Cluster Dynamics in the Internationalisation of Cleantech SMEs

A case study of CLEAN

Master Thesis
Copenhagen Business School
MSc Management of Innovation and Business Development

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15th of May 2020
Supervisor: Stine Haakonsson

Number of characters: 272985
Number of pages: 107

Abstract

This master thesis investigates how cleantech clusters influence the internationalisation of Danish cleantech SMEs. It employs a holistic approach including relevant macro, meso and micro factors in order to investigate interlevel dynamics on the basis of a case study of CLEAN Cluster and three member SMEs. Influential dynamics have been identified from the macro level in that cleantech SMEs are heavily influenced by the institutional environment as well as the industry in which they operate. The thesis finds that clusters can have a mediating role between macro and micro level actors and that clusters can influence the industrial identity of regions as well as the potential for SMEs to access resources through networks. Moreover, cleantech clusters can positively influence the potential for SME internationalisation through extension of networks, identification of international opportunities, learning and facilitation of knowledge sharing between industry, academia and public organisations. The identified effects of these cluster dynamics are indirect and aimed at the initial stages of the internationalisation processes. Hence, the value of these cluster dynamics for the cleantech SMEs is highly dependent upon the individual firm's ability to utilise them for internationalisation.

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1. Introduction

The challenge of climate change is "global in scope and unprecedented in scale" (United Nations, n.d.). Consequently, it is broadly acknowledged that change must occur within a broad variety of social and economic spheres and that such large scale and systemic change requires concerted action through the involvement of multiple stakeholders including consumers, legislators and businesses (ibid.). An indispensable tool within this concerted approach is technological development and innovation (IDA, 2018). This is further emphasised by the President of the UN's Economic and Social Council, Marie Chatardová, who states that "No one can ignore the vital role of science, technology and innovation (STI) in advancing the transformative impact" (United Nations, 2018). Technology within this field is defined as 'cleantech' and includes a wide array of products and services including the production of renewable or resource-efficient industrial processes. Cleantech is a type of technology which reduces negative impact on the environment by utilising resources in a more efficient way than traditional technologies (Burtis el. al., 2006).

Qua the instrumental role that cleantech plays in the green transition, a broad range of scholars, practitioners and legislators engage in the discussion of how to best utilise and drive the development of the cleantech industry. According to EU's climate knowledge and innovation community, Climate-KIC, a vital prerequisite for developing and leveraging cleantech through concerted action is to adopt an international approach (Climate-KIC, 2014). A key finding in a report published by the Climate-KIC is that "Too often the impulse of entrepreneurs and governments is to think locally first and globally later. But thinking nationally or regionally is not enough". This leads to the key recommendation that "Everyone involved in the cleantech sector needs to start thinking on a global scale first and foremost. The value of "co-opetition" is in ensuring that knowledge, skills, insight and best practice is shared across borders around the world" (ibid.). Hence, it is imperative to employ an international and collaborative approach to cleantech.

An important aspect of this international approach is export of cleantech solutions. In 2019 Denmark was the leading country in Europe in terms of export of sustainable energy technology and number two within export of water solutions (CLEAN, 2019b). In recent years, the export of cleantech solutions has been the fastest growing sector of Danish exports, and this development is expected to continue due to the support from both the public and private sector (Worklivestay, 2018). This strong international position resides from the fact that the Danish government has been able to shape the industry and strengthen the surrounding innovative ecosystem through significant investments in R&D, supportive policies and access to private-public organisations (Cleantech Group & WWF, 2017). However, this growth potential and vast focus on export is largely concentrated around the large companies in the industry, as Small and Medium-sized Enterprises (SMEs) often struggle to acquire the necessary

resources to operate, scale and internationalise within this capital intensive industry (Leonhard, 2018). However, on a global scale SMEs represent a large share of the overall landscape of cleantech firms and they account for a large amount of the innovation within the field (Koirala, 2018). Therefore, it is crucial to address the role of SMEs and their capabilities to scale and internationalise.

To this end, a networked approach to internationalisation is an area of research that has gained increasing interest, particularly for smaller firms. This has led to the recognition of network theory and its alternative perspective on the international development patterns of small firms (Coviello & Munro, 1995; Coviello & McAuley, 1999; Dunning, 2000). A firm's existing network as well as the ability to establish new relationships can now be viewed as a key competitive advantage and thus as an important factor in the firm's internationalisation efforts (Coviello & Munro, 1995). This increasing focus on networks and collaboration is also foundational for the United Nations' Sustainable Development Goal (SDG) 17; *Partnerships for the goals*, which focuses on global collaboration for sustainable development (United Nations, n.d.).

An important tool for governments in driving this collaborative approach is cluster development. In Denmark, clusters are prioritized highly in order to facilitate collaboration within industries (Cluster Excellence Denmark, n.d.). In example, the Danish cleantech cluster, CLEAN, focuses on creating Danish business opportunities within energy and environmentally friendly solutions both domestically and abroad. The cluster aims to accelerate sustainable transition whilst realising growth for the Danish cleantech sector. This is done through a focus on triple helix collaborations between private firms, the public sector and knowledge institutions as well as international collaborations and knowledge sharing (CLEAN, 2019a). Hence, when assessing clusters as part of a national and global infrastructure for collaboration, SDG 17 interlinks with SDG 9; *Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation* (ibid.). More specifically, SDG 9 focuses on upgrading infrastructure and industries to make them sustainable, and by combining these two SDGs, it becomes relevant to explore how collaboration plays a part in the establishment of an institutional infrastructure for cleantech innovation.

Due to the importance of cleantech as a tool in the sustainable transition and the call for internationalisation of cleantech solutions, this will be the overarching theme of the thesis. Given that SMEs are particularly challenged in this industry, but simultaneously hold the potential to contribute with valuable innovation, it is empirical to focus on how SMEs can realize this potential and internationalise their solutions. Specifically, due to the increasing focus on networks and collaboration as a means to overcome some of these challenges, the role of clusters as facilitators of networks will be assessed. This will be addressed through the following research questions:

- How do clusters influence internationalisation of cleantech SMEs?
    - How is the internationalisation of cleantech SMEs' influenced by the underlying dynamics of their context and access to resources?
    - In which way do clusters influence these dynamics as well as the SMEs' capabilities for internationalisation?

In order to understand how clusters influence the internationalisation of cleantech SMEs, this thesis will investigate the case of CLEAN and three member SMEs. A holistic perspective will be applied and thereby include relevant macro, meso and micro factors, to fully understand the interdependencies within the industry and subsequently how the cluster is able to influence internationalisation.

This thesis will be structured as follows: Firstly, an assessment of relevant literature within the fields of national innovation systems, clusters and internationalisation will be conducted followed by a representation of the theoretical framework identifying interdependencies between the theory and areas of analysis. Subsequently, the methodological decisions are explained followed by a description of the case that has been chosen as the empirical context. Next, in the analysis the theory is applied to the case of CLEAN to understand the effects of the cluster on the SMEs internationalisation process. Subsequently, the findings will be discussed and the managerial implications arising from the findings will be presented. The thesis will then summarise the limitations of the research and make contributions for further research. Lastly the thesis will conclude, by providing an answer to the research questions, based on the findings.

2. Theoretical Background

Extensive and well developed literature and research have laid the ground for understanding respectively innovation systems on the regional and national level, cluster dynamics and internationalisation. While the innovation systems- and cluster literature have been related to the green transition and sustainable innovation in much of the literature, there is little to no research seeking to explain how cluster dynamics influence the internationalisation process of SMEs in the cleantech industry. Hence, there is a gap in the literature where these otherwise relatively independent bodies of research intersect. In order to truly grasp the complexity of how cluster dynamics influence SME internationalisation within this specific industry, a holistic approach is imperative to understand the interdependencies and causal links between the different spheres of research. Therefore, this gap in the literature will be the focal point throughout the thesis. In order to fill this gap and employ a holistic approach, literature within each of the respective fields is combined, and emphasis is put on the overlaps and mutually influencing dynamics.

In order to illustrate the different levels that are part of this integrated approach, figure 1 illustrates three interlinked levels of analysis which will be addressed both individually and in combination throughout the thesis. The macro-level refers to broad the national and international systems which are influenced by political environment, mega-trends and norms. The inclusion of the macro level is important as the context of the following analysis is the Danish cleantech industry, which is currently experiencing significant growth driven by increasing commercial and societal interest due to it's instrumental role in a green transition (Burtis et al., 2006). The meso-level incorporates networks among a wide range of actors including industry actors, research institutions and public organisations. Lastly, the micro-level refers specifically to individual SMEs.

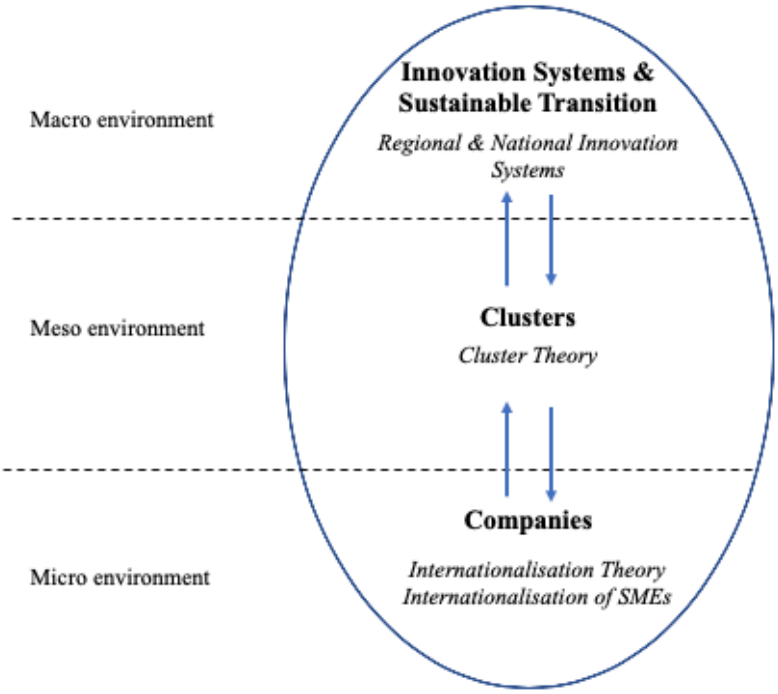

Figure 1: Level of Analysis (Own Design)

The main contribution of this thesis will be directed towards the field of SME internationalisation and the mutually influential dynamics between clusters and SME internationalisation. Hence, the analysis will mainly address the micro-, and meso levels. Despite the broad holistic approach, the study is narrowed through the specific focus on SMEs in the cleantech industry. The macro level is thereby included as an underlying influential context and not as an object of analysis in itself.

In order to be able to describe the macro environment in which CLEAN is positioned, the following section will identify the concept of national and regional innovation systems. Next, the meso level will be addressed through the application of cluster theory. Subsequently, a theoretical framework regarding

the potential for clusters to contribute to sustainable transition of larger systems will link the macro and meso levels together. The micro level will be described specifically in the context of internationalisation of SMEs, and will be related to theory from both the meso and macro levels.

2.1 National Innovation Systems

The concept of national innovation systems has received increasing attention over the past decade, as knowledge and network interactions have continued to show positive effects on innovation. According to Nelson (1993) national innovation systems can be defined as "... A set of institutions whose interactions determine the innovative performance of national firms" (Godin, 2009). A key characteristic of system approaches to innovation is the general acknowledgement that innovations are carried out through a network of different actors all connected in an institutional context. The interactions between these institutions thus create a framework from within which the government can form and implement policies to influence future innovation processes (Sharif, 2006). The synergies that arise between the different actors are highly complex and dynamic, and together they constitute the system of innovation (Asheim et al., 2003). The underlying assumption of national innovation systems is that the interactive and complementary learning processes that arise on a national level and the role of the nation-based institutions are highly important in explaining differences in innovation performance across countries. Innovation is in this context considered to be a socially and territorially shaped interactive learning process that can only be understood in its institutional and cultural contexts (ibid.).

National innovation systems include three main actors; industry firms, public organisations and academia. These systems can have either a broad or a narrow scope, which is determined by the type of institutional actors that are included in the innovation system. Broad scope national innovation systems compromise all interrelated institutional actors that can create, disperse and exploit innovation. Contrarily, the narrow scope innovation systems include organisations and institutions that are directly related to searching and exploring technological innovations. Thus, narrow scope national innovation systems primarily include R&D departments, universities and public institutions (Chung, 2002).

Inspired by the concept of national innovation systems, regional innovation systems follow a similar logic (Asheim & Coenen, 2005). However, the difference between national and regional innovation systems is that a national innovation system is the innovation system of an entire country, and can be comprised of multiple regional innovation systems existing within the country. In regional innovation systems, organisations are connected in an institutional environment and are systematically engaged in different interactive learning processes (Asheim et al., 2003). Asheim and Isaksen (2002) further conceptualise regional innovation systems to be comprised of regional clusters surrounded by

supporting knowledge organisations. This conceptualisation infers that the innovation system comprises different actors including the companies in the main industrial clusters in a region, and the actors backing the innovative performance such as research institutions, business associations etc. (Asheim et al., 2003). Similarly, regional innovation systems can be viewed to be the strategic institutional infrastructure that is set in place to support innovation within the production structure of a region (ibid.). Hence, regional innovation systems can take several forms, but as long as firms are actively and systematically engaged in interactive learning within the regional production structure, and the supportive infrastructure consists of both public and private research institutes, a regional innovation system exists. It is therefore the interactions between the different actors in a region that is often labelled as systems of innovation (Asheim & Coenen, 2005).

This section has sought to explain the concepts of national and regional innovation systems, and how they acknowledge that systemic innovation is the outcome of interactions between different actors within an institutional context. A fundamental part of national and regional innovation strategies is cluster development. Therefore, the next section will move from the macro- to the meso-level by addressing cluster theory.

2.2 Clusters

A cluster is a geographically proximate group of interconnected companies or industries that are closely related by technology, skill, knowledge and/or other linkages (Porter, 2003; Delgado et al., 2016). Clusters may develop organically or be strategically developed as part of an innovation system to stimulate economic activity in a specific region or country (Davies, 2013). In strategically developed clusters the founding parties have more influence over the direction, as well as the innovation and collaboration systems utilised. By grouping actors within one or several industries together in a cluster, a range of benefits such as resource pooling, better infrastructure and more specialised labour can be obtained to benefit all involved parties (Davies, 2013).

Cluster theory stipulates that the close geographical location, mutual learning and knowledge exchanges between the organisations can lead to innovation and increased productivity due to the sharing of common technologies, infrastructure, pools of knowledge and skills etc. (Davies, 2013; Delgado et al., 2016). The innovative environment within the cluster and vast pool of resources also helps facilitate new business formation and support the growth of successful startups. By providing entrepreneurs with access to suppliers and/or low cost access to specialised inputs, the cost of failure and thereby also the barriers for entry are lowered, making it easier for entrepreneurs to develop and commercialise their new technologies (Delgado et al., 2010).

The triple helix collaboration between industry, university and government has received increasing attention and refers to innovation and collaboration between the three entities. The general objective of the triple helix approach is to realise an innovative environment in which initiatives for knowledge based economic development can evolve (Etzkowitz & Leydesdorff, 2000). Strategically developed triple helix clusters is sometimes used by governments to support innovation and growth in specific regions, as they through the triple helix approach can provide assistance and resources to the firms within the cluster. By taking part in, or locating in close proximity to a triple helix cluster, the firm increases its exposure to potential knowledge spillovers from all three entities, which especially benefit technically advanced firms or firms of innovative nature, as they seek academic input (Alcacer & Chung, 2007). To secure the benefits of a triple helix approach, it is key to ensure that all entities (industry, university and governments) have an equal interest in the collaboration. If the interest levels of the three entities vary, then the foundation for innovative knowledge and the according benefits disappear (Davies, 2013).

However, member firms in a cluster may also experience lock-in effects. Lock-in effects can be considered internal barriers for the restructuring of an industry and can cause the innovation or development within a cluster to be directed toward a specific direction independently of the intentions of the individual firms (Belussi & Hervás-Oliver, 2017). Lock-in effects can exist on each of the different levels depicted in figure 1 and are often divided into three main categories, namely functional, political or cognitive (ibid.). The functional lock-ins concern the reduced need for firms to develop certain functional specialities, because they can easily and cost-effectively be outsourced to another firm possessing these attributes through a relationship within the cluster (ibid.). Despite the advantages with this cooperation, it can be problematic in the event of external changes arising, as this functional lock-in may prevent or decrease the firm's ability to react quickly and effectively to the change (ibid.). Political lock-ins, on the other hand, refer to the so-called 'thick institutional tissues' which are aimed at preserving the existing industrial structures, and consequently slowing down the restructuring of an industry (ibid.). These institutional barriers may originate from either formal structures, such as political administrations and large enterprises, or norms, rules and laws. The behavioural patterns influencing the political lock-ins, such as norms or rules, are closely related to the cognitive lock-ins which refer to the existence of a common world-view within a cluster (ibid.). Cognitive lock-ins may sometimes cause a misconception of reality or market potential, which can lead to flawed decision making and thus affect the future success of the clustered firms. On the regional level, functional, cognitive and political lock-ins are interrelated and influenced by factors both within and outside the region (ibid.). The combination of lock-in effects can have vast consequences for individual firms within the cluster, as it in some cases restricts the support available from the surrounding support system, and thereby shapes the future and the direction of the individual firms. For that reason, it is relevant to consider the inherent lock-in effects when analysing clusters, as they can have vast effects on the efficiency of the cluster.

