusters. While Spain is actively working on several Sustainable Development Goal (SDG) targets, the other clusters seem to have made substantial progress in the same areas and receive greater recognition for their sustainability endeavors. Interestingly, market access does not appear to be strongly correlated with attractiveness rankings. For instance, the relatively small region of South Karelia ranks higher in attractiveness than the Basque Aclima, despite the latter benefiting from a larger population of over 2.2 million residents in its vicinity, against South Karelia's 130 thousand.

In examining the activities of these clusters, it becomes evident that all organizations are deeply committed to enhancing cooperation and providing robust information and communication channels. Each of the four clusters places a strong emphasis on fostering collaboration among their members to drive the advancement of innovative clean technologies. Moreover, they offer a steady flow of information regarding available projects, conferences, and other pertinent news. Interestingly, the Spanish cluster stands out for its additional focus on Marketing and PR activities. It prominently underscores its endeavors in internationalization, aiming to elevate the relevance of its members on the global stage. In contrast, the CLEAN cluster exhibits a greater orientation toward the practical implementation of newly developed technologies. Their efforts extend to political validation and the provision of training to various entities for the effective implementation and utilization of these innovative technologies. The Finnish Greenreality, through its participation in numerous European financed projects, also allows its members to more easily access these external funding streams.

Cluster	Average age (years)	Frequent FTE range	Frequent business model	Region or country's environmental strategy	Population	Cluster activities
Aclima	31	11-50	Service based	Basque Country has its own programs and plans for sustainable development, following spanish and european objectives. Spain focuses on SDGs 11, 3, 12, 13 and 15.	2.2 mln	Co-operation Information and communication Marketing and PR
CLEAN	12	1-10	Product based	The Central Denmark Region is focused on reducing the environmental impact of its public institutions. Denmark is active and well performing on several SDGs.	1.3 mln	Co-operation Information and communication Political lobbying Training and qualification
Greenreality	33	1-10, 11-50	Service based	South Karelia presents its own circular economy roadmap and is focused on sustainable tourism. Finland is focused on SDGs 13 and 15.	130 k	Co-operation Information and Communications Access to Financing
Water Alliance	29	1-10	Service based	The Netherlands is active in pursuing all 17 SDGs. Main focus lies in renewable energy, combating climate change, fortifying environmental conservation efforts, and safeguarding biodiversity.	18 mln	Co-operation Information and Communication

Figure 4.54: Table reporting the results of each case report, on the cluster level, for age, size, business model, policies, population and cluster activities

4.2.3 Comparison of deep dive tables' observations

Figures 4.55 and 4.56 report the findings and observations for the deep dive into the companies, within each cluster, that have received funding. The analysis wants to give an additional layer to the previous sections. By delving into the information provided by companies which have been found to have received funding, it wants to establish cluster-level and cross-case observations able to further clarify the dynamics of investment attractiveness of clusters.

For the companies with funding that also filed for patents, two types of observations were elaborated. For Aclima and Water alliance, no discernible trends in the deal amounts, types and associated investors for companies with patents were identified. However, for CLEAN and Greenreality, the companies with records of patenting activity were also the ones with the highest total amounts of reported funding. No peculiarities were identified in any of the clusters in regard to the type of deals and investors associated with companies showing patenting activity.

Analogously, no specific deal or investor type was linked with companies active in academic publishing, which also were not associated with any peculiarities in total funding amounts. Only for Greenreality, it was found that the only company having reported activity in this sense was also the most funded company in the set. However, the company also showed patenting activity, which as previously mentioned has been associated with high funding amount for two out of the four clusters.

Distances from the nearest universities do not yield any distinct insights with regard to funding levels. Nevertheless, it is noteworthy that the Aclima cluster presents an intriguing observation: its most highly funded companies also happen to be the ones reporting the shortest distances from their neighboring universities. For the CLEAN and Greenreality clusters, it was also observed that the companies with the shortest distances were also the sole receivers of Accelerator/Incubator type of investments.

		Companies with patents		Companies with publications		Distances from closest university		
Cluster	Companies with funding	Total	Observations	Total	Observations	Highest value (km)	Lowest value (km)	Observations
Aclima	13	3	All companies have obtained 2 patents. No observations on amounts. Differing funding and investor types.	2	Values of 1 and 3. No observations on amounts. Differing funding and investor types.	90.11	0.94	Companies with highest amounts located at or under median. Companies at highest distances do not report high amounts.
CLEAN	9	3	Values of 1 or 2. Firms with patents are also the highest funded. No peculiarities for deal and investor types.	1	3 publications. No peculiarities from other firms in sample.	55.58	1.41	Companies with most funding have differing distance values. Companies with the lowest values are the sole receivers of Accelerator/Incubator type funding.
Greenreality	7	5	Values mainly between 1 and 3. Firms with patents are also the highest funded. No peculiarities for deal and investor types.	1	6 publications. The only company with publications is also the highest funded. No peculiarities for deal and investor types	18.37	0.37	Companies with most funding have differing distance values. Companies with the lowest values are the sole receivers of Accelerator/Incubator type funding.
Water Alliance	35	16	Values between 285 and 1. No unique observations for companies with patents, which present differing amounts, deals and investor types.	9	Values between 87 and 1. No unique observations for companies with publications, which present differing amounts, deals and investor types.	84.2	1.86	Varying values of funding amounts and types for companies with highest and lowest values.

Figure 4.55: Table reporting the results of each case's deepdive, for patents, publications and distances

Moving to the assessment of the additional control factors, it becomes evident that the ranges of values for founding years and full-time equivalent (FTE) categories among funded companies can exhibit significant variations across the clusters. Nevertheless, a consistent trend emerged in all instances: the companies that garnered the highest total funding amounts shared a common characteristic—they were all, to some extent, engaged in product or technology-oriented activities. None of the highly-funded companies were exclusively centered around service-oriented activities. Apart from this commonality, no other notable distinctions were observed within or between the sample groups.

	Founding years		FTE ranges		Business model		Observations
Cluster	Highest	Lowest	Biggest	Smallest	Most common	Least common	
Aclima	2017	1890	201-500	1-10	Uniform		No clear observations for the variables. Companies with highest funding are both product based.
CLEAN	2020	2014	11-50	1-10	product based	service based	No commonalities for the highly funded companies for age and size. All highly funded companies are to some extent involved in product related activities.
Greenreality	2018	1990	10000+	1-10	product based	service based	The two youngest and smallest companies are the sole receivers of Accelerator/Incubator type funding. The highly funded companies are product-centric.
Water Alliance	2019	1911	10000+	1-10	service based	both	Highly funded companies show different attributes in all columns. All highly funded companies are to some extent involved in product related activities.

Figure 4.56: Table reporting the results of each case's deepdive, for founding years, FTE ranges and business models

Chapter 5

Discussion

The theoretical framework outlined in Chapter 2 establishes various possible connections between the identified variables and the primary dependent variable of cluster-level investment attractiveness. The propositions derived from this framework need to be validated within the context of the cluster-level analysis. Nonetheless, it's important to note that valuable insights drawn from the individual case findings are also incorporated in this discussion to provide additional information, particularly focusing on exceptional cases that might offer valuable insights.

5.1 Key findings

5.1.1 Evaluation of the propositions and updated theoretical framework

Driven by the works of Nadeau (2010) and Breitzman and Thomas (2002), the first proposition stated that patenting activity plays a positive influence on the investment attractiveness of a cluster. In addition to these prior studies, Burger et al. (2015) introduced the concept of patent activity within cluster companies as a potential factor contributing to cluster quality.

Proposition 1: Clean technology clusters with high patenting activity in the area of cleantech will receive more investments.

While the proportions of companies with patents within the cluster do not precisely mirror the ranking of investment attractiveness, the results do exhibit a certain level of correlation between the two aspects. It's noteworthy that the three most appealing clusters also display the highest proportions of companies with patents, although not in the exact same order. Furthermore, a common trend across all clusters, though to varying degrees, is that companies with funding demonstrate a higher proportion of companies with patents within their subset compared to the subsets of companies with no reported funding. To further bolster the relationship proposed in the first proposition, evidence is drawn from two of the four cluster deep dives. Specifically, in the cases of the CLEAN and Greenreality clusters, it was observed that firms with patents coincided with firms within the subset that had received the highest total funding amounts. These observations collectively suggest that Proposition 1 finds some degree of support in the results of the analysis, and is in agreement with the literature (Nadeau, 2010; Breitzman & Thomas, 2002) holding the argument that patents are taken into account during VC and M&A assessments, constituting a positive signal for investors looking for companies able and willing to innovate.

The same can not be said for the second proposition.

Proposition 2: Clean technology clusters with high academic publishing activity in the area of cleantech will receive more investments.

Once again, it holds true that the more attractive clusters tend to report higher overall proportions of companies with records of publication activity. However, when delving into the comparison between companies with funding and those without, this does not yield additional support for the proposition. Among the clusters, a pattern emerges where half of them exhibit higher proportions of companies with publications for those with funding, while the relationship is reversed for the remaining two clusters. Likewise, the examination of the deep dive tables for all four cases fails to provide any valuable insights into the relationship between funding and publication activity. In general, the comparison of publication activity and funding amounts does not yield any unique points of observation. There is only one instance in one cluster where a peculiar characteristic is noted: a company stands out as not only the most funded within the set but also the sole company engaging in patenting activity. However, it's essential to recognize that its funding amounts may be influenced by various other factors, and its uniqueness does not contribute to substantiating the second proposition. Consequently, this proposition appears to lack support within the analysis results. This contrasts somewhat with the body of literature gathered, albeit in a manner consistent with the research scope. It's important to note that previous studies, such as Hsu et al. (Year) (Hsu et al., 2021), have indeed emphasized the positive association between publication activity and the market valuation of companies. However, it is worth highlighting that the literature reviewed primarily concentrated on individual firms or, as in the case of Hsu et al., publicly listed companies. Therefore, the findings from this research do not necessarily contradict these previous findings and should be considered within the context of the scope and focus of this study. Referring instead to the Burger et al. (2015) paper, which introduced publishing activity as a possible measure for the quality of clusters, the findings of this research could perhaps motivate a discussion toward this statement. As it has been found that the number of published articles by companies in a cluster does not appear, within the case studies of this research, to influence the investment attractiveness of the cluster, perhaps this could apply to the perceived quality of a cluster as well. However, such a statement would have to be verified by future researchers.

The third proposition suggested a positive relationship between the proximity of clusters to research universities, and the attractiveness of the cluster.

Proposition 3: Clean technology clusters located in close proximity to research universities will receive more investments.