This section employs a structural perspective on clusters, their definition and the associated benefits and risks. However, in order to fully understand the dynamics within a cluster, it has further been found relevant to look into the formation of clusters and thus how agglomeration of related economic activity emerges.

2.2.1 Cluster Development and Inherent Dynamics

When addressing cluster formation theory, there are different perspectives on how clusters are formed. Economic geography generally accepts three distinct drivers for agglomeration of related economic activity as presented by Marshall in 1920; knowledge spillovers, labor market pooling and input output linkages. These drivers contribute to cost and productivity advantages for the involved firms which drives companies to locate in close geographical proximity to related industries (Delgado et al., 2016). Knowledge spillovers in this context is not limited to that of competing firms, but can also stem from governments and academia (Alcácer & Chung, 2007). When knowledge is tacit and localised, its transfer requires frequent interaction which can only be facilitated by close geographical proximity. Hence, this view explains cluster formation through a micro perspective, since it is based on the interests and location strategies of individual firms.

Stuart and Sørensen (2003) emphasise how networks and their ability to provide access to knowledge are fundamental to the formation of clusters. In this perspective, cluster formation is discussed primarily from a micro- and meso level perspective, as its main focus is the inter-firm networks as a determining factor for how firms choose their geographical location. They further argue that even though relationships can exist virtually, the specialised resources that are important for firm establishment, such as technical experts and VC firms are often bound to a specific location. This perspective therefore somewhat aligns with Marshall's (1920) drivers for agglomeration and thus the reasoning behind geographic location based on the increased potential for knowledge spillovers from other firms or academia. Thus, industries cluster because of the difficulty associated with leveraging social ties and industry knowledge, when the firm locates far from the necessary social resources (Stuart & Sørensen, 2003). Contrary, Krugman's (1991) approach toward cluster formation can be considered to relate to the macro-level, as he argues that it is the quality and strength of a region's natural, industrial and institutional resources that drives cluster formation. Thus, in this view, companies decide on a geographical location based on the economical environment in a specific location.

Romanelli & Khessina (2005) digress from these explanations by introducing a more holistic view on 'regional industrial identity'. This refers to the attributes of a region which constitute it's capacity for developing clusters and attracting resources from other regions. This approach is more systematic and

allows for comparison, because it identifies distinctive features of regions and clusters (Romanelli & Khessina, 2005). In this view, a region's industrial identity to be comprised of the shared understandings of the region's characteristics. The shared understanding of the region consists of the perceptions that the residents and local business possess, but also that of foreign investors and other external observers. It is largely dependent on the perceptions of the businesses that already exist in the region, since they provide a physical evidence of which type of businesses that can thrive in the environment. In example, the perception of Las Vegas as a gambling city derives from the many gambling firms which are present in the city, and this influences the decision of both foreign investors and young firms within that industry, when contemplating where to locate or direct their investment (ibid.).

The perceptions of a region relies specifically on two core dimensions: focus and strength. Here, focus refers to the scope of activities that businesses in the region undertake. Thus, the focus can be narrow in the sense that only one sort of activity is undertaken, or it can be generalised in the sense that the firms that operate in the area are diverse in terms of the products and services they offer although they have the same overall focus (ibid.). Strength on the other hand refers to the size and number of observers that share the same perception of a region. The industrial identity can be strengthened through various mechanisms such as media, but most importantly, it happens through interactions among actors in networks. Initially, the identity develops internally in the region through interactions among internal actors. Subsequently, interactions among internal and external actors occur and cause external actors to validate and thereby strengthen the perception of the identity through investments or other engagements in the area (ibid.).

The strength of a region influences the size of the resource inflows that it attracts, so the stronger the identity, the larger the inflows of resources. The focus influences the diversity of inflows, since a narrow focus will attract homogenous resources while a generalised focus will attract more heterogeneous resource inflows. Regions with a strong and generalised identity generally show greater potential to maintain a positive growth and innovative development over time because spillovers can occur between the diverse focus areas and different branches of technology can contribute to each other's development or even converge. Contrarily, the innovative development in an area with a strong focused identity is more likely to decline over time because it does not receive inputs from diverse sources, which makes it more prone to disruption once the potential of it's technologies become obsolete. Hence, strength and focus are crucial characteristics of a region's identity. However, strength, focus and identity is hard to measure. Therefore, clusters are a relevant object of analysis because they are visible features and drivers of a region's identity (ibid.).

As described in the preceding literature, there is a broad consensus among scholars that clusters impact national and regional development as well as acceleration of innovation among firms (Davies, 2013; Delgado et al., 2016). However, despite aforementioned theory primarily seeking to explain agglomeration of firms in organically developed clusters, similar dynamics such as network effects and knowledge spillover can also be found in strategically developed clusters. Since the focus area of this thesis is clusters and SMEs in the cleantech industry, it is relevant to address whether and how cleantech clusters influence the development of the cleantech industry and the firms operating in it. This in turn includes a focus on cleantech clusters' potential to influence innovative development trajectories.

2.2.2 Clusters and Sustainable Transition

In order to assess clusters as part of the innovation system's strategy towards sustainable transition and investigate their influence on new technology development and commercialisation, it is important first to understand characteristics of the cleantech industry. Hence, the scope is narrowed to solely focusing on cleantech clusters. A key characteristic for this industry is that it envelopes a broad spectrum of technologies within different industries such as the energy, transportation and building industries. This causes the scope to be rather broad and diffuse as it is not clearly defined by a few leading technologies (McCauley & Stephens, 2012). In line with this, Day & Shoemaker (2011) argue that although substitution occurs, different technologies within the cleantech sector often coexist rather than replacing the old technologies all at once. For example, different types of energy, as well as the technologies to support these energy sources coexist (Day & Shoemaker, 2011). Innovation cycles are often long since technologies like solar panels, batteries etc. are capital intensive and take a long time to be developed. This means that ventures in this industry often need long lead time to succeed (McCauley & Stephens, 2012). In line with this, large up front investments in infrastructure need to be made to achieve a sufficient level of minimum efficiency such as a sufficient infrastructure of charging stations for electric vehicles (Day & Shoemaker, 2011). Moreover, consumer demand needs to be induced and stimulated and path dependency greatly determines development trajectories in the industry (McCauley & Stephens, 2012).

In order to analyse cleantech clusters' influence on the SMEs operating in this industry, it is relevant to address the clusters' potential to support the firms in their development and commercialisation processes as well as overcoming industry barriers. This in turn includes the clusters' influence on the technological trajectories in the industry and the influence on the foundational logic in the industry, namely the sustainable transition. Dominant theoretical literature in this field addresses sociotechnical transitions, which refers to shifts occurring in large and complex technical systems. Such sociotechnical systems can for instance be energy- or transportation systems comprised of multiple sub-components which are combined in a complex configuration of interacting technologies, infrastructures and social

structures. Innovation in an established configuration is mainly incremental because the subcomponents are aligned with the shared assumptions in the dominant system. Hence, in order for a sociotechnical transition to take place, radical innovation is needed and technological innovation and experimentation is thus crucial. It can however be difficult for radical innovation to compete with the established technology given that it does not fit into the existing configuration (Geels, 2002). Although such technological innovation is the main focus in this thesis, it should be noted that a sociotechnical transition does not only require technological innovations, but also a change in the regulatory framework, networks among actors, infrastructure, norms, worldviews and the way people perceive and interact with the technology (McCauley & Stephens, 2012; Geels, 2002). Hence, it is evident that both macro, meso and micro level affect and are affected by path dependency.

McCauley & Stephens (2012) have sought to make the complex and abstract notion of sociotechnical transitions more approachable by combining it with cluster theory and focusing on how clusters' influence the institutional conditions for regional transition towards a more sustainable system. Hence, by viewing sustainable transformation as regional transformation, it becomes more context specific and easier to address. This framework concludes that by attracting resources, creating a regional identity focused on cleantech, building networks and trust between actors within the cleantech sector, supporting firm expansion and accelerating sustainable innovation, cleantech clusters can influence the sociotechnical development of the region (ibid.). More specifically, clusters can create conditions to cultivate various technologies and social practices. This includes facilitating networks between firms and thereby enabling different component solutions to converge into large scale solutions. Hence, cluster strategies can have a mediating role between firm level activities and the institutions on the macro level (McCauley & Stephens, 2012).

This mediating role does not only come from the support for firm level activities, as CLEAN also influences actors on other levels. Namely, both McCauley (2012) and Davies (2013) argue that the triple helix aspect of cluster theory is particularly important for clusters within the cleantech industry. This is because non-firm actors, such as universities, often play a larger role in cleantech clusters than clusters in other sectors. Due to their non-profit characteristics, they are more likely than firms to address non-economic aspects. The establishment of networks and trust between macro and micro level actors further contributes to the mediating role of clusters (McCauley & Stephens, 2012). As a result of the contributions that clusters can provide to the cleantech industry, cleantech clusters are widely used as part of regional development strategies seeking to accelerate sustainable development (McCauley & Stephens, 2012).

However, as described in previous sections, clusters build on, and further accelerate, the industrial identity of a region and the development relies on the firms and other actors which already exist in the

region. This path dependency may cause the cluster strategy to favor technologies that support the established configuration, because such technologies and practices often show the largest immediate potential for growth in the existing system. When this is the case, the cluster will prohibit rather than accelerate sociotechnical transition, because radical technologies loose to their more incremental counterparts (McCauley & Stephens, 2012). This dynamic is consistent with political and cognitive lock-ins which may inhibit or slow down restructuring of an industry and create internal barriers for change. In line with this, Davies (2013) concludes that cleantech clusters need to be "... open and inclusive of actors proposing alternative pathways…" in order to contribute to transformation (Davies, 2013: p. 1285). A broad and inclusive cluster strategy also entails a focus on supporting not just technological innovation, but also learning and social change (McCauley & Stephens, 2012).

Hence, it has been established that clusters can influence development trajectories in their industry which explains their instrumental role in innovation system strategies. Given the call for an international approach to cleantech, it is relevant to further explore clusters in an international context.

2.3 Meta Clusters

In order to explore the internationalisation of cleantech through clusters, the notion of meta clusters is employed.

Similar benefits to those enabled through clusters also exist within cluster organisations, or so-called meta clusters. Meta clusters are transnational clustering of clusters, which are developed to strengthen the collaboration, networking and learning in innovation clusters (Davies, 2013; EU Cluster Collaboration, n.d). A meta cluster facilitates access to demand, skills and suppliers among its member clusters and thereby enhances the possibility for collaboration and positive spillover effects (ibid.). While the individual clusters support and enhance spillover effects between its members, the meta cluster provides similar effects on an international cluster level. The meta cluster strengthens the collaboration with its member clusters and facilitates knowledge sharing, joint collaboration projects, internationalisation etc. (Davies, 2013). Through the international network of clusters, the meta cluster can reduce some of the barriers to internationalisation by creating opportunities for global collaboration. This benefits both the cluster as well as the respective cluster's members, as the cluster, through this network is able to establish more direct relationships that they can offer their member firms (ibid.). Participation in a meta cluster can further help promote the individual cluster on a global scale and thereby support continuous growth, by accelerating the cluster's brand abroad.

While the preceding literature has addressed clusters, cluster formation, their role in the sustainable transition and the concept of meta clusters, the next section will examine internationalisation theory and the drivers and barriers that SMEs face in order to understand the dynamics of the micro level.

2.4 Internationalisation

In order to understand the micro level dynamics of SME internationalisation, the following sections will look to address internationalisation theory. First, the three schools of internationalisation theory will be addressed, and the concept of internationalisation defined. Thereafter, the dominant framework for internationalisation, The Eclectic Paradigm, will be presented.

Within internationalisation theory, the research generally distinguishes between three different schools. 1) Foreign Direct Investment theory, 2) Establishment chain theory and 3) Network theory. The school of Foreign Direct Investment theory builds on transaction costs as the foundation for decision making regarding internationalisation. In this view, firms choose the location and organisational structure which allows them to minimise transaction costs. Establishment Chain theory, also known as stage model theory, on the other hand proposes two distinct patterns related to internationalisation. Firstly, that the internationalisation process develops through a sequence of stages, that each indicate increased commitment to the market as a consequence of greater market knowledge and experience (Bell, 1995). Secondly, that a firm will initially target neighboring countries and only at a later stage approach foreign markets with larger geographical and psychic distance, namely countries with larger cultural, economic and political differences compared to their domestic location (ibid.). However, the relevance of psychic distance, have been argued to have decreased drastically in recent years as global communication and transportation infrastructures have improved, and markets are becoming increasingly homogeneous (Johanson & Vahlne, 2009). Uncertainty can thus only be reduced by engaging in foreign networks within the country of interest. This point of view is rather similar to that of the last school of thought, namely network theory, where international market entry is viewed as a system of relationships (Coviello & Munro, 1995). The relationships can include both formal and informal relationships with customers, suppliers, competitors and private- and public support agencies etc. (Coviello & McCauley, 1999). These networks and interfirm relationships provide firms with the opportunities and the motivation to internationalise and are therefore sometimes described as bridges to foreign markets (Coviello & Munro, 1997). From this perspective, the internationalisation process of firms, and the choice of location, is often highly dependent on the opportunities that arise within the social network of the firm. Therefore, strategic action and location choice is rarely limited to a single firm, which suggests that firm strategy emerges as a pattern of behaviour influenced by the firm's network relationships (Coviello & Munro, 1995; 1997). Thus, foreign market selection and choice of entry mode emanate from the opportunities created through the network and firm connections, rather than from

strategic decisions taken by the management (Coviello & Munro, 1995). This new perspective on internationalisation and firm behavior has caused well-established authors generally associated with the other perspectives on Internationalisation theory, like Dunning, Johanson and Vahlne to revisit and evaluate their established frameworks to incorporate the dynamic nature of firm relationships and their influence on the internationalisation process (Dunning, 2000; Johanson & Vahlne, 2009). This therefore led to Johanson and Mattson in 2015 to suggest that a firm's success when entering a new market is more dependent on its relationship within current markets, both domestic and international, than on the chosen market and its cultural characteristics. Thus, a firm can expand to an international market through its existing relationships which offer contacts and help to develop new partners and positions abroad (Johanson & Mattsson, 2015). However, despite offering new international opportunities, the relationships may also restrict the nature of a firm's growth initiatives (Coviello & Munro, 1995).

While each of these three schools are based on different definitions of internationalisation, an integrated approach calls for a wider and more holistic definition. Therefore, the definition by Beamish (1990) is adopted throughout this thesis. Internationalisation is thus defined as "…The process by which firms both increase their awareness of direct and indirect influence of international transactions on their future, and establish and conduct transactions with other countries." (Coviello & McCauley, 1999). By adopting Beamish's definition it is acknowledged that internationalisation has both economic and behavioral aspects. Moreover, it includes the fact that internationalisation is a dynamic and evolutionary process in which network relationships are established through international activities and influence the firm's subsequent growth and expansion to other countries (Coviello & McCauley, 1999). The most dominant framework within internationalisation, namely the Eclectic Paradigm, employs such holistic definition. This framework will be explored in the following section.

2.4.1 The Eclectic Paradigm

The Eclectic Paradigm (OLI) has for more than four decades been the dominant analytical framework for explaining foreign activities of multinational enterprises (MNEs). The paradigm provides a framework for categorising the MNE activities that are undertaken when a firm engages in cross-border value-adding activities (Dunning, 1993). The framework builds on both economic and organisational theory which provides it with a broad scope for analysis of a company's activities when looking to internationalise. It has further undergone comprehensive refinement since its introduction in the mid-70s to reflect the vast changes in the economic environment as well as progressions within scholarly thinking (Dunning, 2015). These refinements have transformed the former static framework to become more dynamic in its nature (Dunning, 2000).