The proposition arose from the review of works such as Gradeck (2004), Abramovsky and Simpson (2011) and Arundel and Geuna (2004), who investigated the positive influence of universities on the development of clusters. The findings do not show a linear relationship between the ranking of attractive clusters and their average distance from universities, with the more attractive clusters Greenreality and Water Alliance showing an average firm distance from universities higher than the one recorded for the least attractive cluster Aclima. Nevertheless, it is noticed that the three more attractive clusters show lower average distances for the companies which received funding than for the ones which did not. The deep dives don't however show the same support as the high-level table, with companies with high funding amounts showing differing distances from their closest university. A commonality met in two of the clusters is however that it is those companies that are closest to the universities, which are also the sole receivers of accelerator/incubator type funding. These companies were also found to be the youngest and smallest in their respective samples, hinting that perhaps more than one factor is at play. Nevertheless, it would appear that proximity to universities does not so much influence the amounts received by the firms, but may play a role in the type of investments directed towards them. This goes in partial agreement with the works of Gradeck (2004), who thought of universities as promoters of innovation and as vital elements in the development of a cluster. Therefore, the third proposition does not receive full support from the findings, which rather hint that it would be the type rather than the amounts of funding, that would receive more influence from proximity to universities. Nevertheless, such a consideration is relevant at the company level more than at the cluster level.

5.1.2 Additional remarks from cluster-level factors

As proposed by the theoretical framework, there can be several other factors at play when investigating the investment attractiveness of clusters. While it was found that the average age of firms within each cluster does not linearly relate to their attractiveness ranking, and that age does not seem to be strongly related to the amounts and types of funding recorded in the deep dives, more could be said about size. From a high-level assessment, it would appear that the most attractive clusters - Water Alliance, CLEAN and Greenreality - are also those which show the lowest FTE range of 1-10 as the one most commonly occurring within their sets of companies. However, the deep dives did not offer any additional insights for this metric, with differing funding amounts and types across the different ranges. The varying observations for these metrics is in line with the literature (Gala & Julio, 2016; Rodríguez-Gulías et al., 2020), which reported how these aspects may play a role in the investment attractiveness of firms, but such role is changeable and dependent on a series of other factors.

Three out of four clusters showed a majority of service based firms, with the three most attractive clusters showing different trends. However, it was found true for all clusters that the companies with the highest reported amounts of funding were, at least to some extent, involved in product- or technology related activities. This could have some implications for clusters, and in particular cluster organisations, who might choose to direct more of their resources to these types of business models in order to attract more investors. However, such a statement would require further analysis and research.

The analysis reveals that the four clusters exhibit similarities in their policy initiatives aimed at advancing clean technologies, as each region or country expresses its commitment to pursuing the United Nations' Sustainable Development Goals. However, Spain stands out as a somewhat distinct case, as it appears to have garnered less international recognition for its sustainability endeavors and continues to emphasize areas where other countries have already made significant progress. This divergence in policy focus for Spain may potentially manifest in the policies being implemented and could, in part, explain why Aclima was identified as the least attractive cluster, displaying occasional variations in behavior compared to the other case clusters. Continuing to examine the attributes of the regions and countries where the four cases operate, there doesn't appear to be any evident correlations between cluster attractiveness and their market accessibility, albeit this was only briefly examined by considering the total population in the respective areas. It's essential to clarify that this research does not intend to provide definitive conclusions in this regard, nor is it within the scope of its primary focus.

The cluster activity bundles presented by the cluster organisation corresponding to each case do not appear to vary significantly, or to show any strong relation with the attractiveness of the clusters. Water Alliance, the most attractive cluster, shows a small bundle but presents one characteristic, seen during the case selection, which might contribute to its attractiveness. The cluster is solely focused on water technologies, while the other clusters tend to differentiate their focus areas to a bigger extent. The real influence of this observation on the attractiveness of the cluster is out of the scope of this analysis, but it constitutes a notable difference worth mentioning.

5.1.3 Answers to the research questions

The research questions outlined in Chapter 1 were developed with the overarching objective of conducting a comprehensive investigation into the factors at the company level that shape the investment attractiveness of clean technology clusters.

The first and second research sub-questions served as guiding pillars during the literature review phase. They sought to answer two crucial inquiries: "What are the company-level factors that have the potential to impact the investment attractiveness of clean technology clusters?" and "What are the distinguishing characteristics of clusters that should be considered when evaluating the appeal of clean technology clusters?" With the guidance of these sub-questions, a theoretical framework was constructed, shedding light on specific company-level variables warranting in-depth examination. Notably, patent and publishing activity, along with proximity to universities, emerged as the primary company-level variables meriting further scrutiny. Moreover, the theoretical framework acknowledged the presence of additional factors at the cluster level that might exert influence on the investment attractiveness of the clusters under investigation.

The third sub-question, "How should the concept of 'investment attractiveness' be evaluated within the context of clean technology clusters?" is addressed within the Literature Review and Methodology chapters. Drawing from prior research that utilized previous investments as indicators of investment attractiveness, a similar approach was adopted in this study. However, due to limited availability of information pertaining to investment amounts, investment frequency was used as a proxy measure for cluster-level attractiveness.

The fourth sub-question pertained to understanding the mechanisms through which the identified company-level factors influence the investment decisions made by investors in clean technology clusters. The propositions formulated in Chapter 2 provide potential answers to this question. These propositions put forth plausible relationships between each company-level factor and the investment attractiveness of clusters, and are evaluated through the case-study analysis.

Lastly, through the extensive analysis presented in Chapter 4, and following the discussion of the implications of these findings within the same chapter, the primary research question, "What is the impact of company-level factors on the investment attractiveness of clean technology clusters?" is addressed. Based on the results of this case study, it appears that, for the four clusters under examination, patenting activity at the company level exerts a certain degree of positive influence on the investment attractiveness of clean technology clusters. However, it's important to note that the analysis also attempted to establish a similar connection for publishing activity and proximity to universities, but these corresponding propositions did not find consistent support within the results.

5.2 Limitations

The limitations inherent in this research have implications for the final results and conclusions on various fronts.

Firstly, the restriction to collecting funding information solely from secondary publicly available sources confines data collection to what companies have chosen to disclose within their financial profiles. This constraint limits the quantity and quality of observations available for the deep dive analysis, which ideally would necessitate more comprehensive details on each company's full funding deals. Additionally, the scarcity of accessible data led to the use of investment frequency as a surrogate for investment attractiveness at the cluster level. This choice inhibits the depth of subsequent observations, reducing investment attractiveness to a singular dimension and preventing a more comprehensive analysis. While the introduction of deep dive analyses aimed to enhance this cluster-level examination, an untreated bias arises from categorizing firms without Pitchbook and Crunchbase links as not having received funding, thus skewing the results by introducing a significant number of companies without information into each sample.

Furthermore, limitations are found within the literature review. In certain instances, concepts extracted from articles dedicated to the analysis of individual companies were extrapolated to the cluster level. This may have introduced a bias into the study, where the formulated propositions might have required further research to be adapted for cluster-level analysis, or they should have been retained as company-level propositions, eventually necessitating a different analytical approach.

The chosen methodology of a case study confines the final observations to the specific samples under investigation. While this is not a limitation of the methodology itself, which serves the purpose of offering contextualized, in-depth descriptions of each case and analyzing their differences, it does not provide a high level of generalisability to the study as a whole. This descriptive and exploratory case study inherently lacks the same level of generalisability achievable through an explanatory case study and significantly differs from the precision afforded by statistical analyses.

Regarding data collection and analysis, it's important to acknowledge a limitation related to the information gathered about cluster-level policy differences. While some preliminary research was conducted to understand the overall sustainability approach of regions and countries, a more comprehensive examination of the specific policies implemented by these countries would offer deeper insights into the tools accessible to clusters. Similarly, using population counts as the sole method for assessing market accessibility has limitations as it does not consider the multifaceted nature of this concept. Factors such as infrastructure, competitive landscape, and economic conditions, among others, contribute to market accessibility, and these should be taken into account for a more comprehensive evaluation.

Lastly, even though the deep dives added a valuable supplementary dimension to the analysis, certain information that could have shed light on the relationship between patenting and investment attractiveness was overlooked. Specifically, the data collected did not include the filing years of the patents held by each company. This omission means that the study did not account for the potential inverse relationship where funding could influence patenting. Patenting can be an expensive undertaking, and it's plausible that while the analysis indicated that patenting might have a positive impact on attractiveness, the receipt of funding could also play a role in determining the patenting opportunities available to companies.

5.3 Implications and future research

The implications of this study primarily pertain to areas warranting future research, while also offering some recommendations to clusters. It's essential to bear in mind the highly contextual nature of this case study and its inherent limitations.

Although consistent support for the second and third propositions was not attainable, the first proposition did receive some backing from the findings. It appears that patents may indeed contribute positively to the investment attractiveness of clusters. This finding suggests that companies may benefit from pursuing patent IP protection as a means to enhance the overall appeal of their cluster. Contributing to the previous works by Nadeau (2010) and Breitzman and Thomas (2002), this research increases the amount of academic works confirming the positive influence of patenting activity on the allure of companies and clusters to investors.

An additional avenue of research stemming from the results of this thesis could explore the real impact of publishing activity on the perceived quality of clusters. Given how the denial of the second proposition seem to somewhat contrast Burger et al.'s (2015) methods of assessment for the attractiveness of a cluster, it would be interesting to verify if publication activity can still exercise some influence in the perception of a cluster, though perhaps not from the perspective of investors.

Future research endeavors could consider a more refined iteration of the same study. If one opts to continue with a descriptive case study approach, examining additional clusters and collecting more comprehensive data on their constituent companies could yield higher-quality results. In such cases, it would be advisable to gather information from both primary and secondary sources to build a more comprehensive dataset, even for those companies that lack publicly available financial profiles. As Sunny and Shu (2019) remark in their work, additional research of the dynamics of funding of clean technology clusters is still required in order to fully comprehend this recent phenomenon, hence motivating additional studies such as the one just concluded.

Looking at the results obtained from the analysis of distance of firms in a cluster from universities, it was not possible to obtain any recommendations at the cluster level. However, from the literature review, an interesting avenue opens for an analysis at the company level. Garcia's (2015) discovery regarding firms' inclination to collaborate with higher-ranking universities, as opposed to those in close proximity, could serve as inspiration for a study that compares firms engaging in partnerships with distant universities to those partnering with nearby institutions. Such research has the potential to yield valuable insights into discerning disparities in investment attractiveness between firms collaborating with institutions that are geographically distant or proximate. Consequently, this study could offer valuable guidance to companies seeking new academic collaborations.