The eclectic paradigm builds on three firm specific interdependent variables, which compromise three sub-paradigms to explain international activity, namely; Ownership-specific advantages (O advantages), Location-specific advantages (L advantages) and Internalisation advantages (I advantages) (Dunning, 1993). The O advantages refer to the resources and capabilities comprising the firm's competitive advantage, the L advantages to the assets bound to a country or region and the I advantages to the different approaches for the firm to exploit their O and L advantages combined (ibid.). However, as this thesis applies a holistic approach to understand cluster dynamics and their influence on the internationalisation process, the advantages arising from specific foreign locations have been considered out of scope. Therefore, the sub paradigm of the L advantages will not be examined. This limitation further creates implications for the application of the I advantages, as this sub paradigm traditionally combines the O and L advantages (ibid.). Therefore, the I advantages in this thesis will focus on the entry mode decision and how clusters influence the internationalisation process of SMEs.

In its traditional use, the eclectic paradigm avers that based on the OLI configuration, the framework will determine three things: 1. The extent to which a firm engages in foreign production, 2. the form of which the production will take (FDI vs. non-equity alliances), and 3. the location of the production (Dunning, 2015). The general proposition of the paradigm is that the more prominent the O-advantages, the more value-adding opportunities favour a foreign relative to a domestic location for generating, accessing or deploying the assets (ibid.). And the more it is in the economic or strategic interest of the firm to internalise the foreign transfer and organisation of the O-advantages, the more likely the firm will be to engage in FDI (ibid.).

The context in which the paradigm is applied is of great significance. Generally, two contextual variables are important to identify: 1. The motivation behind the internationalisation and 2. the geographical and firm-specific characteristics or other variables that may influence the value that each OLI variable is given (Dunning, 2015). When addressing the first contextual variable, scholars generally distinguish between four main motives for engaging in FDI: market seeking, resource seeking, efficiency seeking, and strategic asset seeking. As evident from the names, they each relate to the type of assets or competitive advantages that the investing firm is seeking to acquire or gain access to (ibid.). Other motives for internationalisation include escape and support investments. The former with the motive to escape restrictive macro-organisational policies or legislations set by home governments, and the latter to support the activities of the rest of the firm (Dunning, 1993). The motivations can change over time, and in some cases a firm may be pursuing several of these objectives at once (Dunning, 1993). As with the motivation behind the internationalisation, the factors influencing the value appointed to the individual OLI-variables are also time and context dependent (Dunning, 2015). In approaching FDI, scholars further distinguish between aggressive and defensive activities. In an

aggressive approach, the investing company seeks to take proactive action to advance its strategic objectives. Contrary, in a defensive approach, the investing company's behaviour is primarily reactive rather than proactive in that the firm reacts to the strategic moves of competitors or foreign governments to protect its market position (Dunning & Lundan, 2008).

The Eclectic Paradigm employs a wide range of explanatory variables and can thus be used to address the holistic and dynamic environment within which the companies operate (Dunning, 2001). As the framework therefore is able to encompass the complexity of internationalisation, it has been considered relevant to apply in this alternative context. The following sections will thus look to address the O and I advantages in more detail and consider possible linkages to cluster theory.

2.4.1.1 Ownership-Specific Advantages

The ownership specific advantages (O advantages) refer to the capabilities of an organisation to supply either a foreign or a domestic market from a foreign location. This is highly dependent on the assets that the organisation possesses or has the possibility to acquire, which give them an advantage over potential competitors in the foreign market (Dunning, 1993). Assets in this context, support the characterisation of resources as put forward by Wernerfelt (1984), and later Barney (1991). Thus, it refers to all resources, capabilities, organisational processes, information and knowledge that is controlled by a firm and which enable it to implement strategies to enhance effectiveness (Dunning, 1993). O-specific advantages can be divided into three subcategories. The first category, asset-specific advantages (Oa), refers to the asset structure of the firm. This asset structure depends on the tangible and intangible assets such as property rights, innovatory capacity, non codifiable knowledge, product innovations, market systems etc (ibid.). These assets are distinguished from the assets that minimise the firm's transaction costs (Ot). This type of advantages include the economies of scope and specialisation that arise from the size and experience of the firm as well as the diversity of products. Moreover, having exclusive or favorised access to important resources such as labour, information, financing or natural resources is an important component of Ot (Dunning & Lundan, 2008). Lastly, institutional assets (Oi) refers to the advantages that arise from the institutions that are determining for the activities and processes both internally in the firm and between the firm and other actors (ibid.). The definition of institutions employed here is derived from Douglas North, who describes institutions as "formal rules (e.g. constitutions, laws and regulations) and informal constraints (norms of behaviour, conventions and self imposed codes of conduct)" (Dunning, 2015). Hence, it is crucial to understand that both formal and informal institutions have great effect on the OLI components and their configuration. In order to fully assess a firm's O-advantages, all of these subcategories need to be included in the analysis.

The assets that lead to O-specific advantages can be developed internally through product diversification or innovation, or alternatively they can be acquired from other companies. Cooperation, competition and knowledge sharing are gaining an increasingly important role in resource creation and allocation. Therefore, the concept of the individual firm as an independent source of intellectual capital is no longer suitable and the firm should rather be viewed as an organiser of a collection of assets generated internally and accessed from other firms (Dunning, 2001). This aligns with the underlying logic of clusters, as by the physical proximate location to firms with interlinking capabilities, the firm exposes itself to the possibility of knowledge spillovers and interfirm collaborations. O-advantages therefore no longer only depend on the resources that are internally generated, but also upon the firm's competence to seek out, harness and influence the innovation, price and quality of assets of other institutions, with which they have a relationship (ibid.). All in all, organisations now more than ever depend on their ability to be ambidextrous, meaning that they need to have the capabilities to simultaneously employ their existing competencies whilst exploiting new opportunities (Raisch & Birkinshaw, 2008).

O-advantages are often determined by the size of the organisation, which leads to great differences in the pursuit of foreign investments between large enterprises and SMEs. Smaller businesses deal with size related issues and differ from large corporations in a range of ways such as managerial style, resources, ownership and scale/scope operations (Coviello & McCauley, 1999). SMEs are therefore often considered to suffer from the liabilities of smallness, as gaining access to financial or human capital resources is often more difficult for the smaller firms compared to the larger counterparts (Stoian et al., 2017). As a result of the resource constraints that SMEs are facing, recent literature have put an increasing focus on the importance of networks and interfirm relationships upon which the SMEs can draw on in order to mediate these challenges (Coviello & Munro, 1995). According to several scholars, by linking themselves to extensive, established networks, like that of a cluster, SMEs are able to accelerate their internationalisation process, as the strengths of the network outweigh the limitations faced by most SMEs (Coviello & Munro, 1995). Thus the liability of smallness can, in this view, be somewhat overcome (Stoian et al., 2017). It should however not be forgotten, that relationship building is a lengthy process, and in some cases it can take as long as five years to establish a strong bond. Thus, a working relationship requires a considerable investment and should be considered an important firm resource (Dyer & Singh, 1998).

In stage model theory, lack of relevant network relationships causes uncertainty and lack of market-specific knowledge. This is defined as the liability of outsidership and can be somewhat overcome by inclusion in relevant networks (Johanson & Vahlne, 2009). More specifically, some types of knowledge is confined to network insiders, so inclusion in the network can allow firms to discover and create opportunities, that are not available for firms outside the network (ibid.). Establishing international

relationships therefore offer great potential for learning, trust building and commitment to the new market which in turn reduces uncertainty by enabling the firm to accumulate new knowledge through exchanges within its network. Consequently, the firms within the network will have an advantage over other firms wishing to enter the market, and therefore inclusion in relevant global networks can be considered an important O-specific advantage.

2.4.1.2 Internalisation Advantages

The internalisation sub-paradigm assesses different approaches for firms to acquire, get access to and exploit their O advantages in coordination with the L-advantages available to them. More specifically, it allows for an assessment of the different modes through which a firm can obtain, develop and leverage their core competencies in a foreign country given the location specific advantages that exist in the foreign country as well as the home country of the firm (Dunning, 1993, 2015; Dunning & Lundan, 2008). However, due to the approach taken in this thesis which focuses mainly on the O advantages, the I advantage sub paradigm applied will instead focus on the entry mode decision, as well as how O advantages and cluster dynamics influence internationalisation decisions and strategies.

Entry modes can be categorised into non-equity and equity modes of entry, dependent on the required investment and level of control required. Non-equity modes of entry can be internationalisation through either export or contractual agreements, whereas equity modes of entry require resource commitments such as through e.g. a Joint Venture or a wholly-owned subsidiary (figure 2).

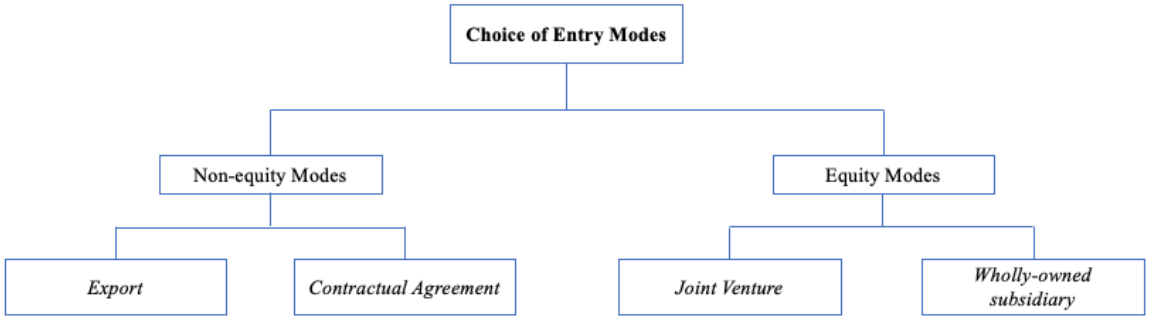

Figure 2: Choice of Entry Modes (Adopted from Pan & Tse, 2000 - simplified)

Through equity based modes of entry the firm gains more control over the foreign operations, but at a higher cost and often increased risk because of the heavy resource commitment necessary for the foreign establishment. Non-equity modes on the other hand are often used when the collaboration between two firms revolve around a time-limited project in another country, through e.g. export, and it therefore does not require the same level of committed resources, which decreases the risk but at the cost of less control (Kumar & Subramaniam, 1997). Deciding on an entry mode is a critical strategic decision, as the mode

of entry influences the future decisions and operations for the firm in the foreign market (ibid.). Ultimately, when firms make these decisions, they need to weigh different parameters against each other in order to meet various interlinked objectives. Often, some of the goals will be conflicting, and therefore the firm will have to weigh the short-term objectives of transaction cost minimization against long-term objectives of efficiency, asset creation and augmenting, access to new markets etc. (Dunning, 2000).

As clarified by the preceding literature, if a firm is part of a cluster network it may influence the firm's O advantages. Furthermore, being an SME may cause the firm to experience certain limitations in the entry mode decision. Due to the liability of smallness, SMEs are known to have limited capital resources, which in turn affects the opportunities they have in entering foreign markets. However, as previously established, by linking themselves to a cluster, the SME may be able to limit the liability of smallness by gaining access to a pool of resources otherwise unattainable (Coviello & Munro, 1995). The cluster may further help reduce some of the initial transaction costs in identifying foreign opportunities and business partners, as well as to help shorten the extensive work that comes with creating foreign market analysis, by sharing previous experiences and foreign connections (Davies, 2013; Delgado et al., 2016). It may therefore be a strategic choice for the SME to use the relationships and networks established within a cluster to gain access to opportunities abroad, and thereby limiting pre-internationalisation costs.

The decision to continue to build on foreign connections made through the cluster network, may therefore also reduce the time to market as trust can more easily be established between the parties with a common trustee. Building trust, especially across national borders can be a lengthy process, and therefore, by having a common relation through the cluster, or another cluster member firm may decrease this time, and potentially even influence the level of risk that the parties are willing to accept in the process. It may further allow a firm to use the connections through the cluster network to find and build a trusting relationship with a foreign partner, and thereby enter a foreign market through a strategic alliance before establishing a physical presence in the country. However, by choosing to internationalise through networks and cluster dynamics, the firm may accept a lower level of control, as the international opportunities available is the outcome of the cluster member firms and the inherent global network. Therefore, if deciding to internationalise through the cluster network, the individual SME may not be able to single handedly decide the location within which they wish to internationalise nor the entry mode. As stipulated by Coviello & Munro, 1995, the location and the entry mode decision therefore becomes somewhat interlinked, and the firm will consequently have to surrender some control of their foreign operations. It should be noted however, that if following the underlying assumptions of stage model theory, the firm will gain more confidence with internationalisation as their experience

increase (Johanson & Vahlne, 2009). Therefore, one could assume some SMEs are using the international network opportunities to gain experience and establish the direct and necessary links to foreign suppliers, to further in the future increase their foreign involvement.

In conclusion, in combining cluster theory with internationalisation theory and the limitations that SMEs sometimes face, it can be argued that the networks SMEs establish through clusters can influence the way they approach internationalisation. The cluster thus provide a strategic alternative for SMEs with an interest in internationalisation, as they allow for experimentation and opportunity identification. The cluster may in this perspective be viewed as a place for SMEs to test their success with internationalisation and experiment with foreign collaborations.

2.5 Connecting the Theoretical Pillars

To lay the ground for a holistic analytical approach, the respective theoretical pillars have been outlined in the previous sections. In order to bridge the gap between these pillars, the overlapping aspects and mutually influencing dynamics must be addressed. The integration of the pillars is visualised in figure 3.

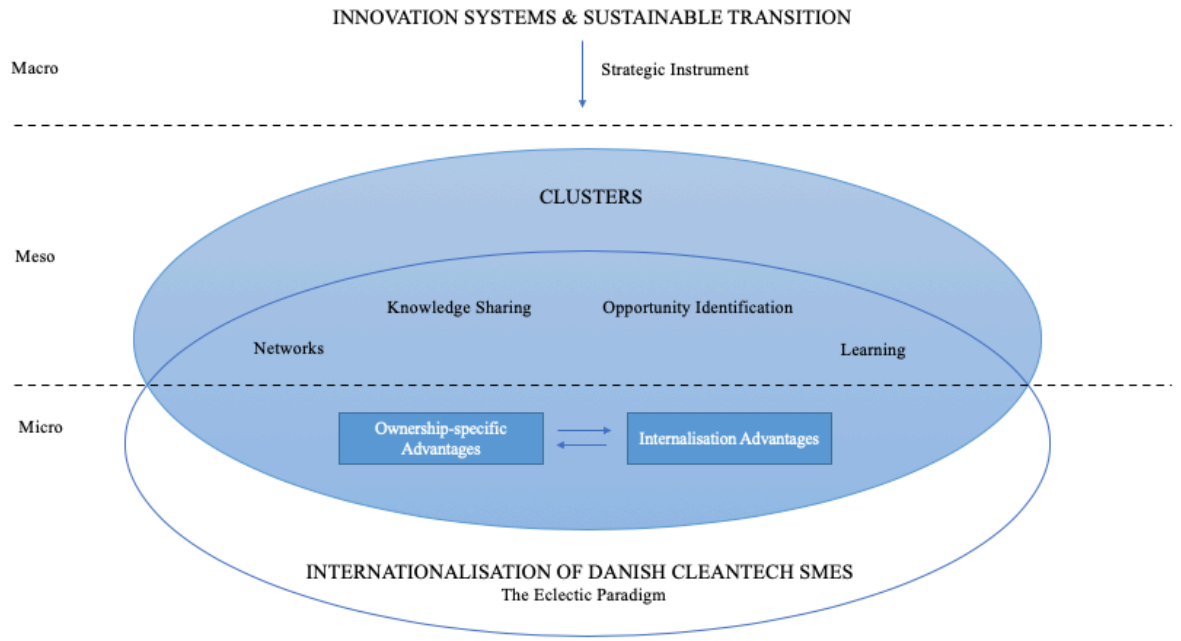

Figure 3: Connecting Literature on Innovation Systems, Clusters and Internationalisation (Own Design)

As depicted in figure 3, the theoretical framework takes its starting point in the innovation systems and institutional infrastructure surrounding the cleantech industry. A key instrument in such strategies is cluster development as illustrated through the downwards pointing arrow in the top. The sustainable

transition is the foundational logic for the context in which cleantech SMEs operate and these underlying macro dynamics have a significant influence on the meso and micro levels. The filled blue circle illustrates the cluster level and the other circle the Eclectic Paradigm. Networks, knowledge sharing, learning and opportunity identification are foundational aspects in both pillars of theory and thus have the potential to influence the SMEs internationalisation processes. Therefore they have been identified in the overlap between the two circles. The O and I components of internationalisation theory are also depicted in the overlap between the meso and the micro level to illustrate the influence of cluster dynamics on internationalisation.