The limitations highlight the need for more in-depth exploration of factors like policy and market accessibility. Tthe academic literature currently lacks comprehensive research in these areas, especially concerning clean technology clusters (Sunny & Shu, 2019). Consequently, conducting studies specifically focused on examining the impact of regional and national policies, as well as the complexities of market accessibility at various levels, on the investment attractiveness and finding dynamics of clusters, could offer valuable insights. Such research endeavors have the potential to generate practical recommendations for policymakers seeking to promote the advancement of innovative clean technologies within their regions.

Chapter 6

Conclusion

This study aimed to uncover the factors influencing the investment attractiveness of clean technology clusters. I explored company-level and cluster-level variables to understand their impact on attracting investors. The research questions posed at the start of this study served as guidance throughout the research, illuminating the path toward identifying the company-level factors that may influence the investment attractiveness of clusters, and the possible nature of the connections between these variables. Such factors were identified as patenting activity, publishing activity and proximity to research universities.

The research followed a case study methodology, analysing the data through two separate steps. Firstly, single case reports were created for each of the selected four clean technology clusters. The reports served as a tool to provide a detailed investigation of each case, bringing forward cluster-level observations to be compared, during the second analysis step, to the other case clusters. This cross-analysis therefore was the main contributor to the evaluation of the propositions developed during the Literature Review, which stated the existence of positive relationships between each of the company-level factors and the investment attractiveness of clusters.

The propositions crafted during the exploration of the literature, serving as bridges between theory and practice, provided a framework for understanding how these company-level factors influence investment decisions. While some propositions found support within the case studies, others revealed a more intricate background that calls for further examination and refinement. The only proposition that found backing within the results is the one regarding patenting activity. Indeed, it would seem that, for the four clusters under study, this factor has a positive influence on the attractiveness of the clusters.

However, as this thesis concludes, it is essential to acknowledge its limitations. The study grappled with constraints in data availability, the need for further exploration of policy and market accessibility, and the inherent challenges of generalizing findings from descriptive case studies. These limitations open doors to future research opportunities, inviting scholars to delve deeper into the complexities of clean technology clusters.

Future avenues of research could delve into the iteration of this study, being mindful of its limitations and biases. Repeating this analysis on bigger and better samples could provide more information on the quality of the findings of the present research, as well as contributing a new set of information to the body of knowledge associate with cleantech clusters. researchers could also opt for different directions, either at the company or cluster case, to illuminate the role of university proximity on the attractiveness of firms or of policies and market accessibility on the attractiveness of clusters.

The implications of this thesis for clusters suggest that patenting could serve as a useful intellectual property protection method to attract investment, both at the company and cluster levels. Although further research is needed, the study's results may offer valuable insights for cluster actors and organizations. Similarly, the frequency of product- or technology-based firms receiving funding could motivate cluster organizations to provide additional support and attention to such companies to enhance investor interest in their cluster.

In the end, the story of clean technology clusters is one of innovation, sustainability, and the continuous effort for a greener future. As the world increasingly looks to these clusters as catalysts for change, their investment attractiveness remains a dynamic and ever-evolving story, one that promises a brighter, more sustainable future for all. The research journey embarked upon in this thesis contributes a chapter to this narrative, offering insights and frameworks that can guide cluster actors and organisations as they navigate the terrain of clean technology clusters.

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Appendix A

Supplementary Tables and Figures

The following tables report, in order, the full lists of results for the clusters Aclima, CLEAN, Greenreality and Water Alliance.

Name	Type	Country	Region	Founding Year	FTE	Employee Count	Address	Patents	Publications	Funding	Business model
TEKNIKER	company	ES	Europe	2015	201		C. Iñaki Goenaga, 5, 20600, Gipuzkoa, Spain	75	151	no	product based
ECOMAT	company	ES	Europe	1991	11		Pol. Ind. Ugarte, Pabellon 4 y 5, Calle A, s/n, 48480 Bilbao, Biscay, España	0	0	no	both
GARAY	company	ES	Europe	1985	51		Arboleda Obispo Otaduy 7-11 20560 Oñati	0	0	no	service based
ARCELORMITT	company	LU	Europe	1994	1001		Chávarri, 6 48910 Sestao (Bizkaia)	154	1566	multinational	
UNIVERSIDAD	university	ES	Europe				Enparantza Torres Quevedo Ingeniariaren, 1C, 48013 Bilbo, Bizkaia, Spain	0	0	university or government	
UNIVERSIDAD	university	ES	Europe	1952	1001		Campus Universitario, 31009 Pamplona, Navarra, Spain	0	0	university or government	
SENER	company	ES	Europe	1956	1001		Avenida de Zugazarte 56 ENTRY Cervantes, 8 48930 Getxo	102	119	no	both
BEFESA	company	DE	Europe	1993	1001		Carretera Bilbao-Plencia 21, Asua-Erandio, ES	27	15	multinational	
DOMINION	company	ES	Europe	2010	11		Pío Baroja Plaza, 3, 1ª Planta, 48001 Bilbo, Bizkaia	0	0	multinational	
TECNALIA	university	ES	Europe	2010	1001		Parque Científico y Tecnológico de Gipuzkoa Mikeletegi Pasealekua, 2 E-20009 Donostia-San Sebastián (Gipuzkoa)	195	83	university or government	
LUNDBERG	company	US	orthern Americ	1977	51	37	Zugatzarte 32, 2.1 48930 Getxo-Spain	1	0	multinational	
ALBA	company	ES	Europe	2022	1	201	Barrio San Martín, 5 C.P: 48550 Muskiz Bizkaia Spain	0	0	no	service based
IDOM	company	ES	Europe	1957	5001		Zarandoa Etorb., 23, 48015 Bilbo, Bizkaia, Spain	6	60	no	both
GESTIONET	company	ES	Europe	2001	11		Av. Ribera de Axpe Nº 11 Edificio A, Local 209 Erandio (48950), Bizkaia	0	0	no	service based
HANSON	company	DE	Europe	1997	11		C/ Cardenal Marcelo Spínola 42, 1ª, Madrid, Madrid 28016, ES	0	0	multinational	
SPRI	government	ES	Europe	1981	51		Alda. Urquijo 36 4th floor	0	0	university or government	
ANTHESIS LAV	company	ES	Europe	2013	201		C. Marcelo Celayeta, 75, Edificio IWER, Bloque 3, Oficina 18	0	9	address not found	
BROMALGAE	company	ES	Europe	2018	1	3	C/Reodriguiez Areias 17 4 derecha, 48011	0	0	no	both
PREZERO	company	DE	Europe	1927	201		4388 Serrano Drive Serrano DrJurupa Valley	2	0	multinational	
SERTEGO	company	ES	Europe	2017	51	14	Gorgs Lladó, 54 - 68, 08210	0	0	no	service based
TRADEBE	company	GB	Europe	1983	1001		Tradebe Amorebieta Barrio Ercoles, s/n 48290 Euba-Amorebieta Vizcaya	2	1	multinational	
ECOMAGNET	company	ES	Europe	2021	1		Manuel Lardizabal Ibilbidea, 15 20018 Donostia - San Sebastián Gipuzkoa	0	0	yes	product based
KOOPERA	company	ES	Europe	1990	201		Poligono Zabalondo, Derio Bidea 57 48100 MUNGIA (Bizkaia)	0	0	no	service based
AYUNTAMIENT	government	ES	Europe					0	0	multinational	
DIGIMET	company	ES	Europe	2013	1		C. Gabiria, 82, 20305 Irun, Gipuzkoa	2	0	yes	both
SUDS	company	ES	Europe	1998	1		Calle Portuetxe 23 B Edif. CEMEI Oficina 201 C.P. 20018 Donostia-San Sebastian	0	0	no	service based

FACTOR CO2	company	ES	Europe	2004	51	133	Colón de Larreátegui, 26 48009 Bilbao (Bizkaia)	0	0	no	service based
ORLOGA	company	ES	Europe	1978	11		Avda. Carlos I, nº 10, 4º B/C 20011 Donostia-San Sebastián, Gipuzkoa	0	0	yes	both
HEIDELBERG M	company	DE	Europe	1874	5001		C/ Cardenal Marcelo Spínola 42, 1ª, Madrid, Madrid 28016, ES	0	0	multinational	
GAIKER	company	ES	Europe	1985	51	103	Parque Tecnológico de Bizkaia, 48170	28	167	no	both
CEIT	university	IT	Europe	1982	201		Paseo Manuel Lardizábal, 15, San Sebastián, Guipuzcoa 20018, ES	0	0	university or government	
MONDRAGON	university	ES	Europe	1997			Loramendi, 4. Apartado 23 - 20500 Arrasate - Mondragón	0	0	university or government	
UNIVERSIDAD	university						Unibertsitate Etorb., 24, 48007 Bilbo, Bizkaia, Spain	0	0	university or government	
FIVEMASA	company	ES	Europe	1980	51		Ibañez de Bilbao, 28 3º Planta 48009 BILBAO	0	0	yes	both
TECOPLAS	company	ES	Europe	1991	11		Polígono Industrial, Trapaga - Causo, pabellones 16-17 Ctra. San Vicente, s/n. 48510 Trapagaran, Bizkaia.	0	0	no	both
AQUADAT	company	ES	Europe	2017	1	8	C/Luis De Castresana 6-12 48903 Barakaldo	0	0	yes	service based
ONDOAN	company	ES	Europe	1982	201		Parque Científico y Tecnológico de Bizkaia Ibaizabal Bidea 101 C 48170 Zamudio. BIZKAIA	0	0	no	service based
AAC AS	company	ES	Europe	1993	11	14	Leonardo Da Vinci Kalea, 14, 01510 Gasteiz, Araba, Spain	0	0	no	service based
ACODAL	company	CO	South America					0	0	multinational	
AEPA	company	CL	South America					0	0	multinational	
AFESA	company	ES	Europe	1985	11	67	Idorsolo Kalea, 15, 48160 Derio, Bizkaia, Spain	2	0	no	service based
AGRUPA LABO	company	ES	Europe	2016	11	13	Barrio Arteaga, 43T, 48160, Biscay, Spain	0	0	no	service based
ALEALSA	company	ES	Europe	1982			Calle, San Miguel de Atxa Kalea, 17, 01010 Vitoria-Gasteiz, Álava, Spain	0	0	no	product based
AMBAR PLUS	company	ES	Europe	2007	51	61	C/San Bartolomé, 10, P.I. Goiain. 01170 Legutio	0	0	no	service based
AMVISA	government	ES	Europe				Plaza España 1, 01001 Vitoria-Gasteiz	1	1	university or government	
ANBIOTEK	company	ES	Europe	1991	11	14	Ribera de Axpe 11 B201, 48950	0	8	no	service based
ARC AS	company	ES	Europe	2005	1	5	Portuetxe K., 45B, 2ª planta, oficina 7, 20018 Donostia-San Sebastian, Gipuzkoa, Spain	0	0	no	service based
AYUNTAMIENT	government	ES	Europe					0	0	university or government	
AYUNTAMIENT	government							0	0	university or government	
BALGORZA S.A	company	ES	Europe	2003	11		Zorrostea, 10 (Interior). Pol.Ind. Ali Gobeo. 01010 · Vitoria-Gasteiz.	0	0	no	service based
BASOINSA S.L.	company	ES	Europe	1985	11	37	Calle Dr. Luis Bilbao Líbano,11 -Entr.D 48940 Leioa (Bizkaia)	0	1	no	service based
BELAKO LANAK	company	ES	Europe		11	9	C/ Tejera, 7 – Mungia – Bizkaia	9	0	no	service based
BERZIKLATU	company	ES	Europe	2005	11		Barrio Orkonera, s/n 48530 ORTUELLA (Bizkaia) SPAIN	0	0	no	service based
BETEARTE	company	ES	Europe				Carretera BI 3342 p. k. 38 Alto de Areitio - 48269 Mallabia	0	0	no	service based
BIKZAIA ENERG	company	ES	Europe	1998	11		Insula A-1, 48340 Amorebieta - Etxano	0	0	yes	product based
BRIZIPLASTIC	company	ES	Europe	2020	1		Barrio el Peñueco, 4. 48800 Bizkaia	0	0	no	both

BUNTPLANET	company	ES	Europe	2000	11	18	Zuatzu Kalea 9 20018 San Sebastian	2	1	yes	product based
CÁMARA DE C	government	ES	Europe	1934	201		Camino de Portuetxe, 2	0	0	university or government	
CÁMARA DE C	government	ES	Europe					0	0	university or government	
CAMPEZO	company	ES	Europe	1940	201		Antonio Valverde Kalea, 20014 Donostia, Gipuzkoa, Spain	2	0	no	service based
CEMENTOS LE	company	ES	Europe	1917	11		Barrio Arraibi 40 48330 – Lemoa (Bizkaia)	2	3	yes	both
CIMAS	company	ES	Europe	2003	51	108	c/ Elcano, nº 14 – 3ª Izda. 48008 – Bilbao	0	0	no	service based
COMETEL	company	ES	Europe	1987	11	6	Poligono Industrial Albitxuri no. 8, 20870	4	0	no	both
CONSTRUCCIO	company	ES	Europe	1927	201		Paseo de Errotaburu, 1-5ª planta Donostia - San Sebastián	0	0	no	service based
CONSULTORES	company	ES	Europe				Out of area	0	0	address not found	
CONTENOR S.L	company	ES	Europe	1986	11		Polígono Industrial Trapaga-Ugarte Pol., 48510 Ugarte, Bizkaia, Spain	0	0	no	service based
DINAM	company	ES	Europe	2006			Parque Tecnológico Zamudio, 804, 48160 Derio, Biscay, Spain	0	0	no	service based
DIPUTACIÓN F	government	ES	Europe					0	0	university or government	
DIPUTACIÓN F	government	ES	Europe					0	0	university or government	
DIPUTACIÓN F	government	ES	Europe					0	0	university or government	
EKIONA	company	ES	Europe	2010	1		Sarobe 6 20800 Zarautz (España)	0	0	yes	both
EKO3R	company	ES	Europe				Paseo Ubarburu, 20 20014 San Sebastián (Guipúzcoa)	0	0	no	product based
EKOIURE	company	ES	Europe	2012	1	2	Calle Ercilla 18 - 2º izda. 48009 Bilbao.	0	0	no	service based
EMAÚS	company	ES	Europe	1980	51		Mundaitz Kalea, 6, 20012 Donostia, Gipuzkoa, Spain	0	0	no	service based
ENVISER	company	ES	Europe	1997	1001		IBAÑEZ DE BILBAO Nº 3, 2ª PLANTA 48001 BILBAO – BIZKAIA	0	0	no	service based
ESCOR	company	ES	Europe	1987			Zurrupitieta Kalea, 27, 01015 Gasteiz, Araba, Spain	0	0	yes	service based
FCC AMBITO	company	ES	Europe				Out of area	0	0	address not found	
GARBIKER	government	ES	Europe				Gran Vía de Don Diego López de Haro, 44, 48011 Bilbo, Bizkaia, Spain	0	1	university or government	
GEOLAN	company	ES	Europe				NBF Eraikina, c/ Arranomendia 5, 1.2. bulegoa 20240, Arranomendia, 20240 Ordizia, Gipuzkoa, Spain	0	2	no	service based
GMSM	company	ES	Europe	1998			Casa Arróspide, Calle de, Gregorio de la Revilla Zumarkalea, 27, 48010 Bilbao, Biscay, Spain	1	0	no	service based
GOBIERNO BA	government							0	0	university or government	
GOBIERNO BA	government						not found			university or government	
GRUNVER	company	ES	Europe	2015	1	11	Calle de Ogoño, 1 Planta 3, Oficina 7, 48930	0	0	no	service based
GRUPO OTUA	company	ES	Europe	1974	201		C/ SAN ANTOLÍN, 10 POL. INDUSTRIAL GOIAIN, LEGUTIO (ÁLAVA), SPAIN	0	0	no	both
GUTRAM	company	ES	Europe	1990	1	2	El Campillo	0	0	no	both
IHOBE	government						Alameda Urquijo Nº36 - 6ª planta, 48011 - BILBAO	0	0	university or government	
IK/INGENIERIA	company	ES	Europe	2004			Avd. Cervantes, 51 - 5º - Dpto 7 48970 Basauri (Bizkaia)	0	1	no	service based
INDUMETAL RI	company	ES	Europe	1928	51	28	Carretera de la Cantera, 11 E-48950 ASUA-ERANDIO	9	0	no	both
INGURU	company	ES	Europe	1991	11		Plaza del Renacimiento 9 – 5ª planta, 01004 Vitoria – Gasteiz	0	0	no	service based
IRAGAZ	company	ES	Europe	2003	11	2	Polígono Ugarte, 14520720 Azkoitia Gipuzkoa	1	1	no	both

IZADI21	company	ES	Europe	2006	1		Lasala Pl., 3, 20003 Donostia, Gipuzkoa	0	0	no	service based
J.RAMÓN S.L.	company	ES	Europe				Aritzatxu Bidea 2, Bajo dcha. 48370, Bermeo	0	0	no	both
JOLAS	company	ES	Europe		11		C/Mª Etxe Txiki, 19. Polígono Industrial Apartado 44. 20800 ZARAUTZ (Gipuzkoa)	0	0	no	both
KREAN GROUP	company	ES	Europe		201		Goiru Kalea, 7, 20500 Arrasate, Gipuzkoa, Spain	0	0	no	both
LANCHA RESTA	company	ES	Europe				Barrio Carolinas S/N 48500 Abanto-Zierbena Bizkaia	0	0	no	service based
Lezama Demol	company	ES	Europe	1995	51		Trapaga Elkartegia Bº Ugarte, s/n, 48510 Bilbao, Biscay	0	0	yes	
LIMIA & MART	company	ES	Europe	1993	11	4	Muelle Tomás Olabarri, 3 48930 Getxo (Bizkaia-Spain)	0	0	no	service based
LUR STUDIO	company	ES	Europe	2018	1		c/Barroeta Aldamar 6, 4ª planta 48001 - Bilbao	0	0	no	service based
MANKOMUNI	government							0	0	university or government	
METALLO	company	BE	Europe	1866	5001		Arana Bidea, 20, 48640 Berango, Bizkaia, Spain	9	0	multinational	
NEIKER	university	ES	Europe				Berreaga Kalea, 1, 48160, Bizkaia, Spain	0	0	university or government	
NOVATTIA	company	ES	Europe	2010	1		Txorierri Etorbidea, 46 Polígono Berreteaga, Nave 12b 48150 Sondika – Bizkaia	0	7	no	service based
NWORLD	company	ES	Europe	2010	1001		Out of area	0	0	multinational	
Consorcio de A	company	ES	Europe	1967	201	97	Calle San Vicente nº 8 48001 Bilbao	0	0	yes	service based
PREOCA SERVI	company	ES	Europe	2003	1		Vicente Aleixandre Kalea, 25, 01003 Gasteiz, Araba	0	0	no	service based
QUILTON	company	ES	Europe	1983	11		Amezti 6 48991 Getxo – Spain	0	0	no	both
QUIMYCAT	company	ES	Europe				Artsenalbidea, 19 ES48013 Bilbao	0	0	no	service based
RECYPILAS	company	ES	Europe	1989			Carretera de la Cantera, 11 E-48950 ASUA-ERANDIO (Bizkaia) SPAIN	0	0	no	service based
ROTOBASQUE	company	ES	Europe	1999	11		Parque Empresarial Boroa, 16 PARCELA 2B-9, 48340 Boroa, Biscay, Spain	0	0	no	product based
SADER	company	ES	Europe	1986	51		Artsenalbidea, 19, 48013 Bilbo, Bizkaia	0	0	no	service based
SAIOLAN	company	ES	Europe	1985	11	7	Goiru, 1, 20500	0	0	no	service based
SERBITZU	company	ES	Europe	1991	51	9	Ugarte Industrialdea, 145, 20720 Azkoitia, Gipuzkoa	0	0	no	service based
SERCONTROL	company	ES	Europe	1998	11		Archer Marinelaren Kalea, 37, 48013 Bilbo, Bizkaia, Spain	0	0	no	service based
SIDENHOL	company	ES	Europe	2021	1		Gran Vía 45, Bilbao, 48011	0	0	no	service based
SOGECAR	company	ES	Europe	1996			Torrelaragoiti, 48170 Zamudio, Bizkaia, Spain	0	0	no	service based
SOLVE SISTEM	company	ES	Europe	2016	11		Polígono Industrial el Campillo 26A, 48500 Abanto-Zierbena	0	0	no	both
TEKNIMAP	company	ES	Europe	1993	11		Otaola Hiribidea, 7, 2, 20600 Eibar, Gipuzkoa	0	0	no	service based
TH COMPANY	company	ES	Europe				Out of area	0	0	multinational	
TRIENEKENS	company	ES	Europe		51		Polígono Industrial Zubieta – Parcela PI 1B 48340 Zornotza-Amorebieta Bizkaia	0	0	no	service based
TSANDS	company	ES	Europe				Not available	0	0	address not found	
URA - AGENCI	government	ES	Europe					0	0	university or government	
VI4CRANE S.L.	company	ES	Europe	2015	1	3	Juan XXIII Auz., 9, 20730 Azpeitia, Gipuzkoa	0	0	no	product based
VICRILA	company	ES	Europe	1890	51		Avda. Autonomía 12 48940 Leioa - Bizkaia (España)	0	0	yes	product based
VISESA	government	ES	Europe					0	0	university or government	