Cluster dynamics intensify network effects which in turn changes the conditions for internationalisation of SMEs. According to the presented theory, clusters can allow SMEs to gain access to a large and often global network (Coviello & Munro, 1995). This has the potential to influence the O and I components in a range of ways. For instance, the cluster may allow the firm to identify new opportunities abroad, decrease the liability of outsidership, influence the location of the foreign activities and affect the entry mode chosen by the firm (Johanson & Vahlne, 2009; Coviello & Munro, 1995). Utilising internationalisation opportunities through networks may expand the firm's market knowledge whilst reducing the perceived risk of foreign activities. Moreover, the knowledge sharing dynamics within the cluster may add positively to the Oa-advantages, as it increases the intangible assets of the organisation (Raisch & Birkinshaw, 2008; Dunning, 2001; Davies, 2013). The cluster may further support the firm in reducing the costs related to internationalisation, as it provides a broad network for possible collaborations and synergy effects, positively affecting the O advantages (Delgado et al., 2010).

Another central overlap between the theoretical pillars is the focus on institutions. In the Eclectic Paradigm, institutional advantages, or Oi advantages are deemed crucial for firms' internationalisation processes (Dunning, 2000). Similarly, cluster literature establishes that clusters provide institutional support for firms through the network between triple helix stakeholders (Davies, 2013). Because both theoretical pillars have this inherent focus on institutions, combining their respective views on institutions appears natural. This combined approach to institutions enables more breadth and depth in the analysis. More specifically, including Romanelli & Khessina's (2005) notion of regional industrial identity in the analysis of Oi advantages allows for a more nuanced approach because it enables a deeper analysis of the advantages that the regional industrial identity provides. Moreover, according to Dunning (2015), organisations are increasingly dependent on informal institutions. This thesis seeks to examine how the industrial identity of Denmark as an underlying factor influences these informal institutions. Hence, it contributes to the eclectic paradigm by adding a deeper layer of analysis. Simultaneously, it allows the notion of regional industrial identity to be used in the context of internationalisation rather than merely in the context of regional cluster development and attraction of

resources. This adds a broader scope of application to the Romanelli & Khessina (2005) framework because it makes it possible to use it for analysis of outwards patterns of investment rather than only inwards patterns.

In order to summarise these overlaps and complementary aspects of cluster theory and the Eclectic Paradigm, table 1 provides an overview of the key assumptions derived from combining the respective theories. The table provides an operational framework and a range of underlying assumptions which will be used to structure the forthcoming analysis.

Table 1. Incorporating Cluster Dynamics into the Eclectic Paradigm	
	Ownership Specific Advantages
Original Sub paradigm characteristics	• Resources, capabilities, organisational structures and processes • Oa, Ot, Oi
Cluster Dynamics	
Institutions	• Informal and Formal Institutions • Institutional Thickness
Networks	• Inclusion in relevant global networks • Increased resource pool • Opportunity awareness
Knowledge	• Knowledge Spillovers • Increased market knowledge
Internationalisation Experience	• Know-how
Lock-in effects	• Lock-in effects

Table 1: Incorporating Cluster Dynamics into the Eclectic Paradigm (Own Design)

In order to apply these theoretically derived themes in a more practical setting, the following section will look to describe the methodological choices made to collect, structure and verify our data and findings.

3. Methodology

In order to investigate how cluster dynamics influence the internationalisation of SMEs, a range of methodological decisions have been made to operationalise the research area. The following section will thus look to explain the reasoning behind the methodological choices made.

The methodology section has been structured around Saunders' (2007) research onion in order to provide a detailed description of the research process. This section will therefore firstly describe the

research philosophy and approach, secondly explain the research design and lastly outline how the data has been collected and subsequently analysed (figure 4).

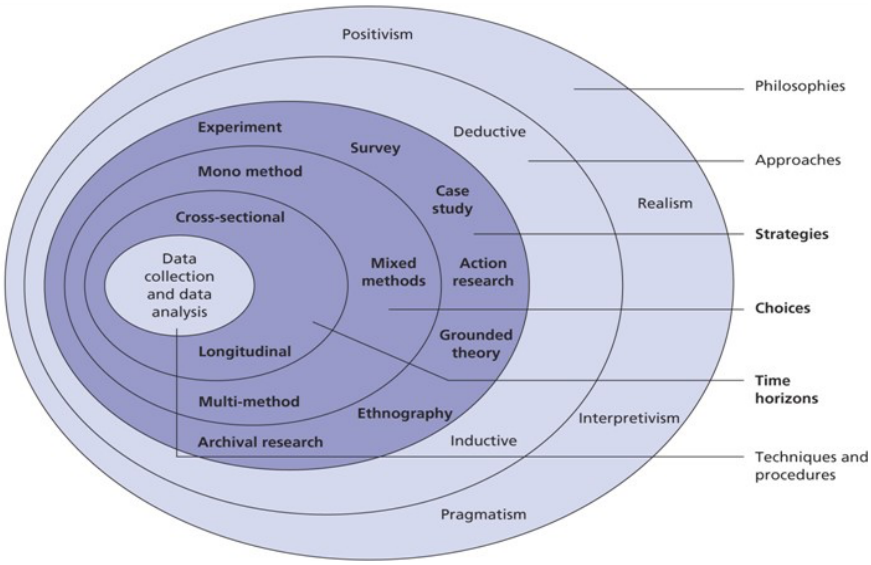

Figure 4: The Research Onion - Source: Saunders et al., 2007

3.1 Research Philosophy and Approach

This section will address the research philosophy and the research approach employed in the thesis as depicted in the two outer layers of the research onion. In order to understand the development of knowledge, it is imperative to address the epistemological stance of the researchers qua the approach and the theoretical frameworks employed. Thereafter, it will be addressed how the generation of knowledge is approached.

The knowledge development in the thesis exhibits elements of two different research philosophies, namely critical realism and hermeneutics. Aspects of critical realism are present in the research conducted through the case study, as it is accepted that the knowledge that is generated merely shows a limited part of the bigger picture. Additionally, the obtained understanding of reality partly results from social conditioning, meaning that the actors that have been involved in the knowledge generation process, such as the interviewees, are determining for the researchers' understanding of reality. The holistic multi level approach employed in this thesis is also consistent with a critical realist approach to knowledge generation in that the purpose of exploring different levels of analysis is that each of the levels influence the researchers' understanding of the studied topic. The importance attributed to this multi level approach exhibits characteristics of critical realism because it allows the researchers to assess a larger amount of structures and processes and identify the underlying dynamics between the two. Moreover, the theoretical pillars employed in this thesis all rely greatly on the dynamic nature of

cluster development and internationalisation processes. This coheres with the critical realist notion that the social world is undergoing continuous change (Saunders et. al., 2016).

The development and understanding of knowledge in this thesis also exhibits similarities with hermeneutic research given that the researchers acknowledge having a certain pre-understanding of the themes that are explored. This pre-understanding becomes an integrated element in the researchers' perception of the explored phenomenon because it is part of the interpretation process. In the encounter with the empirical data such as interviews, the researchers are presented with the interviewees' perception of a phenomenon. In example, the interviewees from the SMEs present their perception of how the cluster has influenced their internationalisation processes. Through this interaction between the researchers and the interviewees, the researchers' perception of the investigated phenomenon gradually changes. By including the pre-understanding in the interpretation of the interviewee's perception, the researcher achieves a new perception of the studied phenomenon. The analysis is thus an ongoing iterative process in which new data continuously leads to reinterpretation and development of new perceptions (Lippert-Rasmussen et al., 2015). These underlying research philosophies influence the research approach employed in the thesis.

The research approach employed in this thesis is abductive. The initiating steps of the research process consisted of assessing secondary data concerning clusters. Additionally, an initiating unstructured interview was conducted with CLEAN with the purpose of discussing and exploring different themes of importance to the cluster. On the basis of these primary and secondary data sources, the phenomenon of cleantech clusters was explored broadly and different dynamics between the cluster and its members were identified. Specifically, a pattern among the SME members was identified concerning their challenges in terms of internationalisation. Similarly, it was identified that supporting SMEs in their international activities is a key focus area of the cluster. Hence, the themes that have been explored in this thesis emerged inductively. In order to explore these themes further, theory within the topics of respectively internationalisation and clusters was studied. From these theories an iteration regarding the scope of the thesis was made because it was identified that a macro level aspect needed to be included in order to capture the dynamics from the innovation system influencing the cluster. This inclusion of the macro level is particularly important given that CLEAN is a strategically developed cluster which has emerged from a macro level strategy of supporting the cleantech industry.

On the basis of the various identified themes and patterns from the initial data and the theory, a conceptual framework was built as depicted in table 1. This table laid the foundation for the themes and dynamics to be investigated through subsequent data collection. Hence, interview guides were structured to explore these themes further, and the employed theory was used to develop broad interview

questions in order to allow for emerging themes. Throughout the process, new themes and patterns emerged. For example, it appeared from the first SME interview that an important characteristic and potential challenge in the industry is the access to funding as well as the competitive situation between small and large firms. Therefore, these emerging themes were included in the interview guides for the subsequent interviews. Iterations were thus made on an ongoing basis, and the research process combined an inductive approach with a deductive approach by moving back and forth between data and theory. This is consistent with an abductive approach according to Saunders et. al. (2016). Through this abductive approach, the thesis seeks to apply existing theory and modify the conceptual framework through ongoing iterations and combination of different theoretical pillars.

3.2 Research Design

This section will seek to address the research design, and thus the overall plan for answering the research question. The research design encompasses the three middle layers in the research onion concerning the research strategy, the research choices and the time horizon of the project (Saunders et al., 2007).

Before addressing the research design, it is however imperative to specify the purpose of the research. In this thesis, the research combines an exploratory and explanatory purpose. Initially, an exploratory purpose was employed as the researchers sought to gain a better understanding of the research topic. This was done through unstructured interviews and an extensive look into relevant literature within wide-ranging themes. The exploratory approach has allowed the researchers to adapt the research process to the emerging themes and new insights that arose from the data and thus supports the abductive approach (Saunders et. al., 2016). These initiating exploratory steps enabled the delimitation of the research area. As this continuously became more defined, the purpose of the research process became increasingly explanatory and focused on causal relationships and dynamics between clusters and cleantech SME internationalisation.

In order to gain a deep understanding of how clusters influence the internationalisation process of Danish cleantech SMEs, a case study strategy was chosen as it allows for in-depth analysis of the phenomenon based on multiple sources of evidence (Saunders et al., 2016). CLEAN was chosen as the case cluster for several reasons. Firstly, the cleantech industry in which CLEAN is positioned is an example of an industry where the presence of clusters can be particularly important given the need for public involvement to support firm and industry development. Therefore, CLEAN is a relevant object of analysis due to the triple helix nature of the cluster which can, according to theory, provide connections between public and private actors (CLEAN, 2019a). Moreover, cleantech is considered a competitive position of strength for Denmark. CLEAN proclaims that the role of the cluster is to accelerate this position of strength internationally by supporting Danish SMEs in internationalising their

cleantech solutions. Hence, the industrial context is important for the choice of CLEAN as a case cluster, which supports the notion from Saunders et. al. (2007) that the boundaries between the alaysed phenomenon and the context in which it is embedded cannot be clearly drawn. Furthermore, CLEAN is a member of the International Cleantech Network (ICN), which connects the cluster to thirteen other cleantech clusters around the world (CLEAN 2019a; International Cleantech Network, n.d. b). This shows that CLEAN is part of a bigger network, which according to cluster theory is a great advantage. Moreover, as we will see in section 5.1.1, Denmark is leading on several parameters within cleantech, largely due to the ability of the innovation system to support cleantech firms through public involvement and access to clusters. Thus, given that CLEAN is positioned in a leading country within the industry, and that reports identify the access to clusters as part of the reason for this national advantage, it can be argued CLEAN is likely to facilitate positive dynamics between itself and the members. Hence, the identification of CLEAN as a case cluster for the thesis involved the purposive sampling technique, critical case sampling (Flyvbjerg, 2011). A 'most likely' critical case sampling method was used to identify a single case that could be able to contribute to explaining the area of interest and in turn to help make logical generalisations regarding how clusters affect the internationalisation of SMEs. Thus, if positive dynamics are not found in this most likely case, it will probably not be found in other cleantech clusters in countries with less advanced institutional infrastructures and access to clusters, or in countries where the prioritisation of cleantech from the public sector is considerably lower (Flyvbjerg, 2011).

In order to use the case study for analysis of cluster influence on the underlying dynamics of SME internationalisation, three member SMEs were included as part of the case study. Therefore, the research strategy can be categorised as an embedded single case study, with CLEAN as the focus entity, and the three SMEs as sub-units in the analysis (Saunders et al., 2016). The embedded single case study thus allow for the case cluster to be analysed through the use of relevant sub-units of analysis, allowing for more depth in the analysis and the subsequent findings (ibid.). By analysing these SMEs, it has been possible to assess how O advantages and the subsequent potential for internationalisation on the micro level are influenced by cluster dynamics. The three firms therefore constitute examples of cleantech SMEs utilising CLEAN in their internationalisation process. It is important to note that CLEAN has functioned as a gatekeeper for the selection of two of the SMEs, namely VisBlue and ReMoni. By using CLEAN as a gatekeeper, it has been possible to utilise the cluster's knowledge about members to select firms which have relevant experience with CLEAN's initiatives. However, this approach also entails certain biases in that the cluster is likely to select firms which constitute positive examples of the cluster's support. In practice it has been observed that these two firms engage in initiatives and projects initiated by CLEAN which are not available to all types of firms. Hence, when analysing the benefits that accrue to the firms based on these projects and initiatives, it is essential to be aware that these dynamics may not be available to other types of firms. The acknowledgement of these biases, and the

attempt to minimize them, is consistent with the critical realist position in this thesis (Saunders et. al., 2016).

In order to mitigate this particular bias, the third firm, STAC, has been selected based on research on various different members. Moreover, specific selection criteria were established beforehand, and these criteria have been determining for both the selection process of the firms through CLEAN and the independent research process. More specifically, the selection criteria entailed that the firms should be relatively similar in terms of age, size, and previous internationalisation experience, and that they should have engaged in activities facilitated by CLEAN - either within developing and improving their resources or specific internationalisation processes. While these basic characteristics should be relatively similar, the thesis sought to select firms from different sub-industries within the cleantech industry with different approaches to internationalisation. This was done in order to investigate how they, based on their similarities and differences, have approached internationalisation and made use of CLEAN in the process.

Moving to the next layer in the research onion, the research design employs a multi-method qualitative research approach, combining unstructured and semi-structured interviews with observations. This is further supported by a vast selection of secondary data supporting the empirical foundation. This has been considered an appropriate selection as it allows the researchers to investigate the organisational environment as well as to gain an in-depth understanding of the phenomenon as perceived by the interview participants. The case study research has occurred over the course of seven months, from when the first informal communication with CLEAN was initiated to when the research was concluded. Moreover, the secondary data includes information about the Danish innovation system, SME collaboration in Denmark etc. which has been collected over a long period of time. Hence, although it is not the purpose of the research to study change and development, it is important to include the change and development that has occurred over time in order to grasp the dynamic characteristics of cluster development, and the development of SME internationalisation. This coheres strongly with the employed literature as Dunning (2015) emphasises the dynamic nature of internationalisation processes.

3.3 Data Collection

This section addresses the inner layer of the research onion, namely data collection and analysis. This layer is where decisions regarding the ‘tactics’ of the project takes place (Saunders et al., 2007). Therefore, the applied types of data sources and the analysis of the data will be addressed.

3.3.1 Interviews

In the initial stages of the process, a non-standardised in depth interview with Hanne Rahbæk Kragh and Lea Jehl (CLEAN) was used to gain a deeper understanding of the topics of interest in order to identify specific areas which called for deeper investigation. Hence, this initial interview was used in an explorative manner in order to determine the topic of research.

However, the primary data collection method employed in this report is semi-structured interviews. This type of interviews are non-standardised, as there is a range of themes and questions which the interviews have sought to cover, but the order of the questions varies from interview to interview (Saunders et al., 2007). The content of the questions have also in some instances varied between the different interviews because they have been adapted to the particular organisation that is being interviewed. Because the order and logic of the questions needed to be varied to accommodate the situation, and because many of the questions needed to be open ended to capture the complexity of the interrelatedness between cluster dynamics and internationalisation, semi-structured interviews have been considered the most appropriate type of interview for this thesis.