VIUDA DE SAIN	company	ES	Europe	1984	201	Polígono El Campillo 19 48500 Abanto-Zierbena (Bizkaia)	1	1	address not found		
ZABALGARBI	company	ES	Europe	2005	51	Artigabidea, 10 48002 Bilbao Bizkaia	0	0	no	both	

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REGION MIDTJYLLAND	government	DK	Europe	1973	10001	12965	Skottenborg 26 8800 Viborg	66	0	university or government	
EXCELLENT SYSTEMS A/S	company	DK	Europe	2000	11	15	Møllevej 2 8544 Mørke, Denmark	6	0	no	product based
AARHUS KOMMUNE	government	DK	Europe		10001	837	Rådhuspladsen 2 8000 Aarhus C Danmark	0	0	university or government	
STJERNHOLM A/S	company	DK	Europe	1997	11	20	Langelandsvej 4A 8940 Randers SV	1	0	no	both
AARHUS UNIVERSITET	university	DK	Europe	1928	10001	10669	Nordre Ringgade 1 8000 Aarhus C Danmark	34	0	university or government	
CONVERT	company	DK	Europe	2017	1	7	Møllerupvej 26 8410 Rønde Danmark	0	0	no	service based
AGRIFARM A/S	company	DK	Europe	2007	1	11	Bommen 2 DK-8620 Kjellerup	2	3	yes	product based
VISBLUE	company	DK	Europe	2014	11	15	Bautavej 1A 8210 Aarhus V Denmark	0	0	yes	both
FRECON A/S	company	DK	Europe	1999	11	44	Egeskovvej 2B 8700 Horsens Danmark	0	0	no	service based
CONSIBIO	company	DK	Europe	2017	11	13	Sindalsvej 37 st. 8240 Risskov Danmark	0	0	yes	product based
BIO2OIL APS	company	DK	Europe	2014	1	1	Inge Lehmanns Gade 10, 5, Aarhus C, Midtjylland 8000, DK	0	0	yes	product based
40 GREENERGY	company	DK	Europe	2022	1	3	c/o Lars Lemming, Sadelmagertoften 96 8270 Højbjerg Danmark	0	0	no	product based
A BETTER OCEAN APS	company	DK	Europe		1	6	Skovvejen 46M 1. tv. 8000 Aarhus C Danmark	0	0	no	product based
AIRPLANT IVS	company	DK	Europe	2016	1	4	Veilgårdsvej 4 DK-8340 Malling Denmark	1	0	no	product based
AQUA CLEANTECH	company	DK	Europe	2016	1	6	Virkevangen 13, Assentoft DK-8960 Randers SØ	0	0	yes	service based
BBK BIO AIRCLEAN A/S	company	DK	Europe	1992	1	6	Linnerupvej 5 7160 Tørring Danmark	0	1	no	product based
DANISH WATER TECHNOLOGY GROUP	company	DK	Europe	1976	201	20	Lysbrohøjen 24 8600 Silkeborg Denmark	0	0	no	service based
DANSK ALGE PLAST	company	DK	Europe		1		c/o Henrik Truelsen, Linå Bygade 29 8600 Silkeborg Danmark	0	0	no	product based
EJLSKOV	company	DK	Europe	1999	11	26	Jens Olsens Vej 3 DK-8200 Aarhus N	5	1	no	both

FILTER4EVER APS	company	DK	Europe		1		Fusagervej 11 8382 Hinnerup Danmark	0	0	no	product based
GENVAND APS	company	DK	Europe	2012	1		Lemmingvej 227 8361 Hasselager	0	0	no	service based
GMAF CIRCULAR MEDICO APS	company	DK	Europe	2020	1	2	Eriksvej 22 DK-8960 Randers SØ Denmark	0	0	no	product based
GREEN SURVEY	company	DK	Europe	2020	1	6	Hveensgade 1, 3. sal 8000 Aarhus C Denmark	0	0	no	service based
GREENSAND DENMARK APS	company	DK	Europe		10001		Vessø Vænge 18 8680 Ry Danmark	0	0	no	service based
GREY WATER SOLUTIONS APS	company	DK	Europe	2019	1	1	Rosenvænget 2 8541 Skødstrup Danmark	1	0	no	product based
HERNING VAND	company	DK	Europe	2010	51	45	Ålykkevej 5 7400 Herning	0	1	no	service based
HYBRIDFILTE R A/S	company	DK	Europe		1	4	Oddesundvej 24 6715 Esbjerg N	0	0	not in region	
INCUBA A/S	company	DK	Europe	1986	11	35	Inge Lehmanns Gade 10 8000 Aarhus C	0	64	no	service based
INSTRUMATI C EMI A/S	company	US	orthern Americ	1977	1	15	Ellemosen 5 8680 Ry Denmark	0	0	multinational	
MPS-SOLUTIONS	company	DK	Europe	2021	1	1	Solbærmarke n 27 8641 Sorring	0	0	no	service based
NEWRETEX	company	DK	Europe	2020	1	11	Nørre Langgade 93 8840 Rødkærsbro	0	0	no	product based
NGIN A/S	company	DK	Europe	2016	11	24	Bautavej 1A, 8210 Århus V	0	0	no	service based
ØKOTØMRER EN	company	DK	Europe	2010	1	1	Mondrupsvej 8 8260 Viby J Danmark	0	0	no	service based
PLAZZO	company	DK	Europe	2021	1	2	Nydamsvej 17 DK – 8362 Hørning	0	0	no	product based
POND TWELVE APS	company	DK	Europe	2015	11	9	Balticagade 24 8000 Aarhus C, Denmark	0	0	no	product based
RE-ZIP APS	company	DK	Europe	2018	11	13	P.O. Pedersens vej 9 Port 7, 8200	1	0	yes	both
RENO DJURS I/S	company	DK	Europe	1997	51	24	Nymandsvej 11 8444 Balle	0	1	no	service based
SILKEBORG FORSYNING	company	DK	Europe		51	111	Tietgensvej 3 8600 Silkeborg	0	0	no	service based
SULFILOGGER A/S	company	DK	Europe	2020	11	25	Stokagervej 8G DK-8240 Risskov Denmark	1	0	yes	product based
TECHRAS NANO APS	company	DK	Europe	2021	1	2	Ferskvandsce ntret, Vejlsøvej 51 8600 Silkeborg	0	0	no	product based
TEXTILE CHANGE	company	DK	Europe	2019	1	8	Tysklandsvej 7 DK – 7100 Vejle	3	0	no	product based
THE UPCYCL	company	DK	Europe	2020	1	9	Borggade 4 8000 Aarhus C	0	0	yes	service based
TOLSTRUP & HVILSTED APS	company	DK	Europe	2011	11	17	Mosevej 3 8240 Risskov	0	0	no	service based

VENGE APS	company	DK	Europe	2011	1	2	Tornagervej 15, 8240 Risskov	0	0	no	service based
WALLPIPE	company	DK	Europe	2018	1	2	Grenåvej 19 8960 Randers SØ, Denmark	0	0	yes	both

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LAITEX OY	company	FI	Europe	1986	51	37	Kuormaajankatu 16 FI-53300 Lappeenranta	0	0	no	service based
AURELIA TURBINES	company	FI	Europe	2013	11	21	Höyläkatu 1 53500 Lappeenranta Finland	3	6	yes	product based
MITRA	company	FI	Europe		11	7	Heikinkatu 1, 55100	0	0	no	service based
GRANLUND	company	FI	Europe	1960	1001	913	Malminkaari 21 00701 Helsinki	0	14	no	service based
METSO OUTOTEC	company	FI	Europe	1990	10001	9930	Töölönlahdenkatu 2	167	0	yes	both
DANFOSS EDITRON	company	DK	Europe	1933	10001	14592		0	0	multinational	
METSÄ FIBRE	company	FI	Europe	1973	1001	400	Revontulenpuisto 2 02100 Espoo, Finland	25	14	no	product based
WIMAO	company	FI	Europe	2016	11	4	Oppilaankatu 4, FI-53100 Lappeenranta, Finland	1	0	yes	product based
LAPPEENRANNAN ENERGIA	company	FI	Europe	1901	51	37	Simolantie 18, Lappeenranta, 53600, FI	0	0	no	service based
PROHEAT	company	FI	Europe	2005	1	2	Alaniitynkatu 6, 53550	0	0	no	service based
EASY EV LATURI	company	CN	Asia		11	11	Kaskenkaatajantie 16 A9 02100 Espoo Finland	0	0	multinational	
CITY OF LAPPEENRANTA	government	FI	Europe	1649	1001	325	Villimihenkatu 1, 53101	0	0	university or government	
FINNSEMENTTI	company	FI	Europe		201	85	Skräbbölentie 18 21600 PARAINEN	3	3	no	both
APILA GROUP	company	FI	Europe	2006	1	12	Hietalantie 7A, 80710 Lehmo	1	0	no	both
ASSI GROUP	company	FI	Europe	2010	11	4	Kauppakatu 28 53100 Lappeenranta Finland	0	0	no	service based
BIOVAAKA	company	FI	Europe	2018	1	2	Laserkatu 6, 53850 LAPPEENRANTA	1	0	yes	both
CITY OF IMATRA	government	FI	Europe	1948	501	156	Virastokatu 1, IMATRA, South Karelia 55100, FI	0	0	university or government	
ELEKTROWAY	company	FI	Europe		11		Muovikuja 3, 55120 Imatra	0	0	no	service based
ELSTOR OY	company	FI	Europe	2017	1	4	Tuotantokatu 2, 53850	1	0	yes	product based
ETELÄ-KARJALAN JÄTEHUOLTO OY	company	FI	Europe	1996	11	27	Hulkonmäentie 130 54190 Konnunsuo Finland	0	0	yes	service based
OP South Karelia	company	FI	Europe	1902	10001	7513	Teollisuuskatu 1, 00510	0	0	no	service based
FIBER-X FINLAND OY	company	FI	Europe	2019	1	4	Teollisuustie 1, 54710 Lemi	0	0	no	service based
IMATRA REGION DEVELOPMENT COMPANY KEHY	company	FI	Europe	1982	1	9	Tainionkoskentie 14, 55100 Imatra	0	0	no	service based
IMATRAN LÄMPÖ OY	company	FI	Europe	2014	1		Kuusirinne 30 55800 Imatra Finland	0	0	no	service based
IMATRAN SEUDUN SÄHKÖ	company	FI	Europe	1928	51	14	Karhumäenkatu 2, 55120	0	0	no	service based
ITULA OY	company	FI	Europe	1990	11	1	Tyvitie 4 56510 Puntala	3	1	no	both
JOUTSENO COLLEGE	university	FI	Europe	1950			Pöyhiänniementie 2b 54100 Joutseno Finland	0	0	university or government	
KIELO OFFICE SOLUTIONS	company	FI	Europe	2017	11	17	Piippukatu 11, Jyväskylä, West and Inner Finland 40100, FI	0	0	no	service based
KYMI-SOLAR	company	FI	Europe	2016	1		Pernoontie 342 48410 Kotka Finland	2	0	no	product based
LAB UNIVERSITY OF APPLIED SCIENCES	university	FI	Europe	2020	201	456	Yliopistonkatu 36, 53850 Lappeenranta	0	0	university or government	
LAPPEENRANNAN ASUNTOPALVELU	company	FI	Europe	1981			Valtakatu 44 53100 Lappeenranta Finland	0	0	no	service based
LAPPEENRANTA BUSINESS FACILITIES LTD	company	FI	Europe					0	0	address not found	
LAPPEENRANTA STUDENT HOUSING FOUNDATION LOAS	company	FI	Europe		11		Laserkatu 1 C 53850 Lappeenranta Finland	0	0	no	service based
LUT UNIVERSITY	university	FI	Europe	1969	1001		Yliopistonkatu 34 53850 Lappeenranta, Finland	0	0	university or government	
LUUMÄKI MUNICIPALITY	government	FI	Europe				Linnalantie 33 54500 TAAVETTI Finalnd	0	0	university or government	
NANOPAR	company	FI	Europe	2007	1	4	Kotiniementie 16, Puumala, 52200, FI	0	0	no	product based
NEOEN RENEWABLES FINLAND	company	FR	Europe	2008	201	367	Mikonkatu 7, 00100 Helsinki, Finland	9	2	multinational	

NORDI	company	FI	Europe	2021	1	6	Oksatie 4 C 1, Lappeenranta, 53950, FI	0	0	no	service based
REJLERS FINLAND OY	company	FI	Europe	1980	1001	632	Graanintie 5, 20 paikkakuntaa, Suomi 50190, FI	1	1	no	both
ROXIA	company	FI	Europe	1993	51	129	Myllykallionkatu 2, Lappeenranta, FI-53101, FI	8	0	no	both
SAIMAA VOCATIONAL COLLEGE SAMPO	university	FI	Europe	2015	1	7	Armilankatu 40 53101 Lappeenranta	0	0	university or government	
SYNCRON TECH OY	company	FI	Europe	1992	11	32	Laserkatu 6 53850 Lappeenranta	0	0	no	both
TAIPALSAARI MUNICIPALITY	government	FI	Europe	1571	51	24	Kellomäentie 1 54920 TAIPALSAARI Finland	0	0	university or government	
UPM KAUKAS - BIOFORE INTEGRATION	company	FI	Europe	1978	10001	6550	Alvar Aallon katu 1, FI-00100	87	26	no	both
WSP FINLAND	company	FI	Europe	2011	501	404	Heikkiläntie 7, 00210	3	15	multinational	
YASKAWA ENVIRONMENTAL ENERGY / THE SWITCH OY	company	FI	Europe	2006	201	146	Elimäenkatu 5 FI-00510 Helsinki Finland	0	0	yes	service based

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ENDRESS+HAUSER	company	CH	Europe	1953	10001	8548	Nikkelstraat 6 1411 AJ Naarden	5114	253	multinational	
BIOTRACK	company	NL	Europe	2011	11	10	P.O. Box 7560 8903 JN Leeuwarden	3	2	yes	both
EASYMEASURE	company	GB	Europe	2020	1		Radonweg 16D 3812 RL Amersfoort	0	0	no	product based
GEORG FISCHER	company	CH	Europe	1802	10001	5619	Lange Veenteweg 19 8161 PA Epe Nederland	0	1	multinational	
MIJN WATERFABRIEK	company	NL	Europe	2014	1	3	Bruchterweg 88 7772 BJ Hardenberg	0	0	no	service based
AQUA COLOR SENSORS	company	NL	Europe	2015	1		Tweede Sluisweg 35 8413 NN Oudehorne	2	0	yes	product based
KLAREN INTERNATIONAL	company	NL	Europe	1953	201	10	Hanzeweg 35N, 3771 NG Barneveld, The Netherlands	1	0	yes	product based
LG SONIC	company	NL	Europe	2011	11	34	Heliumstraat 7, 2718SL Zoetermeer	0	0	no	both
ECONVERT WATER & ENERGY	company	NL	Europe	2012	51	56	Venus 33-35 8448 CE Heerenveen, The Netherlands	0	0	yes	both
QSENZ	company	NL	Europe	2015	1	6	Maricoweg 15a 1791 MD Den Burg	0	0	no	service based
ROYAL HASKONINGDHV	company	NL	Europe	1881	5001	6635	Laan 1914 35 3818 EX Amersfoort	0	180	no	service based
AQUALITY	company	NL	Europe	1991	1	5	Scheelhoekweg 9, LZ	0	0	no	service based
THE SENSOR FACTORY	company	NL	Europe	2015	1	12	Hermes 8 8448CK Heerenveen Netherlands	0	0	no	product based
NX FILTRATION	company	NL	Europe	2016	51	114	Josink Esweg 44 7545 PN Enschede The Netherlands	4	0	yes	product based
VITENS	company	NL	Europe	2006	1001	1474	Postbus 2014 6802 CA Arnhem	8	24	no	both
QUOOKER	company	GB	Europe	2005	11	53	Staalstraat 1 2984 AJ Ridderkerk	0	0	multinational	
WETSUS	company	NL	Europe	2004	51	188	Oostergoweg 9 8911 MA Leeuwarden	75	755	no	both
SPAANS BABCOCK	company	GB	Europe	1897	11	34	Postbus 79 8560 AB Balk Nederland	4	0	multinational	
PAQUES	company	NL	Europe	1960	201	206	T. de Boerstraat 24 8561 EL Balk The Netherlands	285	87	yes	both
HACH	company	US	orthern America		1001	2867	Laan van Westroijen 2a, 4003 AZ TIEL	369	176	multinational	
REDSTACK	company	NL	Europe	2005	11	12	Graaf Adolfstraat 35G, 8606 BT Sneek	14	15	yes	product based
LOGISTICON WATER TREATMENT	company	NL	Europe	1988	51	57	Energieweg 2, 2964 LE, GROOT-AMMERS	0	1	no	service based
COLUBRIS CLEANTECH	company	NL	Europe	1984	51	69	Stevinstraat 11-15 7102 DZ Winterswijk The Netherlands	1	0	no	product based
BLUE-TEC	company	NL	Europe	2014	1	5	Agro Business Park 7d 6708 PV Wageningen	0	0	yes	product based
BRIGHTWORK	company	NL	Europe	2007	1	6	Hegedyk 2 8601 ZR Sneek The Netherlands	0	0	no	service based
MUNISENSE BV	company	NL	Europe	2008	11	21	Touwbaan 38, A0. 08 2352CZ Leiderdorp	1	0	yes	both
FLOTTWEG	company	NL	Europe	1984	11	10	Nijverheidsweg 23 2102 LK Heemstede	29	0	multinational	
AVIC	company	NL	Europe	2002	11	11	Molenwal 20a 5301 AW Zaltbommel Nederland	0	0	no	service based
PURE WATER GROUP	company	NL	Europe	1998	11	33	Korte Hei 3, 4714 RD Sprundel	0	0	yes	both

WETTERSKIP FRYSLÂN	company	NL	Europe	1993	501	483	Fryslânplein 3 8914 BZ Leeuwarden	1	5	no	both
ATB NEDERLAND	company	NL	Europe	1988	1	4	Eeser Boulevard 21 8332 VM Steenwijk	0	0	no	service based
ROYAL EIJKELKAMP	company	NL	Europe	1911	51	92	Nijverheidsstraat 9 6987 EN Giesbeek The Netherlands	0	1	yes	both
BLUECON	company	NL	Europe	2016	1	6	IJsselsteyn 7, Spankeren, Gelderland 6956 AZ, NL	0	0	no	product based
YP YOUR PARTNER	company	NL	Europe	1987	11	17	Ampèrelaan 1 9207 AM Drachten	0	0	no	both
BIOCOMPACT	company	NL	Europe	2002	1	5	Nettenboetsterstraat 3 3133EP Vlaardingen	0	0	no	both
SAMOTICS	company	NL	Europe	2015	51	105	Bargelaan 200 2333 CW Leiden The Netherlands	0	0	yes	both
PRIMIX	company	NL	Europe	1984	11	4	Nijverheidsweg 17-f 3641 RP Mijdrecht The Netherlands	0	0	no	both
WAFILIN SYSTEMS BV	company	NL	Europe	2012	11	24	Agora 4 8934 CJ Leeuwarden	2	0	yes	both
AKANOVA BV	company	NL	Europe	1999	1	2	Koperslagersstraat 58 8601 WP Sneek	0	0	no	both
SOLTEQ ENERGY - FRESHWATERMILL	company	NL	Europe		1		Agora 4 8934 CJ Leeuwarden	0	0	no	product based
CLEAN TEQ WATER	company	AU	Oceania	2018	11	31	Agora 4 8934 CJ Leeuwarden	16	0	multinational	
AQ GROUP	company	NL	Europe	1994	51	43	Rijpwetering 1, 3543 AT	0	0	no	service based
GRENDEL GAMES	company	NL	Europe	2003	11	13	Blokhuisplein 40, 8911 LJ, Leeuwarden, The Netherlands	0	0	yes	service based
BIOSOLUM	company	NL	Europe	2016	1	2	Graafschap Hornelaan 163 6001 AC Weert	2	0	no	both
DMT ENVIRONMENTAL TECHNOLOGY	company	NL	Europe	1987	51	15	Yndustrywei 3	0	0	yes	both
VAN REMMEN UV TECHNOLOGY	company	NL	Europe	1999	11	18	Hooglandweg 3a 8131 TE, Wijhe The Netherlands	3	5	no	product based
RWB WATER	company	NL	Europe	2001	51	65	Ambachtstraat 20 7609 RA Almelo	0	1	no	service based
NOBIAN	company	NL	Europe	1918	1001		Van Asch van Wijckstraat 53 3811 LP Amersfoort The Netherlands	0	0	yes	product based
BERGHOF MEMBRANES	company	NL	Europe	1966	51	21	Agora 4 8934 CJ Leeuwarden The Netherlands	11	0	no	both
CIV WATER	company	NL	Europe	2013	1	6	Oostergoweg 9 8911 MA, Leeuwarden	0	0	no	service based
WIRE WEAVING DINXPERLO	company	US	orthern Americ	1917	51	14	Anholtseweg 18 7091 HA Dinxperlo	0	0	multinational	
WETLANTEC	company	NL	Europe	1994	1	8	Meanderlaan 137 1349HE Almere	0	0	no	service based
RINAGRO	company	NL	Europe	2001	11	6	Buren 4, 8756 JP Piaam	2	0	no	both
ACQUAINT BV	company	NL	Europe	2014	11	22	Zwettestraat 27b, 8912 AV Leeuwarden	0	0	yes	both
WATERBEDRIJF GRONINGEN	company	NL	Europe	1879	201	222	Griffeweg 99 9723 DV Groningen	0	3	no	service based
WETSALT	company	NL	Europe	1996	51	61	Lange Lijnbaan 15, 8861NW Harlingen	0	0	no	product based
ADS GROEP	company	NL	Europe	1947	51	129	NIEUWENKAMP MATES 8 7472 DE GOOR	0	0	no	service based
HOLLAND WATER	company	NL	Europe	2003	51	35	Nijendal 52, 3972KC	1	1	yes	both
CIRTEC	company	NL	Europe	2010	11	7	Nijverheidsweg 26 1442 LD PURMEREND The Netherlands	0	0	yes	both
PATHEMA	company	NL	Europe	2008	1	5	Droogdokkeneiland 6 5026 SR Tilburg Nederland	0	0	no	both