In order to investigate the dynamics between the meso and the micro level, eight interviews were conducted with actors on these levels. On the meso level, three interviews have been conducted with different employees in CLEAN in order to avoid the interviewee bias that can occur when merely interviewing one person. These interviews include the initial interview with Chief Consultant Hanne Rahbæk Kragh and Project Assistant Lea Jehl. These interviewees were chosen due to their broad interface with the different departments in CLEAN which was useful given the explorative character of the interview. Next, the interview with the Senior Project Manager in the Internationalisation department, Scott Allison, has been conducted to gain insights into his area of expertise, namely the internationalisation activities and projects for which he is responsible. By conducting several interviews with CLEAN concerning the operations and objectives behind the cluster's SME support provided a better overall understanding of the different views within the organisation. Moreover, one interview was conducted with the head of the secretariat, James Armour, from the International Cleantech Network (ICN). This interview was conducted in order to understand ICN's role as a meta cluster, the interplay between the ICN and CLEAN, and how the ICN influences the internationalisation of CLEAN's member firms. As James Armour also works as an internationalisation assistant in CLEAN, an additional unstructured interview was conducted with him on the topic of CLEAN to gain a better understanding of the organisation and its initiatives.

To examine micro level dynamics, interviews were conducted with three member SMEs; VisBlue, ReMoni and STAC. The purpose of these interviews was to understand their interactions with CLEAN

as well as to gain a more practical understanding of how CLEAN influences the internationalisation processes for the member firms. These interviews have been used to examine how the firms' internationalisation processes have been influenced by the context, individual firm resources and CLEAN. These interviews were conducted with the SME CEO's as well as one supporting interview with the head of Communication and Marketing in VisBlue.

Throughout the data collection process, a range of emails, phone calls and other ongoing communication was arranged, allowing the researchers to ensure a deep understanding of complex aspects by following up and asking questions continuously throughout the process. This in turn contributed to the establishment of trust between the researchers and interviewees. All interviews and ongoing communication has been presented in table 2 below.

DATA SOURCES

Interviewees

#	Interviewee(s)	Role	Company Name	Duration	Date	Structure
1	Hanne Rahbæk Kragh & Lea Jehl	Chief Consultant Project Assistant	CLEAN	2 hours	01.10.2020	Un structured
2	Scott Allison	Senior Project Manager	CLEAN	1 hour	05.02.2020	Semi-structured
3	Bo Eskerod Madsen	CEO & Solutions Architect	ReMoni	45 mins	19.03.2020	Semi-structured
4	Poul Bohn Christoffersen	CEO & Co founder	STAC	1 hour 32 mins	20.03.2020	Semi-structured
5	Søren Bødker	CEO	VisBlue	32 mins	20.03.2020	Semi-structured
6	Katharina Ejlskov Laursen	Marketing & Communications Manager	VisBlue	35 mins	23.03.2020	Semi-structured
7	James Armour	Head of the Secretariat	International Cleantech Network	50 mins	24.03.2020	Semi-structured
8	James Armour	Internationalisation Assistant	CLEAN	30 mins	24.03.2020	Un structured

Ongoing Communication

Name	Type of communication	Time period
Hanne Rahbæk Kragh	Email & Phone calls	01.10.2019 - Ongoing
Scott Allison	Email & Phone calls	05.02.2020 - Ongoing

Table 2: Data Sources

To ensure that the interviews focused on the relevant issues related to the research area, the interview guides were comprised of a combination of open, probing and specialised questions. Firstly, the interviews were divided into key themes that were found relevant based on the level of analysis in the theoretical framework. For CLEAN, the interviews took their point of departure in understanding the services provided and identifying areas corresponding to themes identified in the reviewed cluster theory. The interview guide therefore included questions like; "How do you help your members become part of a consortia?" and "How does the internationalisation department overlap and cohere with the two departments for energy and environment?". The full interview guide can be found in appendix 1.1.

In the interview with ICN, the key objective was to gain an understanding of the collaboration between ICN and the member clusters and the influence that ICN has on CLEAN as well as the SMEs. Questions for this interview therefore included; “Where do you see that your support to the SMEs differs from the support provided by the individual clusters?” and “How would you describe your collaboration with the clusters?” (Appendix 1.2).

When designing the interview guide for the SMEs, table 1 was used to establish a frame around the key areas that were particularly interesting to understand from a firm perspective. On that basis, the main themes for this interview guide were; *Networks, Knowledge, Institutions, Internationalisation Experience and Lock-in effects*. This was done in order to be able to compare the cluster and internationalisation dynamics identified throughout the literature to the chosen case, and to understand how these areas affect the internationalisation process of SMEs. Questions in these interviews included: “Have you participated in projects/activities with CLEAN, which you later used for other purposes?” and “Have you experienced that your opportunities for internationalisation have been affected by your size?” (Appendix 1.3). Including somewhat open questions in all interviews increased the flexibility and allowed the interviewee to elaborate processes or areas in more detail. It further enabled the researchers to ask follow up questions to ensure understanding of complex topics. This further allowed for a deeper understanding within certain processes and thereby helped the researchers increase reliability.

Two of the interviews took place in CLEAN’s Copenhagen office which allowed the researchers to observe the dynamics around the office and ask questions throughout the process to gain a better understanding of CLEAN as an organisation. This contributed positively to the data analysis process, as it enabled the researchers to interpret the interview data in the context of the organisation. The remaining five interviews were conducted online via Skype with video in the native language of the interviewee. Hence, the interviews made with Scott Allison and James Armour were conducted in English and the remaining interviews in Danish. This was done in order to ensure that all interviewees felt comfortable speaking their mind, and to avoid misunderstandings caused by language barriers. In the interview process, both researchers asked questions and ensured that all important themes were covered. Prior to the interviews, permission was given to the researchers to record the interviews. This was found relevant in order to allow the interviewers to concentrate on questioning and listening as the interview went along. It further made it possible for the interviewers in the interpretation phase to revisit parts of the interview, to avoid wrongful interpretation based on inadequate notes or memory.

3.3.2 Primary Data Analysis

In order to structure and interpret the primary interview data and identify similarities and differences, the interviews were transcribed and manually thematically coded in an excel sheet (figure 5). This coding method supports the abductive approach, as the predetermined themes were derived from the theoretical framework and continuously modified and supplemented by emerging themes.

	A	B	C
1	**Pre-set Codes**	**Emerging Codes**	
2			**Visblue (Katharina)**
15	- Resources		Interviewer *Og nu er i jo en mindre virksomhed. Hvordan tænker i at jeres størrelse påvirker jeres muligheder for internationalisering?* Interviewee *Jamen helt klart, fordi vi er en mindre virksomhed, så har vi ikke lige så mange resourcer som de større virksomheder har til at fokusere på flere markeder, fordi i ressourcer, der snakker jeg om mennesker her, vi sidder jo ikke nok mennesker her til at kunne have fem markeder som fokus markeder. Så på den måde er vi helt klart udfordret.*
16		- Funding	Interviewee (15.04) *Ja, altså en af vores investorer har været (Boream?) jeg kan ikke huske om de er helt eller halvt offentlige. De er ihvertfald en del af en offentlig investeringspulje. De er så gået i opløsning nu, så de stopper her indenfor de næste par år. Ellers så har vi primært private business angels der investerer i os* Interviewee *Udelukkende danske business angels. Og så får vi en del af vores penge gennem soft money, altså funding penge. Så både danske og internationale funding projekter. Vi har både fået noget igennem EØDP men vi har også fået noget gennem Horizon.*

Figure 5: Snippet of Micro Level Coding Excel Sheet

Three different coding frameworks have been made respectively for the SMEs, CLEAN and ICN as they address different level of analysis, namely the micro level in the SME interviews and the meso level in the CLEAN and ICN interviews. The separate coding frameworks were created by initially identifying a range of topics based on the theoretical framework and interview guides. One predetermined topic in the SME interviews was “Resources”. This code allowed us to identify the issues that the SMEs explicitly describe that they face in terms of resource constraints. In example, the following section from the interview with Katharina Ejlskov Laursen (VisBlue) has been placed under this code: “Because we are a small firm, we do not have as many resources as larger firms have to focus on several markets. Within resources, I am referring to people. We are not enough people to focus on five markets. So in that way we are definitely challenged” (VisBlue interview 2). In other instances, longer sections from the interviews have been summarised and placed under the appropriate code in order to explain the context of the quote and maintain an overview in the coding sheet. During the process of categorising interview sections, new codes emerged and were added to the framework. In example, ‘funding’ emerged continuously as a topic in the interviews with the SMEs and was therefore added as an emerging code. The analysis has thereby taken its point of departure in a framework of existing codes reflecting the theoretical framework, but allowed for iterations during the process. An example of this visualisation is shown below (Figure 6) All pre-set and emerging codes for the interviews have been visualised in appendix 3.

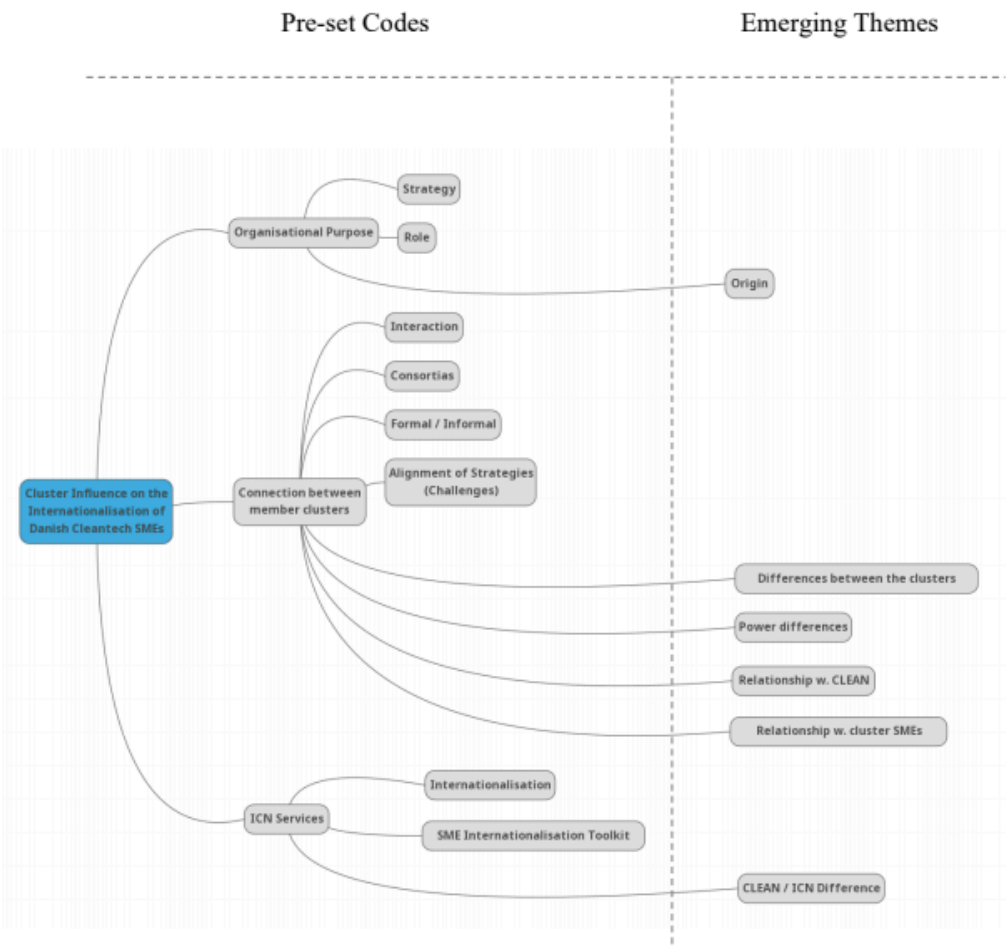

Figure 6: Code Visualisation - ICN Example

As the coding process is subjective and based on the individual researcher's interpretation of the data, misinterpretations and biases may arise (Saunders et al., 2016). This limitation has been considered carefully throughout the analysis. To minimise bias, triangulation has been applied through both researchers being involved in both coding process. After the interviews were all coded, the excel sheet as shown in figure 5 was used to identify similarities and differences and reflect over the interview responses.

3.3.3 Secondary Sources

Apart from the primary interview data, different types of secondary data were used to increase the researchers' knowledge on the topic and ensure triangulation in the collected data. These secondary data sources proved especially vital in investigating the macro level (figure 3) and thus the Danish innovation system and the characteristics of the cleantech industry. One of the key disadvantages of utilising secondary sources is the fact that they are collected for a different purpose (Saunders, et al., 2016). Therefore, all secondary sources were evaluated based on following criteria to ensure validity of

the data sources; 1) Does the source provide relevant data meet the objectives? 2) Is the data source sufficiently up to date? and 3) Does the data originates from a trustworthy source?

The secondary data sources include both documentary sources such as white papers and annual reports published by CLEAN and ICN as well as multiple source data sources such as the R&I Reports and the European Innovation Scoreboard published by the European Commission, thus covering both qualitative and quantitative data. The combination of documentary and multiple source secondary data enabled a deeper understanding of the dynamics on the macro and meso level. A brief extract of the types of secondary data can be seen in table 3 below.

Name	Source	Year	Type of Secondary Data
Samfundsinnovation: Hvidbog om klyngeorganisationers rolle i den grønne omstilling	CLEAN	2019	Documentary
Scale-Up NSR	CLEAN	n.d.	Documentary
FIE - Fremme af Innovation inden for Energiteknologi i Region Midtjylland	CLEAN	n.d.	Documentary
Nordic Solutions for C40	CLEAN	n.d.	Documentary
Annual Report 2019	CLEAN	2019	Documentary
The Global Cleantech Innovation Index 2017	Cleantech Group & WWF	2017	Multiple Source
Research & Innovation analysis in the European Semester 2019 Country Report	European Commission	2019	Multiple Source
Research & Innovation Background Report	European Commission	2019	Multiple Source
COSME. Europe's programme for small and medium-sized enterprises	European Commission	n.d	Multiple Source
2019 European and Regional Innovation Scoreboards	European Commission	2019	Multiple Source
Peer Review of the Danish R&I System	European Commission	2019	Multiple Source
European Innovation Scoreboard - Executive summary	European Commission	2019	Multiple Source
Cluster Internationalisation - Internal Market, Industry, Entrepreneurship and SMEs	European Commission	n.d.	Multiple Source
Cleantech i Danmark	IDA	2018	Multiple Source
International Cleantech Network - Global Network of Leading Cleantech Clusters Booklet	International Cleantech Network	2019	Documentary
Cleantech investment in Europe - Place your activities in Denmark	Invest in Denmark	n.d.	Multiple Source
A Powerful Magnet for Cleantech business	Invest in Denmark	n.d.	Multiple Source
GTS Institutes	Ministry of Higher Education and Science	2019	Multiple Source
Innovation Networks Denmark	Ministry of Higher Education and Science	2019	Multiple Source
List of Danish Innovation Networks	Ministry of Higher Education and Science	2019	Multiple Source
Cleantech Outlook 2020: Investment Inflows Look Bright	Neufield: Cleantech Investing News	2019	Multiple Source
Creating Cleantech Clusters: 2006 Update	Burtis et al.: the NRDC and Cleantech Venture Network LLC	2006	Multiple Source

Table 3: Brief extract of Secondary Sources

This secondary data has proven critical throughout the thesis in order to triangulate the data and thereby broaden the foundation for the analysis.

3.3.4 Quality Concerns

In order to be able to ensure the quality of the research, the alternative quality criteria by Lincoln and Guba (1985) have been adopted, due to the qualitative nature of the research design (Saunders et al., 2016). Therefore, quality will be addressed by evaluating the measures taken to ensure credibility, dependability and transferability.

Dependability is the qualitative parallel criterion for reliability and refers to whether the findings derived from the data by the researchers can be replicated (Saunders et al., 2016). In qualitative studies this can be difficult to ensure because of the subjective interpretation of the researcher. Thus, in order to ensure that external observers are able to understand and evaluate the findings and approach,

transparency is ensured in the methodology section. Transparency is further secured through the enclosing of appendix 3, providing accounts for all emerging codes that arose through the interview process.

Credibility refers to the truth of the findings and thus whether the representation of the research participant's perceptions of reality actually match what the participants intended. Credibility thereby represents the qualitative parallel for internal validity (Lincoln & Guba, 1986; Saunders et al., 2019). Credibility was established through prolonged engagement between CLEAN and the researchers. Several meetings in person and over the phone were spent with CLEAN in order to broaden the understanding of the organisation, their objectives and how they work with their member companies. This continuous communication allowed the researchers' to ask the participants for further elaboration of specific areas, to ensure a well-rounded understanding. In the interview process, the researchers put a big emphasis on establishing trust between all parties, to ensure that the interview participants felt confident in the interview process and to establish the credibility of the researchers. The participants were furthermore provided with relevant information in advance, explaining the objectives of the study and the areas that would be covered and were therefore able to consider the information being requested in advance.