BROOS WATER	company	NL	Europe		1		Kalenbergerweg 9-1 8315 PD Luttelgeest	0	0	no	service based
AQANA	company	NL	Europe	2011	11	15	Smidsstraat 2, 8601 WB	1	0	no	both
SALTTECH	company	NL	Europe	2010	11	7	Madame Curieweg 4 8504 XC Joure The Netherlands	0	2	no	product based
WATERSCHAP NOORDERZIJLVEST	company	NL	Europe	2000	201	283	Stedumermaar 1, 9735 AC Groningen	0	4	no	service based
PB INTERNATIONAL	company	NL	Europe	1998	11	39	Stikkenweg 50, 7021 BN Zelhem, Netherlands	2	0	yes	both
AWT WATERTREATMENT	company	NL	Europe		1	6	Wanraay 57 6673 DM Andelst	0	0	no	service based
OISANN ENGINEERING BV	company	NO	Europe	2015	1	2	Agora 4 8934CJ Leeuwarden	0	0	multinational	
AQUALAB ZUID	company	NL	Europe	2009	51	89	Petrusplaat 1, 4251 NN	0	3	no	service based
D2D WATER SOLUTIONS	company	NL	Europe	2018	1		Hoefweg 12 6717 LS Ede	0	0	no	product based
ELIQUO WATER	company	NL	Europe	2014	501	29	Anthonie Fokkerstraat 33A 3772 MP Barneveld - The Netherlands	0	1	no	service based
RN SOLUTIONS	company	NL	Europe	2016	1		Handelsweg 2d, 5492	1	0	multinational	
PHARMAFILTER	company	NL	Europe	2009	11	28	Bennebroekerweg 249 1435 CJ RIJSENHOUT	8	0	no	product based
SENSILEAU	company	NL	Europe	2017	1	5	Industrieweg 1b-3 Unit 3 7944 HT Meppel The Netherlands	0	0	no	service based
STAAL INSTRUMENTS	company	NL	Europe	2015	1	8	Havenweg 7, 5145 NJ, Waalwijk	0	0	no	service based
SUSPHOS BV	company	NL	Europe	2019	1	16	Sixmastraat 15 8932 PA Leeuwarden	0	0	yes	product based
TITAN SALT	company	NL	Europe	2017	51	12	De Marne 53 8701 PV Bolsward The Netherlands	0	0	no	service based
WATER FUTURE BV	company	NL	Europe		1	4	De Leest 9 a-b 5107 RC, Dongen	0	1	no	both
HYDRALOOP SYSTEMS	company	NL	Europe	2016	11	35	Oostergoweg 9 8911 MA Leeuwarden	1	0	yes	product based
ENITOR PRIMO	company	NL	Europe	1938	201	75	Beatrixstraat 7 NL-9285 TV Buitenpost	0	0	yes	service based
DESAH	company	NL	Europe		1	4	Pieter Zeemanstraat 6 8606 JR SNEEK	0	5	no	product based
COLSEN	company	NL	Europe	1989	11	32	Kreekzoom 3 4561 GX Hulst Nederland	2	3	yes	both
CELLVATION BV	company	NL	Europe	2016	1	3	Agora 4 8934 CJ Leeuwarden	0	0	no	product based
MEGAGROUP TRADE HOLDING	company	NL	Europe	1989	201	111	Doornhoek 4205 NL-5465 TG VEGHEL	0	0	yes	service based
FERR-TECH	company	NL	Europe	2020	11	11	Hesselterlandweg 6, 7942 HZ Meppel	0	0	no	both
NIQO SYSTEMS	company	NL	Europe	2019	1	2	Koperslagersstraat 58 8601 WP Sneek The Netherlands	0	0	no	service based
HULO	company	NL	Europe	2021	1	4	Zwettestraat 27, 8912AV Leeuwarden (NL)	1	0	no	product based
BLUE INNOVATIONS	company	NL	Europe	2021	11	34		0	0	address not fo	product based
OXYCOM	company	NL	Europe	2002	11	27	Kaagstraat 31 8102 GZ Raalte The Netherlands	20	0	no	product based
KROHNE NEDERLAND	company	DE	Europe	1921	1001	1883	Kerkeplaat 14 3313 LC Dordrecht	740	133	multinational	
HELLEBREKERS	company	NL	Europe	1971	201	201	Wieling 4 8072 TE Nunspeet (NL)	13	4	yes	both
DUIJVELAAR POMPEN	company	NL	Europe	1955	201	156	Kalkovenweg 13, 2401LJ, Alphen aan den Rijn, NL	1	0	yes	both
NORMEC ALL WATER SERVICES	company	NL	Europe	1991	11	3	Hambakenwetering 16 5231 DC ‘s-Hertogenbosch	0	0	yes	service based

HMS NETWORKS BENELUX	company	SE	Europe	1988	501	808	Architronlaan 1a 5321 JJ, HEDEL Netherlands	0	0	multinational	
NALCO WATER, AN ECOLAB COMPANY	company	US	orthern Americ	1923	10001	11215	Oude Rhijnhofweg 17 2342BB Oegstgeest	601	22	multinational	
MOEKOTTE ENGINEERING AND INSTALLATION GROUP	company	NL	Europe	1966	201	137	Twekkeler Es 45 7547 ST Enschede	2	1	no	both
NORMEC KALSBEEK BV	company	NL	Europe	1948	51	61	Aziëweg 19 9407 TC Assen	0	0	yes	service based
OMEGAM-WATER	company	NL	Europe	2002	11	16	Raadhuisplein 1c 1687 NG Wognum	0	1	no	service based
KEMIRA ROTTERDAM	company	FI	Europe	1920	1001	2981	Botlekweg 175 3197 KA Botlek-Rotterdam	974	473	multinational	
JUSTNIMBUS	company	NL	Europe	2009	1	4	Pampuslaan 194 1382 JS Weesp	0	0	no	both
HDM PIPELINES	company	NL	Europe	2011	11	15	K.R. Poststraat 90, 8441 ER Heerenveen (NL)	0	0	no	service based
EVILIM INDUSTRIEWATER	company	NL	Europe	2007	1	3	Röntgenweg 11 6101 XD Echt	0	0	no	service based
FORU SOLUTION	company	NL	Europe	2011	11	12	Lemsterpad 56 8531 AA Lemmer The Netherlands	0	0	yes	service based
DELTAPORE SYSTEMS	company	NL	Europe	2015	1	1	Binnenvaart 9 6642 CT Beuningen	0	0	no	service based
DUPONT WATER SOLUTIONS	company	US	orthern Americ	1802	10001	401	Bedrijvenlaan 9 2800 Mechelen	8331	6	multinational	
DUTCH EXPORT SOLUTIONS	company	NL	Europe	2020	1	1	Agora 4 8934 CJ Leeuwarden	0	0	no	service based
CENTRITECH	company	NL	Europe	2020	1	6		0	0	no	service based
DEMCON CONVERGENCE	company	NL	Europe	2010	11	39	Josink Kolkweg 23, 7545 Enschede	7	61	yes	product based
FIBRE SECURITY	company	NL	Europe	2017	11	3	Nieuwe Gracht 3 2011NB Haarlem Netherlands	0	0	no	both
ESEP WATER TREATMENT & MANAGEMENT	company	NL	Europe	1989	11	7	Celsius street 20 DG Weert	0	0	no	service based
EWS – EUROPEAN WATER STEWARDSHIP	company	NL	Europe	2003	201	2	Oostergoweg 9 8911 MA Leeuwarden	0	0	no	service based
EUROFINS C-MARK	company	CH	Europe	1987	10001	22858	Munsterstraat 2 L 7418 EV Deventer	71	1453	no	both
EMI-TWENTE	company	NL	Europe	1995	11	13	Drienerlolaan 5 7522 NB Enschede The Netherlands	0	5	no	service based
PAQUES BIOMATERIALS	company	NL	Europe	2021	1	11	Tjalke de Boerstrjitte 13, 8561 EL Balk	1	0	no	product based
WATSON-MARLOW FLUID TECHNOLOGY SOLUTIONS	company	GB	Europe	1956	1001	1130	Oslo 9 2993 LD Barendrecht	29	4	multinational	
AQUASTILL BV	company	NL	Europe	2007	1	2	Nusterweg 69 NL-6136 KT Sittard	0	0	yes	product based
CE-LINE B.V.	company	NL	Europe	2018	1	3	Hermes 8, 8448 CK Heerenveen The Netherlands	0	0	no	product based
GENAP	company	NL	Europe	1951	51	37	Goorsestraat 1 7041 GA 's-Heerenberg The Netherlands	10	0	no	both
FIELDFACTORS	company	NL	Europe	2016	11	8	Van der Burghweg 1 2628 CS Delft The Netherlands	0	0	no	product based
ABALCO® GROUP	company	NL	Europe	1995	51	9	Leemansstraat 9 4251 LD Werkendam	0	0	no	service based
AQA.EARTH	company	NL	Europe	2022	1	1	Tweede Sluisweg 35 8413 NN Oudehorne	0	0	no	service based
AQUA ASSISTANCE BV	company	NL	Europe	2005	11	28	Schootense Dreef 35 5708 HZ Helmond	0	0	no	service based
AQURAAT	company	NL	Europe	2019	1	4	Leerdamseweg 44, 4147 NL	0	0	no	service based
AZZURO	company	US	orthern America		11	12	PO Box 27590	0	0	multinational	
BIOCLEAR EARTH	company	NL	Europe	1988	11	27	Rozenburglaan 13 9727 DL Groningen	0	2	yes	service based
BOSMAN WATERMANAGEMENT	company	NL	Europe	1929	51	34	Steegjesdijk 6 3265 AE Piershil	1	0	no	both
BÜRKERT BENELUX	company	US	orthern Americ	1946	1001		Minervum 7220 4817 ZJ Breda	202	22	multinational	

CENTRE OF EXPERTISE WATER TECHNOLOGY (CEW)	company	NL	Europe	2012	1	23	Oostergoweg 9, 8911 NL	0	0	no	service based
CG DRIVES & AUTOMATION (EMOTRON)	company	SE	Europe		51	112	Polakkers 5 5531NX Bladel The Netherlands	13	4	multinational	
D&F TECHNIEK	company	NL	Europe	1994	11	13	Evergembaan 1 5121 DR Rijen	0	0	no	both
GEA NEDERLAND	company	DE	Europe	1881	10001	13400	Hoogveld 16 5431 NW Cuijk	1868	25	multinational	
H2O BIOFOULING SOLUTIONS	company	NL	Europe	2014	1	7	Nijverheidsweg 14A 6662 NG Elst The Netherlands	0	0	no	both
HUBERT	company	NL	Europe	1880	51	2	Kooijweg 20, 8715 NL	2	1	no	both
HYDROSCOPE	company	NL	Europe	2001	11	44	Minervum 7181, Breda, 4817ZN, NL	0	0	no	service based
HYDROSOURCE BV	company	NL	Europe		1	1	Dorpsstraat 11a 7863 PA Gees	0	0	no	service based
INDAVER SEPARATION TECHNOLOGIES	company	BE	Europe	1985	201	57	Spoorstraat 25 4431 NK 's-Gravenpolder	0	24	multinational	
INDUCON ZWEMBADTECHNIEK	company	NL	Europe	1978	51	20	Bathoorn 3 9411 SE Beilen The Netherlands	1	0	no	product based
INTECH WATER	company	NL	Europe		11	1	Waarderweg 50B, 2031BP Haarlem	0	0	no	service based
ISS TANKS	company	NL	Europe		1	2	De Hanekampen 42 9411 XM Beilen (The Netherlands)	0	0	no	service based
JOTEM WATERBEHANDELING	company	NL	Europe	1965	11	24	De Watergang 16 7671 SW Vriezenveen	0	0	no	both
KERSTEN KUNSTSTOFCOATING	company	NL	Europe	1967	11	7	Vulcanusweg 2 , 6971 GW Brummen	1	0	no	product based
KWA BEDRIJFSADVISEURS	company	NL	Europe	1998	51	80	Regentesselaan 2, 3818 HJ Amersfoort	0	0	no	service based
LANDUSTRIE SNEEK	company	NL	Europe	1913	51	80	Pieter Zeemanstraat 6 8606 JR Sneek	24	3	no	both
NIEUWATER	company	NL	Europe	2004			Dikkewijk OZ 54 7833 HR Nieuw-Amsterdam	0	1	no	service based
OOSTERHOF HOLMAN – ENVIRONMENTAL ENGINEERING	company	NL	Europe	1912	201	181	Kievitsweg 13, 9843 HA Grijpskerk	6	0	no	both
OVIVO HOLLAND	company	CA	orthern Americ	2010	1001	722	Energieweg 1 2382 NA Zoeterwoude	75	11	multinational	
PIPELIFE NEDERLAND	company	AT	Europe		1001	801	Flevolaan 7 1601 MA Enkhuizen	46	0	multinational	
POOLQUIP NEDERLAND	company	NL	Europe	1979	1	7	De Vest 50b 5555XP Valkenswaard	0	0	no	service based
PRO WATER BV	company	NL	Europe	2001	1	3	Lansinkesweg 4 7553 AE Hengelo	0	0	no	service based
PROCESS DESIGN CENTER (PDC)	company	NL	Europe	1987	11	12	Paardenweide 7 4824 EH Breda	2	0	no	both
PURGATORIA	company	NL	Europe	2021	1	2	Veesser Enkweg 28 8194 LM Veessen	0	0	no	product based
RAINMAKER HOLLAND	company	NL	Europe	2007	1		Galileostraat 32H 3029 AM ROTTERDAM	1	0	no	product based
REKO INDUSTRIAL EQUIPMENT	company	NL	Europe	1964	11	3	Delta Industrieweg 36 3251 LX Stellendam Nederland	0	0	no	product based
ROLAPAC	company	NL	Europe	2021	11	2	Middelbroekweg 29 Mailbox 528 2675ZT HONSELERSDIJK	0	0	no	product based
ROSENBERG VENTILATOREN & KLIMAATTECHNIEK	company	NL	Europe	1983	1001	96	Elandlaan 8 3734 CP Den Dolder	29	0	yes	
RPS ANALYSE	company	GB	Europe		5001	6120	Elektronicaweg 2 2628 XG Delft	1	63	multinational	
SENSIBLUE	company	NL	Europe	2013	1	6	Van Bommellaan 15 2245 VN Wassenaar	0	0	no	product based
SMARTWASH SOLUTIONS	company	US	orthern Americ	2009	11	32	Energiestraat 3 7442 DA Nijverdal	3	0	multinational	

SUEZ WATER TECHNOLOGIES & SOLUTIONS NETHERLANDS BV	company	FR	Europe	1853	10001	51791	Toekomstlaan 54 2200 Herentals	0	0	multinational	
TERRACRAWLER	company	NL	Europe	2022	1		Hurksestraat 19-4.41 5652 AH Eindhoven	0	0	no	service based
UNICA BUILDING SERVICES	company	NL	Europe	1933	1001	3246	De Wel 15 3871 MT Hoevelaken	0	0	yes	service based
UPFALLSHOWER	company	NL	Europe	2014	1	3	Antenna Street 8 1322AB Almere	0	0	no	service based
UVOX REDOX	company	DE	Europe	1966		4	Agora 4 8934 CJ Leeuwarden The Netherlands	0	0	no	product based
VDH WATER TECHNOLOGY	company	NL	Europe	1978	51	37	Glashorst 114, 3925 BV Scherpenzeel	0	0	no	both
VERHOEVE MILEU & WATER	company	NL	Europe	1987	51	26	Aventurijn 600, NL-3316 LB Dordrecht	2	1	no	both
VGE BV	company	NL	Europe	1982	11	21	Nieuwe Eerdsebaan 26 NL-5482 VS Schijndel	0	0	no	product based
WATER APPLICATION CENTRE (WAC)	company	NL	Europe	2012	1	6	Agora 1 8934 CJ Leeuwarden	0	0	no	service based
WATERWAVES	company	NL	Europe		1	3	Oosterhoutstraat 17 9001 CC Leeuwarden	26	0	no	product based
WATTER BV	company	NL	Europe	2008	11	21	Mercuriusweg 29 9482 WK Tynaarlo (Drenthe) The Netherlands	0	0	no	product based
WLN (WATER ONDERZOEK ADVIES)	company	NL	Europe	1976	51	107	Rijksstraatweg 85, 9756 AD Glimmen	2	0	no	both
WORLD TRADE CENTER LEEUWARDEN	company	NL	Europe	1999	1	14	Heliconweg 52, 8914 AT Leeuwarden	0	0	no	service based
WSP BV	company	CA	orthern Americ	2011	10001	66316	Orionweg 28 8938 AH Leeuwarden	83	946	multinational	
XYLEM WATER SOLUTIONS	company	US	orthern Americ	2008	10001	13584	Pieter Zeemanweg 240 3316 GZ Dordrecht	288	88	multinational	
ZEBRAPORT	company	NL	Europe	1995	1	1	Moorland 4a-Unit 1.04 5688 Oirschot	0	0	no	service based

Appendix B

Code Samples

Listing B.1: Geocoding: extracting coordinates from addresses

```
import requests
# List of addresses
addresses = [
    "Radonweg 16D 3812 RL Amersfoort",
    # Paste here all addresses
]

base_url = "https://nominatim.openstreetmap.org/search"
params = {
    "format": "json"
}

for address in addresses:
    params["q"] = address
    response = requests.get(base_url, params=params)
    data = response.json()

    if data:
        latitude = data[0]["lat"]
        longitude = data[0]["lon"]
        print(f"Address: {address}")
        print("Latitude:", latitude)
        print("Longitude:", longitude)
        print("-" * 20)
    else:
        print(f"Geocoding failed for the address: {address}")
        print("-" * 20)
```

Listing B.2: Haversine distance: calculating distances between sets of coordinates

```
import math

def haversine_distance(lat1, lon1, lat2, lon2):
    R = 6371  # Earth's radius in kilometers
```

```
    # Convert latitude and longitude from degrees to radians
    lat1, lon1, lat2, lon2 = map(math.radians, [lat1, lon1, lat2, lon2])

    # Haversine formula
    dlat = lat2 - lat1
    dlon = lon2 - lon1
    a = math.sin(dlat / 2) ** 2 + math.cos(lat1) * math.cos(lat2) *
    math.sin(dlon / 2) ** 2
    c = 2 * math.atan2(math.sqrt(a), math.sqrt(1 - a))
    distance = R * c

    return distance

# Coordinates of the reference point (latitude, longitude)
ref_lat = 53.219246
ref_lon = 6.5631006

# List of coordinates to calculate distance for (latitude, longitude)
coordinates = [
    (53.1957398,5.7588089),
    # Paste here all coordinates
]

for coord_lat, coord_lon in coordinates:
    distance = haversine_distance(ref_lat, ref_lon, coord_lat, coord_lon)
    print(f"Distance from reference point to ({coord_lat},
        {coord_lon}): {distance:.2f} km")
```