To further ensure the credibility, triangulation was used to ensure complexity and depth in the research. Triangulation is evident both in the research design and the data various data sources. Data source triangulation is furthermore secured through the use of several interviewees in CLEAN as well as two interviews with VisBlue. By having both researchers interview and subsequently analyse the findings also allow for triangulation and further improve the quality of the research and thus credibility. This enabled the researchers to engage in continuous dialogue leading to complementary and different understandings of certain situations arising from either theory or through the data collection. This ensured that the individual researcher's background, assumptions and perspectives on the topic would not solely affect all methodological choices and interpretations of the findings, and have thus helped reduce bias.

Transferability, as the qualitative parallel to external validity, has been addressed through comprehensive descriptions of the research questions, design, findings and interpretations made. This creates transparency and thus provides the reader with the opportunity to evaluate the transferability of the study to other settings (Saunders, et al., 2016).

3.4 Methodological Ambition

The methodological choices made in this thesis emanate from the philosophical positions taken in the outer layer of the research onion, namely critical realism and hermeneutics, which have been supported by the use of an abductive research approach. This has influenced the subsequent choices in the next layers concerning the research design. Here, the purpose of the research, as inherent in the research question, is both exploratory and explanatory. The overall plan to answer this research question furthermore includes a case study conducted over a longer period of time with a multi-method qualitative approach combining un- and semi-structured interviews with observations. The primary datasets as retrieved from the interviews and observations have further been supported by various sources of secondary data.

These methodological decisions have been considered relevant to investigate how clusters influence the SME internationalisation process, as it allows for an in-depth understanding of the phenomenon, whilst embracing the holistic perspective by including data from all three levels of analysis. Rather than investigating single aspects within the case, these methodological choices enable a pilot study to be conducted. The aim of this pilot study is thus to map and investigate how the SMEs' internationalisation is influenced by the cluster.

4. Case Description

This report focuses particularly on the case of the Danish cleantech cluster CLEAN and how the cluster contributes to the internationalisation of its member SMEs. Therefore, the following section will introduce CLEAN, it's involvement in the International Cleantech Network (ICN) and lastly the three case member firms; VisBlue, STAC Technology and ReMoni.

4.1 CLEAN

CLEAN was established in 2014 after the government initiated a consolidation of the clusters Lean Energy Cluster and Copenhagen Cleantech cluster (CLEAN, 2019a; Kipp, 2014). CLEAN is based on two sub-categories of cleantech, namely energy- and environmental technology and operates with the mission to "accelerate the green and sustainable transition while realising growth for the Danish cleantech sector" (CLEAN, n.d. a). CLEAN seeks to do this by facilitating and accelerating a cleantech ecosystem by connecting industry, universities and public institutions in a triple helix approach to identify trends and opportunities within cleantech in Denmark and abroad. Through these partnerships, CLEAN thus aims to create growth and employment in Denmark by enabling the experimentation and scaling of new and innovative solutions (ibid.). CLEAN's work within the industry is two-fold in that

the cluster focuses mainly on broadening and strengthening industry networks as well as on project-based development with member firms.

CLEAN currently has 166 members of which 58% are SMEs (Cluster Collaboration Platform, n.d). It furthermore comprises a total network of over 800 private companies, public organisations and research institutions (CLEAN, 2019a). CLEAN especially focuses on the private companies by assisting them in their continuous development (CLEAN, 2019a). The cluster has six offices in Denmark and one in Flensburg to ensure that CLEAN representatives are geographically close to the member firms (ibid.).

In 2019 CLEAN arranged over a 100 network activities across Denmark with more than 4000 participants (CLEAN, 2019a). Besides networking events, CLEAN ran more than 75 company initiatives, 50 project development initiatives, 45 innovation projects and 56 export projects. In total these initiatives engaged more than 814 organisations of which 536 were privately owned companies, and out of the 536 almost 86% were SMEs (ibid.).

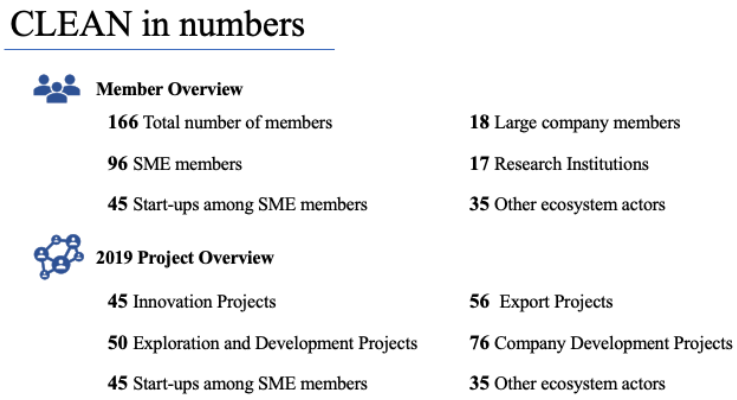

Figure 7: CLEAN Infobox, 2019, Source: EU Cluster Collaboration Platform, n.d. b; CLEAN, 2019a

A central focus in CLEAN is internationalisation, mainly in the shape of export of Danish cleantech solutions to global markets. CLEAN operates with the goal of increasing Danish firms' international market share through cooperation and "solution based sales" which means that, rather than firms exporting single components, firms unite in consortias and deliver combined solutions (CLEAN, 2019a). This is driven by initiatives such as C40 CLEAN City Solutions Platform and Delegation trips (ibid.). The C40 CLEAN City Solutions Platform is a collaboration between CLEAN and C40 which addresses specific challenges in large cities worldwide and facilitates firm participation in developing innovative solutions for the cities (CLEAN, n.d. b). The delegation trips on the other hand aim to connect Danish SMEs with private firms, universities and public institutions abroad. Moreover, CLEAN covers some of the travelling costs and provides assistance on technical and legal matters (CLEAN interview). These initiatives provide firms with the opportunity to enlarge their international

network and participate in project based problem solving abroad. Besides these internationalisation initiatives, CLEAN is a member of the ICN which is the world's leading cleantech network. As a member of ICN, CLEAN can provide international opportunities for their members through this wider and more global network (International Cleantech Network, n.d.).

4.2 The International Cleantech Network (ICN)

The ICN is a network of 13 leading cleantech clusters from around the globe with the main goal to generate new business opportunities, better competitive advantages and create value for companies, public institutions and knowledge institutions worldwide (International Cleantech Network, n.d. a). The ICN members are primarily located in Europe, but are also represented in Canada and Argentina (International Cleantech Network, n.d. c). Together, all the ICN member clusters represent all areas of cleantech namely; Environmental Technologies, Sustainable Energy & Energy Efficiency, and Smart Cities, and combined they connect over 4.000 organisations consisting of businesses, public authorities and research institutions. Through ICN, the member clusters can find support in the areas of project development, knowledge sharing and internationalisation (International Cleantech Network, 2019; International Cleantech Network, n.d. b).

The ICN further indirectly supports the clusters' members through initiatives such as the online ICN platform, the ICN passport and the internationalisation toolkit. The online ICN solution platform, identifies global project opportunities and offer said projects to interested parties (International Cleantech Network, n.d. d). The ICN also offers the possibility of an ICN passport, which allows interested members to request assistance when looking for opportunities or project partners in a specific region where the ICN network is represented (International Cleantech Network, n.d. c). Lastly, the internationalisation toolkit for SMEs, present a wide range of templates on corporation, exploration and project development agreements are available for interested companies to access and use (International Cleantech Network, n.d. e).

The combination of services provided to the member clusters show the vast impact that the ICN have on the cluster and its ability to support its members. The dynamics between the ICN and CLEAN will be further addressed in the analysis.

4.3 CLEAN Member Firms

To investigate the effect that CLEAN has on the internationalisation process of SMEs, the analysis is centered around the three Cleantech SMEs: VisBlue, STAC Technology (STAC) and ReMoni. These three firms are operating in different industries within the cleantech sector, but due to their similarities

in organisational characteristics such as size and age, they constitute examples of SME internationalisation. All three companies will be introduced briefly below.

4.3.1 VisBlue

VisBlue was established in 2014 and is headquartered in Aarhus with an additional office in Porto supporting R&D and business development (Visblue, n/d a). The firm provides an environmentally friendly battery solution that enables companies to better utilise the energy produced by renewable energy sources (Visblue, n/d a). The battery solution is based on a technology called Redox flow, which was invented by NASA in the 1980s, but has now been redefined and modified so that it can be used in other markets (Visblue interview). The products offered are of a modular structure which provides flexibility for the customer to decide the size of the battery and install it directly. Visblue aims to become an international brand on the sustainable energy market and a natural part in major housing development projects where energy comes from solar panels (ibid.). In example, VisBlue's technology is currently used in the case of Housing+, a housing organisation in Søborg which is the first net-zero energy building in Denmark and is equipped with solar panels and a Visblue battery (Visblue, n/d b).

4.3.2 STAC

STAC was established in the spring of 2016 and is positioned in Copenhagen. The technology has been underway for more than 40 years and enables industrial companies to use water as the refrigerant to make cooling. More specifically, STAC provides a unique water compressors which can be used by industrial companies as components in their own technologies, or in products that are developed together with STAC. Hence, STAC seeks to engage in partnerships with industrial leaders to commercialise the technology "at maximum speed for max sustainable impact" (STAC Technology, n.d). The firm furthermore partakes in various alliances and networks worldwide as the founding team has a very large network and strong ties to research institutions including Harvard University, Oxford University and the University of Beijing (ibid.).

4.3.3 ReMoni

ReMoni was established in 2013 and is located in Skanderborg. The firm currently has 10 production sites run by partners. The firm's solution enables companies to monitor their resource consumption and production, which can lead to major financial savings (Proff.dk, n/d; Remoni, n/d). Through the use of clamp-on AI resource monitoring, they are able to monitor and debug power consumption, water pipes and heating/cooling pipes (Remoni, n/d). ReMoni delivers a full-scale solution, as the data that is gathered through the AI clamp-on sensors is transferred directly to the cloud and presented graphicly to the customer (ibid.). The Clamp-on IT sensors are easy to install and relatively inexpensive, as the

solution can be connected to the exterior of the pipes which opposed to their competitors allow them to reduce the associated expenses with up to 90% whilst simultaneously reducing installation risk (ReMoni interview).

4.3.4 Firm Characteristics

Given the selection criteria described in the methodology section, the three firms share certain characteristics. Namely, they are all relatively young and small in size, and they all have some degree of international experience. Similarly, they are all members of CLEAN and have participated in some sort of activity facilitated by the cluster, which will be a focal point throughout this thesis. The firms however operate in different sub-industries of the cleantech sector and have differing approaches to internationalisation. Based on these similarities and differences, the following analysis will assess how these internationalisation approaches are influenced by the context in which they are positioned as well as the influence from the case cluster; CLEAN.

5. Analysis

As outlined in theoretical background, in order to fully understand the influence that clusters have on the internationalisation of cleantech SMEs, it is important to include dynamics on the macro, meso and micro level (figure 3). The first sections will therefore address the macro level and investigate how the three cleantech SMEs are influenced by the Danish innovation system and the cleantech industry. Thereafter the meso level will be covered through an analysis of CLEAN as a strategically developed triple helix cluster and a focus on the macro level influence on the cluster development. Lastly, the micro level will be addressed through analysis of the three SMEs O advantages, how they have used CLEAN to further strengthen said assets and whether CLEANs influence has affected the firms' internationalisation strategies.

5.1 Danish Innovation and Cleantech Characteristics

In order to establish the context within which CLEAN and the SMEs operate, this section of the analysis will investigate macro level dynamics and thus address the top section of the theoretical framework as visualised below (figure 3a).

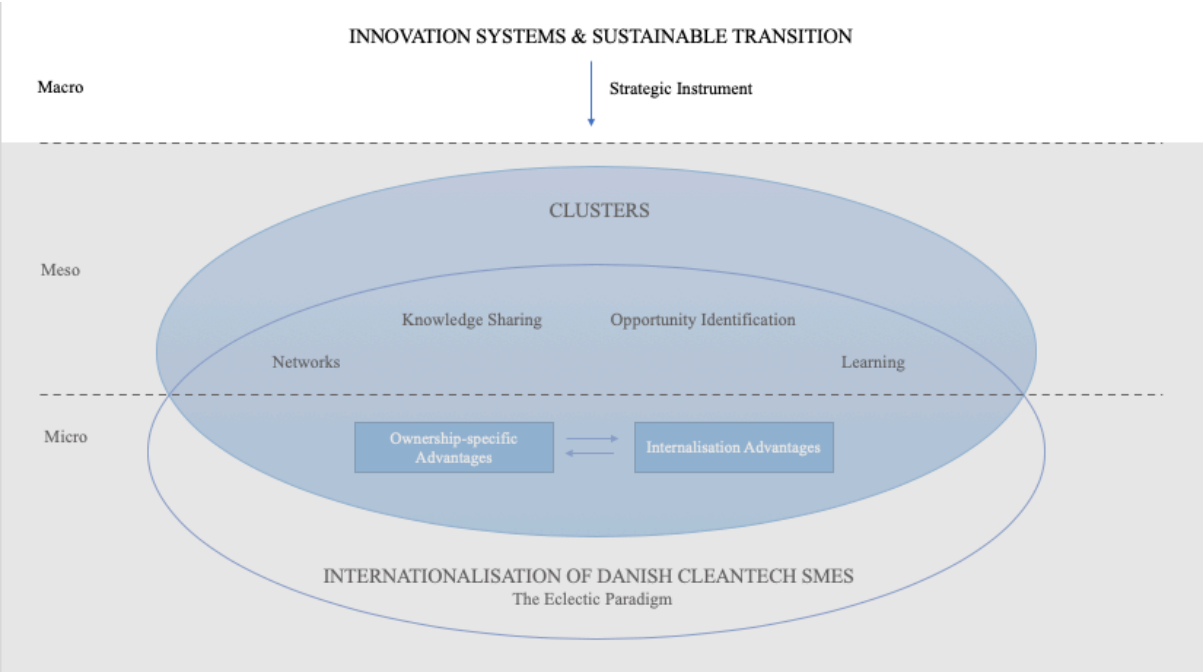

Figure 3a: Theoretical Framework - Macro level focus

This will be done by firstly addressing Denmark's Innovation System in order to understand the nation-based institutions, as these are considered crucial for the country's innovative performance (Asheim et. al., 2003). Thereafter, the cleantech sector will be analysed to investigate the underlying characteristics of the industry to describe the context in which CLEAN and the chosen SMEs operate.

5.1.1 The Danish Innovation System

In order to assess the context in which CLEAN and the three SMEs operate, the national innovation system of Denmark will be described with particular emphasis on its focus on cleantech. This system consists of a range of regional innovation systems which support the innovative environment in different geographical regions. However, as CLEAN is a national cluster that transcends several Danish regions, the regional innovation systems have not been considered individually but collectively through the national innovation system.

Denmark is considered an innovative leader closely following Sweden and Finland according to the European Union (See figure 8) (European Commission, 2019a). Denmark's innovative performance has remained stable since 2011, which indicates long-term prioritisation of innovation and R&D from the Danish government (European Commission, 2019b). This is supported by large investments in R&D in both the public and private sector from 2011 to 2018, far surpassing the average within the EU (ibid.). Denmark has further achieved an R&D intensity corresponding to 3% of the GDP, which makes it one of the few European countries that has reached the EU's 2020 target for R&D (ibid.).

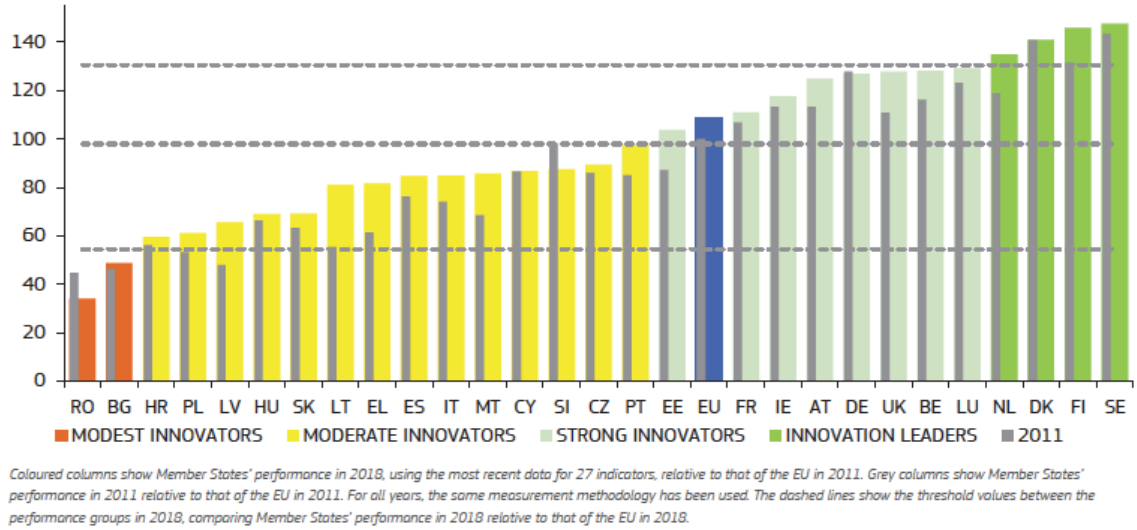

Figure 8: Performance of EU Member States' Innovation Systems (European Commission, 2019a)

However, innovation in Denmark is primarily concentrated around a relatively small number of large firms with only a small degree of diffusion to smaller firms (European Commission, 2019c). This indicates a need to increase the opportunities for knowledge spillovers from the large enterprises to the SMEs. Denmark has seen a vast decrease in innovative SMEs collaborating with each other. More specifically, the indicator has dropped from a score of 215.5 in 2011 to 117.2 in 2018. This suggests a need to build additional capabilities in SMEs to enable them to leverage external knowledge and new technologies (European Commission, 2019b; European Commission, 2019c). However, another report by the European Commission was made due to an inquiry from the Danish government to find ways to improve the current innovation strategy in terms of responding to structural change, commercialising innovation etc. (European Commission, 2019d). This shows willingness from the Danish government to identify and improve shortcomings in the current strategy, despite the already comparably strong European position.

In Denmark, renewable energy technologies contribute to approximately 3% of the country's GDP and cleantech companies generate more than 40% of Denmark's electricity consumption (Worklivestay, 2018). In 2017, Denmark was the top scorer in the Global Cleantech Innovation Index (GCII) which comprises four key drivers for Cleantech Innovation, namely; 'General innovation drivers', 'commercialised cleantech innovation', 'Emerging cleantech innovation' and 'Cleantech specific innovation drivers' (Cleantech Group & WWF, 2017). As can be seen in figure 9, Denmark scores above average on all metrics but shows exceptional strength within commercialisation of cleantech innovations and cleantech specific drivers (ibid.).

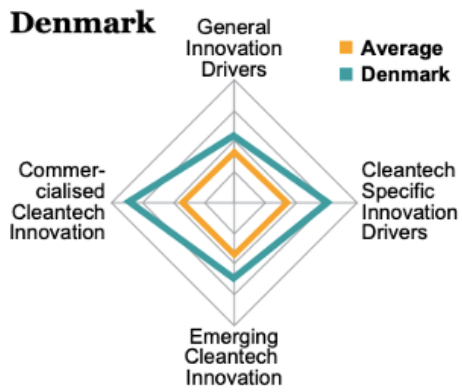

Figure 9: Source: Cleantech Group & WWF, 2017).

This assessment of Denmark's ability to commercialise cleantech includes the ability to import and export green technologies. In recent years, cleantech has been the fastest growing sector of Danish exports (Worklivestay, 2018) and this development is expected to continue due to vast support from both the public and private sector (IDA, 2018). The Danish government has through incentives and funding opportunities influenced the development of the industry by facilitating a cleantech innovation ecosystem. This relates to the GCII 'cleantech specific innovation driver', where Denmark was ranked the leading country as shown figure 10. This indicator measures the ability to drive demand and address industry barriers through cleantech supportive policy, public R&D expenditure, market attractiveness and furthermore the companies' access to cleantech clusters and private-public organisations (Cleantech Group & WWF, 2017).

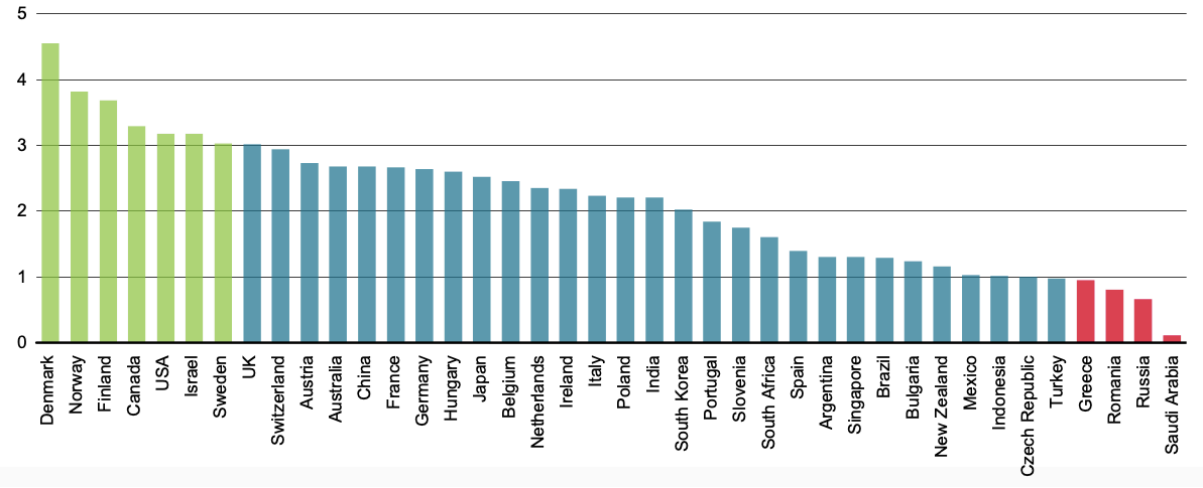

Figure 10: Cleantech Specific Innovation Drivers (GCII 2017 Report).

To support innovative growth, GTS institutes and innovation networks are organised to ensure continuous development and strengthen collaboration and knowledge transfer between public organisations, knowledge institutions, and private firms (Ministry of Higher Education and Science, 2019a). Each year the Ministry of Higher Education and Science grants a multimillion amount to a range of innovation networks. For 2019-2020, a total of DKK 190 million was allocated to 17 innovation networks (Ministry of Higher Education and Science, 2019b; 2009c). In total, approximately 35% (6 out of the 17 networks) of these networks classify as cleantech networks, and out of the six cleantech networks, two of them are controlled by CLEAN. Hence, CLEAN received, DKK 12 million for the network within environmental technology and DKK 8 million for the network within smart

energy (ibid.). This indicates a general wish from the government to support growth and collaboration within the cleantech sector. It further identifies CLEAN as an important actor in the Danish cleantech arena. Thus, the danish innovation system includes both public organisations, industry firms and academia, and focuses on creation, dispersion and exploitation of cleantech solutions, which means that it can, according to Chung (2002), be considered a broad scope innovation system.

In conclusion, the Danish innovation system exhibits an overall strong performance which can somewhat be accredited to the institutional infrastructure and scope of the innovation system. Moreover, the cleantech industry constitutes a position of strength for Denmark, and the country is particularly strong within export of cleantech solutions and the development of an institutional infrastructure supporting the industry. This includes a high prioritisation of cleantech networks and financial support. However, innovation is generally concentrated among large firms and there is identified a lack of knowledge spillovers from large to small firms and a decline in cooperation among SMEs. This highlights the importance of investigating this particular issue. In order to further understand how the dynamics of this particular industry influence the actors who operate within it, the inherent characteristics of cleantech are addressed in the following section.

5.1.2 Characteristics of the Cleantech Industry

A fundamental characteristic of the cleantech industry is that it envelops a broad range of technologies in that the definition of cleantech encompasses various different sectors (McCauley & Stephens, 2012). This heterogeneity is also represented in the chosen SMEs for this thesis, which operate within respectively energy storage, resource monitoring and water cooling. The broadness of the industry is further illustrated in a report from E2, the NRDC and Cleantech Venture Network LLC where ten categories within cleatech are identified to include air quality, energy-tech, materials recovery & recycling, transportation & logistics and so on (Burtis et. al., 2006). Moreover, based on the occupation within each of the sub industries, the focus of the Danish Cleantech is manifested within energy and water technologies which respectively comprise 49,5% and 20,1% of the sector (IDA, 2018). This supports the theoretical notion that the industry is more diffuse than other industries, and that it is difficult to identify a few defining technologies because many technologies can coexist (Day & Shoemaker, 2011). Such coexistence can be exemplified in the market for energy storage, where VisBlue's CEO states that they are not in direct competition with the giants in their industry given that VisBlue is not seeking to disrupt the market in which the giants operate, but to service a niche market (VisBlue interview 1). He further emphasises the breadth of the market by stating that "when people ask me how big this market is, I answer that that is up to them to decide, because it is that big. There are so many players on the market, and there is room for a lot of players" (ibid.)[1].

[1] See translations of all quotes in appendix 4

Other crucial characteristics include long innovation cycles, long required lead times and large investments required to develop and finance many of the technologies in the industry (McCauley & Stephens, 2012). These two fundamental characteristics influence all of the three case firms. The long innovation cycle is particularly evident for STAC, where the foundational water cooling technology has taken over 40 years to develop, and then several years after that to commercialise (STAC Interview). According to the report from E2, the NRDC and Cleantech Venture Network LLC, it can be a barrier for early stage cleantech firms that the development of their technology is characterised by "long technology gestation periods, unproven markets, high capital requirements, and long purchasing cycles" (Burtis et al., 2006). These characteristics are also highlighted by Ulla Brockenhuus-Schack (Managing Partner in Seed Capital) and Ulrik Jørring (Managing Partner in Nordic Alpha Partners) as significant barriers for SMEs in the industry, as it sets larger requirements for them to prove the potential value of the technology to their stakeholders. Ulla Brockenhuus-Schack elaborates that "Many venture funds have experienced losses from their investments in cleantech. It requires very long and capital heavy investments, and the prospects are extremely risky because the market is so regulated. Suddenly, an authority or a new regulation can remove the entire market for a new cleantech firm" (Leonhard, 2018). Hence, another source of risk in the cleantech industry is the heavy regulation which can affect the development trajectories of the markets for the different technologies. This heavy influence from political institutions makes the industry particularly prone to political lock-ins, since rules and regulations have the potential to reinforce existing industrial structures and thereby hinder or slow restructuring of industrial structures (Belussi & Hervás-Oliver, 2017). However, the political influence can also have a positive influence on cleantech markets. For instance, VisBlue's CEO states that "Obviously, if the government says it wants to provide state aid for batteries, that would help us a lot. That was what happened with solar cells a few years ago. There was a lot of public subsidies for solar cells and that boosted the market rapidly" (Visblue interview 1). Political support can thus both hinder and accelerate markets within the cleantech industry. The laws and regulations which are particularly relevant for the SMEs in this thesis will be addressed as formal institutions in under Institutional advantages (section 5.3.2.1.3).

Thus, a precondition for development within cleantech is public support. According to CLEAN, government involvement is particularly important due to the nature of the technological trajectories. More specifically, fundamental R&D lies at the heart of most technological innovation and it is often a long process which is not initially directed towards commercial results. As the process progresses, the research becomes more applied and at some point it reaches a stage where it can be commercialised. While this process is relevant for technological innovation in most industries, it often requires public support to occur in the cleantech sector (CLEAN, 2019b). According to CLEAN, new extensive

climate- and environmental solutions often require involvement from the public sector, in the development, testing and implementation phases, as they often cannot compete with the established solutions on regular market terms. This creates a need for public involvement in order to drive demand and allow for experimentation in these initial phases, since individual firms often refrain from taking on the significant risk of failure that follows from experimentation. This coheres with the barrier of path dependency which many types of cleantech are influenced by (McCauley & Stephens, 2012). Similarly, STAC's CEO argues that it can be challenging that some firms "are so deeply invested in something that has worked well for a long time, even though they know it is not beneficial, but they do not want to change it" (STAC interview). Thus, he perceives path dependency as a general barrier in the industry.

A range of characteristics and barriers have been identified and it can be concluded that the industry is under heavy influence from political and regulatory institutions which can both hinder and accelerate development. These macro level dynamics shape the context in which CLEAN and the SMEs operate. In order to further understand the role CLEAN plays in the Danish innovation system strategy, the following section will address the meso level with a focus on how CLEAN defines its strategy and engages in collaboration with other clusters and networks. This will in turn be used to address how CLEAN influences cleantech SMEs.

5.2 Cluster Strategy and Dynamics

Moving from the macro level to the meso level (figure 3b), this section will clarify how CLEAN as a triple helix cluster functions as an instrument for the macro level goal of a sustainable transition and in turn how this affects the initiatives provided to the member SMEs.

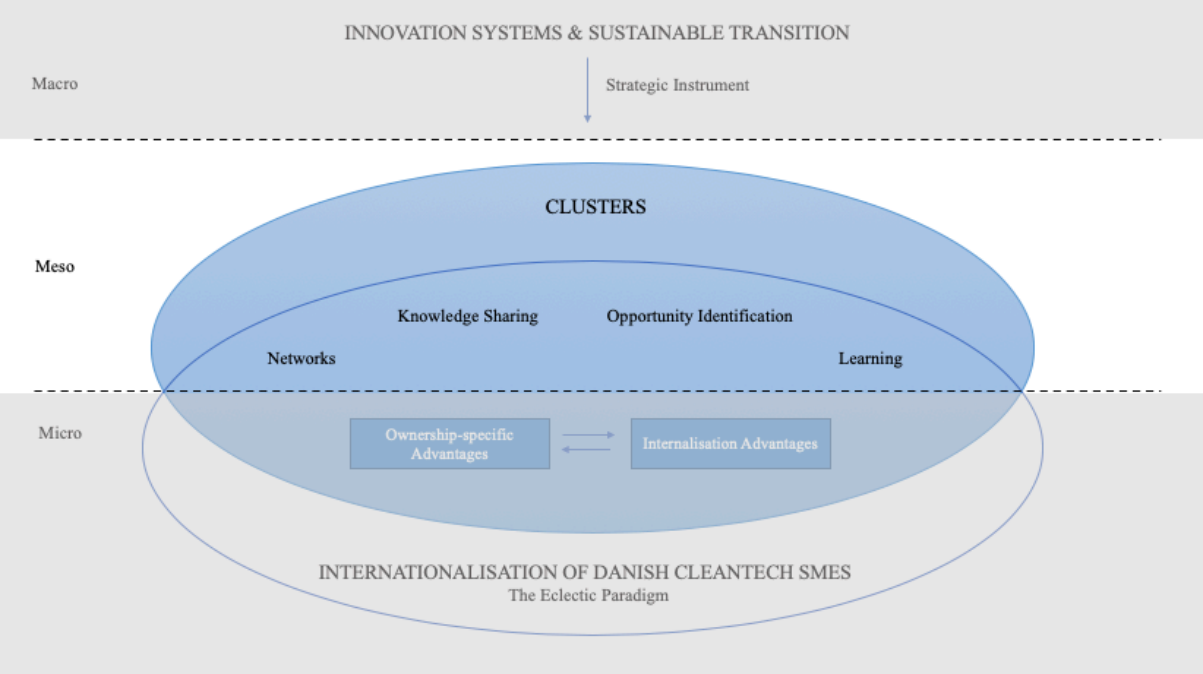

Figure 3b: Theoretical framework - Meso level focus

On this level, the strategy of the cluster will be clarified to lay the ground for subsequent analysis of the influence that cleantech clusters have on SME internationalisation. Hence, it is necessary to first address the means by which CLEAN builds networks and supports the members.

CLEAN is a strategically developed triple helix cluster which, according to theory, means that the founders have significant influence over the strategy and the structure which is employed to achieve the goals (Etzkowitz & Leydesdorff, 2000). This is evident in that the government has shaped the overarching purpose of CLEAN, which is to "create green growth and employment in Danish firms, establish international collaborations and contribute to sustainable development" (CLEAN, 2019a). CLEAN can therefore be argued to play an important role in the Danish innovation system as it helps develop the institutional infrastructure combining the private and public sector within cleantech. The interview with the senior project manager also provides an example of the influence from macro actors. He explains that the main reason for CLEAN's previous engagement in China was that "the Danish government and the cities in Denmark see China as the main target market" (CLEAN interview 1). The characteristics of CLEAN thus support the notion from Alcacér & Chung (2007) that strategically developed triple helix clusters can be a tool for governments to improve and accelerate growth and innovation in a region.

When addressing this overarching purpose, the aim is not to close deals and engage in negotiation or contracts, but to facilitate collaborations which ultimately result in deals being made and solutions being

implemented (CLEAN, 2019 a). CLEAN aims to support the members by helping them to get closer to Danish and global "markets, customers and peers" (ibid.). This in turn shows that CLEAN seeks to establish bridges to foreign markets for their members (Coviello & Munro, 1997). In specific internationalisation initiatives, the entry mode is primarily export. The reason for this focus on non-equity modes of entry is, according to CLEAN, that it is the most efficient way for CLEAN to create value for the SMEs (CLEAN interview 2). This implies that creating and facilitating internationalisation opportunities through more equity based modes would require too many resources (ibid.). Another characteristic of CLEAN's facilitation of projects is that the goal is to employ a broad scope by integrating technologies and solutions to target a broad range of possible applications. This is done in order to make it possible to use the findings from one project in many other contexts as well.

When considering CLEAN's international focus, it is imperative to address the international network in which it is embedded. On a transnational level, CLEAN is embedded in the respective networks that exist within the EU. The European Commission has set up several initiatives promoting international cluster collaboration across borders within and beyond Europe. These initiatives are set in place to support European cluster partnerships, which further help European SMEs within a range of industries to integrate into global value chains (European Commission, n.d. a). In example, the 'Clusters Go International' is an initiative promoting cluster collaboration to enhance competitiveness of European SMEs (European Commission, n.d. b). This is developed to contribute to global collaboration between clusters in the EU, creating an incentive for the clusters to collaboratively target foreign markets and create better international access for SMEs through financial assistance and market support (European Commission, n.d. a.). Partaking in these initiatives may thus benefit not only CLEAN, but also its members by creating collaboration opportunities otherwise unavailable.

This macro level push for clusters to become more international, as materialised in EU initiatives, has influenced the meso level by leading to the establishment of cluster organisations, such as the ICN. The establishment of ICN occured when CLEAN formed a group with five other clusters across Europe to apply for funding from one of the EU initiatives. The funding application was approved, and led to EU supporting the cluster network financially for the first five years. Subsequently, more clusters joined and the network became more formalised and created a membership fee structure of EUR 10.000 per cluster per year (ICN interview). As described by the head of the ICN secretariat, the clusters have different individual structures, sizes, cultural settings and to some extent agendas. However, they set the strategy for the network collectively and they all have the same overarching vision for the ICN, namely to improve the potential for their respective member SMEs to internationalise their activities (ICN interview).

Within this meta cluster, mutual learning processes occur in different ways. On annual meetings, the clusters engage in knowledge sharing through speed dating sessions focusing on both the "operational level and also a content level" (ICN interview). The head of the secretariat explains that "the clusters operate completely differently. Some are more developed while others are quite new, so there's a lot to be learned there, but there is also a lot to be learned on the thematic basis, for example what is going on with water and how can we collaborate bilaterally within water or circular economy?" (ICN interview). Hence, ICN facilitates learning on the organisational cluster level, but also allows for shared access to demand, skills and suppliers on a more specific project based level (Davies, 2013).

The ICN's role varies depending on the project. The role can consist of connecting a diverse set of stakeholders on a large-scale multilateral project, or it can be to contribute to bilateral cooperation between regional clusters by providing institutional infrastructure. On the bilateral level, CLEAN has leveraged the framework of ICN to establish connections with the Swedish and French clusters, which has allowed the clusters to apply for EU funding for combined projects and conduct matchmaking between their members (CLEAN interview 1). These effects also occur on a broader scale in the multilateral collaborations where several clusters collaborate. In example, the head of the secretariat explains that the ICN has facilitated a project with five clusters across Europe spanning two years and costing EUR 2 million funded by the EU. This project supported 170 SMEs in their internationalisation to China, the US and Asia (ICN interview). Another type of multilateral cooperation concerns large scale projects with one specific external actor engaging with the cluster network. For example, the ICN collaborates with the Solar Impulse Foundation which is initiated by a high profile project where a solar powered airplane was flown around the world. The Solar Impulse Foundation seeks to identify sustainable companies around the world and include them in the foundation, but it lacks the capacity and market knowledge to do so (ibid.). The collaboration with ICN therefore allows this external actor to draw on the regional knowledge embedded in each of the clusters, while the clusters benefit by being able to provide their member SMEs with the opportunity of being part of the foundation. Hence, the contribution from ICN to the SMEs occurs indirectly, in that the ICN expands the institutional infrastructure that CLEAN's members can utilise. As the head of the secretariat expresses it, the ICN is "a level away from the SMEs." (ibid.).

Given this indirect effect that ICN has on the SMEs, the following sections will mainly focus on the observed dynamics between CLEAN and the three SMEs, while the ICN will be included only in terms of its indirect effects on the SMEs. The following will thus investigate whether and how clusters influence the firms' internationalisation process given the context and the barriers they face in their industry.

5.3 SME Internationalisation and Cluster Dynamics

Moving from the meso to the micro level, the following sections will look to investigate how the cleantech SMEs' O and I advantages are influenced by their cluster membership (figure 3c).

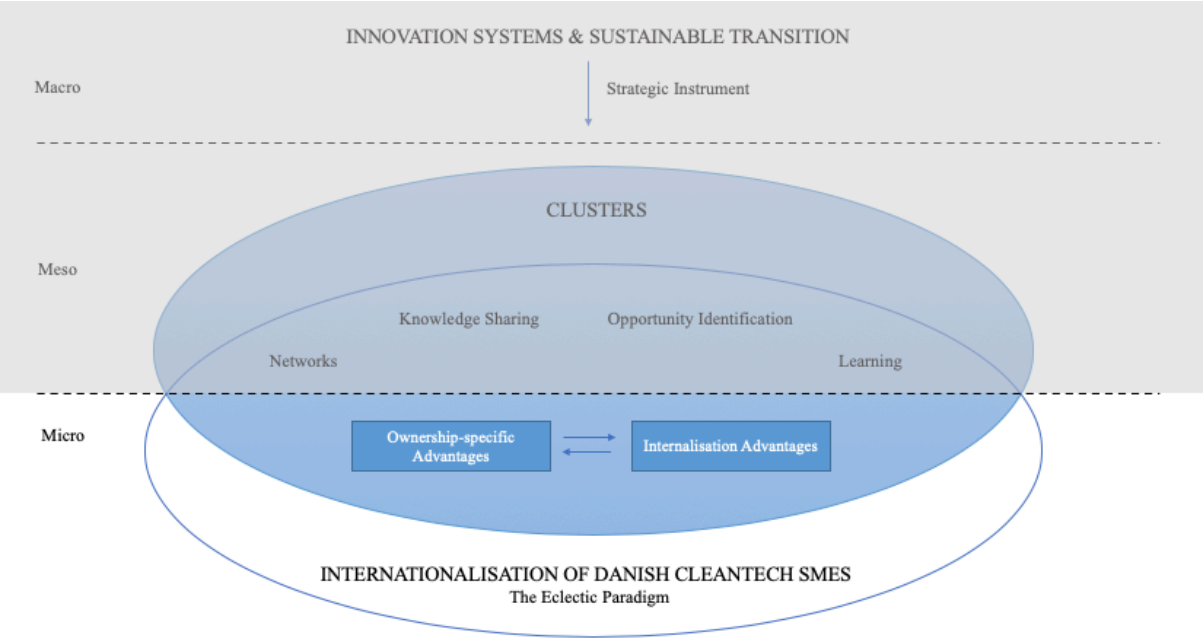

Figure 3c: Theoretical Framework - Micro Level Focus

More specifically, this level will firstly address the SMEs' motives and general approach to internationalisation. Thereafter, the SMEs will be analysed based on their O advantages and the way in which they have used CLEAN to strengthen said advantages. Lastly, the influence that CLEAN has had on the SMEs' internationalisation strategies will be addressed.

5.3.1 Firm Specific Motives and General Approach to Internationalisation

When assessing how the internationalisation of the three SMEs is influenced by CLEAN, it is necessary first to analyse their current cross-border value-adding activities in order to determine their overall strategies and motives for internationalisation (Dunning, 1993).

ReMoni has 10 domestic and international production sites and is currently setting up an additional one in Romania through a partnership with a Romanian company producing similar products (ReMoni interview). This allows the firm to spread the risk over several production sites. Thus, if one breaks down, the others are still able to continue the production (ibid.). According to the CEO; "It is risk minimization of our supply chain … for example now with the Coronavirus, you have to close production in several places around the world, which can suffocate a company" (ReMoni interview).

This additional production site can be considered a support investment, as it has been made to support the activities of the rest of the organisation, ensuring that production can continue (Dunning, 1993). Alongside these international efforts in establishing a Romanian production site, ReMoni is focused on establishing transnational partnerships to help distribute and sell the products. An example is the Eurostars project initiated in 2019, where ReMoni together with a Bulgarian and an Icelandic company have been granted DKK 2.2 million to combine the firm's solutions and subsequently commercialise the new product internationally (CDEU, 2019). This project will thus allow ReMoni, and its partner firms, to reach new markets with their combined solution, whilst realising new uses for ReMoni's technology. The motive behind ReMoni's participation in this project can thus be considered market seeking, as the combined solution will allow ReMoni to commercialise products in new markets (Dunning, 1993).

ReMoni has further shown considerable interest in the American market. Through a CLEAN initiative, a group of member firms, including ReMoni went to New York to meet with potential partners. On this trip, they met with a range of organisations, politicians and other companies in New York to discuss future opportunities for collaboration. The motive behind pursuing this opportunity can also be considered market seeking, as it would allow ReMoni to expand sales markets globally. The approach can further be considered aggressive, as it is a proactive choice to improve the firm's strategic advantages (Dunning & Lundan, 2008). Currently, there are no geographical boundaries included in ReMoni's internationalisation strategy, as the company is considering opportunities as they arise. Instead, it is the specific opportunity and the inherent risk and resources required that determine whether ReMoni considers pursuing a new market. As mentioned by the CEO ".. We would not have touched the American market yet, if it had not been for CLEAN. We would not have taken the full investment in moving to that market today" (ReMoni interview). This illustrates that the firm's strategy is shaped by the opportunities that emerge through network relationships. This is consistent with a network approach to internationalisation (Coviello & Munro, 1995; 1997). Moreover, it is not so much a matter of whether or not to go international, but rather a question of timing: "The most important thing is whether the timing is right for the market" (ReMoni interview*).* Thus when presented with an opportunity, ReMoni evaluates whether the timing is right to seize it.

STAC has a more direct and foundational focus on network and internationalisation in everything the firm does, which aligns with the recommendation from the Climate-KIC that cleantech actors need adapt a collaborative and global approach from the beginning to make an impact (Climate-KIC, 2014). STAC is born global and in the words of the CEO; "Right from the start we understood that this really could make an essential difference for our planet. Therefore, it wouldn't be beneficial to start a project where we could only see the local. We had to have a larger perspective" (STAC interview). To this end,

STAC has established a global advisory board with industry experts and researchers across the US, UK and India (STAC Technology, n.d.). The firm also has several international partners including Alfa Laval, the world leader within heat transfer, separation and fluid handling, Brayton Energy, the leading turbine development firm in the US and Additive Industries in the Netherlands (Alfa Laval, n.d.; STAC interview.). At the partner sites, STAC installs 3D printers to produce components which are then sold in combination with the partner's solutions or used for innovative development. Hence, STAC uses development partners to improve product offerings, research and continuous innovation. This enables STAC to advance innovative competitiveness and in turn allows the firm to compete and distribute products in foreign markets (Dunning, 1993). The firm thus may be able to use the knowledge gained through these development partnerships in one country, and apply it on other markets. This suggests that STACs internationalisation efforts are primarily based around opportunities created through its network, thus exhibiting a network based internationalisation approach (Coviello & Munro, 1995). Moreover, the wish to establish close collaborations with development partners around the world can be argued to stem from a market seeking motive. Similar to ReMoni, this approach can also be considered aggressive, as the purpose of internationalisation is proactive rather than reactive (Dunning & Lundan, 2008).

Similar to ReMoni and STAC, Visblue focuses on establishing partnerships with companies offering similar or complementary products or services abroad. "(..) so when we enter a new market, we establish a partnership with someone who has a cultural understanding and understands the market. That makes it easier for us to infiltrate the market, but also to do it in an appropriate way, because no matter how much cultural knowledge we can have as danes in another market, there is nobody that understands it as well as the people who are born and raised in that country" (Visblue Interview 2). These partnerships further enable VisBlue to reduce the resources required and utilize the foreign partners' cultural knowledge and market experience. It further enables VisBlue to overcome potential challenges in terms of liability of outsidership, as the partner firm is an established part of the market-specific network (Johanson & Vahlne, 2009). Therefore, similar to both ReMoni and STAC, the motive behind these international actions can be considered market seeking, and the approach aggressive.

Due to limited resources, Visblue seeks to establish itself on the Danish market before moving into several international markets. Once settled in Denmark, the strategy is to move to other Scandinavian countries, then Germany and subsequently the firm will move to markets with a longer geographic distance, thus following the logic of stage model theory (Johanson & Vahlne, 2009). Despite this strategy, the firm has established a partnership in Holland with a Dutch company that produces a range of products including containers for the military (Visblue interview 2). As the two products complement each other they are sold in a bundle, and the motive of this international partnership is therefore also market seeking. Before the partnership was established, Visblue ensured that the Dutch partner was

able to install and market their products before the contract was signed. Thus, the partner functions as an additional sales channel in Holland which reduces the related production and costs, as the firm is able to install and service the Visblue products. This enables Visblue to enter the Dutch market without committing vast resources.

However, the partnership with the Dutch firm demonstrates that VisBlue is not consistently following a stage model theory based approach; "We have a strategy right now that states that we focus on Denmark and housing associations, but if there are offers from Australia or other countries outside our current focus, we will not say no right away. We will investigate whether or not it will make sense" (VisBlue interview 2). So, if a viable opportunity for international activity presents itself, despite it not fitting into the initial gradual internationalisation strategy, Visblue is willing to deviate from the strategy to seize the opportunity. Another example of such an opportunity is evident in a trip the firm made to South Korea with CLEAN. Despite the vast geographical distance and deviation from the original strategy, VisBlue considered it worthwhile to review this opportunity. In the end, no contracts were signed but it did further increase the company's knowledge about the market potential in South Korea for their products. Thus, while Visblue's intended internationalisation strategy follows the logic of stage model theory, an emerging strategy constitutes a more network based approach as the firm pursues opportunities arising through networks and relationships (Johanson & Vahlne, 2009; Coviello & Munro, 1997).

In order to summarise similarities and differences, the table below visualises the respective SMEs' current activities, motive for internationalisation, strategy and approach.

Comparing International Activty, Strategy and Motives

	ReMoni	STAC	VisBlue
Current Internationalisation Activity	9-10 Production Sites Eurostars Project	Development Partnerships	Commercial partnership in the Netherlands
Motive for Internationalisation	Support Investment Market Seeking	Strategic Asset and Market Seeking	Market seeking
Strategy	Risk diversification Network based	Network based	Gradual approach Network based
Approach	Aggressive	Aggressive	Aggresive

Table 4: Comparing International Activity, Strategy and Motives

As visualized in table 4, it is evident that all three firms are currently engaged in cross-border value-adding activities through development, project or distribution partnerships. These partnerships have for all three companies been established with a market seeking motive, to enable them to enter new markets

through the sale of e.g. product bundles. When evaluating the general strategy for internationalisation, it is evident that Visblue primarily follows a stage model approach, but with examples of network based influence. In this strategy, VisBlue is considering their size and limited resources a constraint. STAC on the other hand shows a more opportunity based network approach, in which the firm exploits the opportunities available through the large international network (Coviello & Munro, 1997). Contrary to VisBlue, STAC seems not to consider their resource availabilities as a barrier in its internationalisation strategy, but rather see it as an opportunity to use the accumulated networks to overcome potential challenges. Remoni's key priority in its internationalisation initiatives differs from the previous two, as the priority is to reduce risk wherever possible. Sometimes, in order to reduce the underlying risk of an initiative, the firm uses its networks and CLEAN to decrease the associated risk levels.

Similar for all three companies however, is their rather aggressive approach towards internationalisation, as their current international operations have been proactive choices made to strengthen their strategic objectives and competitive positioning. Another similarity between their strategies is the focus on establishing partnerships to achieve their goals, irrespective of whether the goal is to infiltrate a new market or to reduce risk. They all appear to perceive that it is impossible to gain the same understanding of a market as the locals, and they are therefore willing to engage in a partnerships despite having to give up control (Dunning, 2000).

In conclusion, despite the three companies operating within the same industry, being of similar age and having engaged in foreign markets, their strategies and use of CLEAN vary greatly. The differences in internationalisation can be explained by the firm specific characteristics of the respective organisations. Thus, subsequently, their use of CLEAN and the cluster network is dependent on the resources and capabilities already available to the firm.

5.3.2 Cluster Dynamics in the Eclectic Paradigm

In order to analyse the influence of cluster dynamics on SME internationalisation, the specific implications that CLEAN has on the O advantages of the three firms is addressed. Hence, the following sections will look to investigate how the three SMEs have used CLEAN to strengthen and develop their O advantages and subsequently how this involvement of CLEAN has influenced the firms' internationalisation strategies.

5.3.2.1 Ownership Advantages

In order to fully investigate the O advantages that the three firms possess, they have been analysed according to Dunning's (1993) characterisation of Oa, Ot and Oi advantages. As the characteristics of

certain O-advantages may influence several of the aforementioned categories, figure 11 has been created to visualise these interconnections.

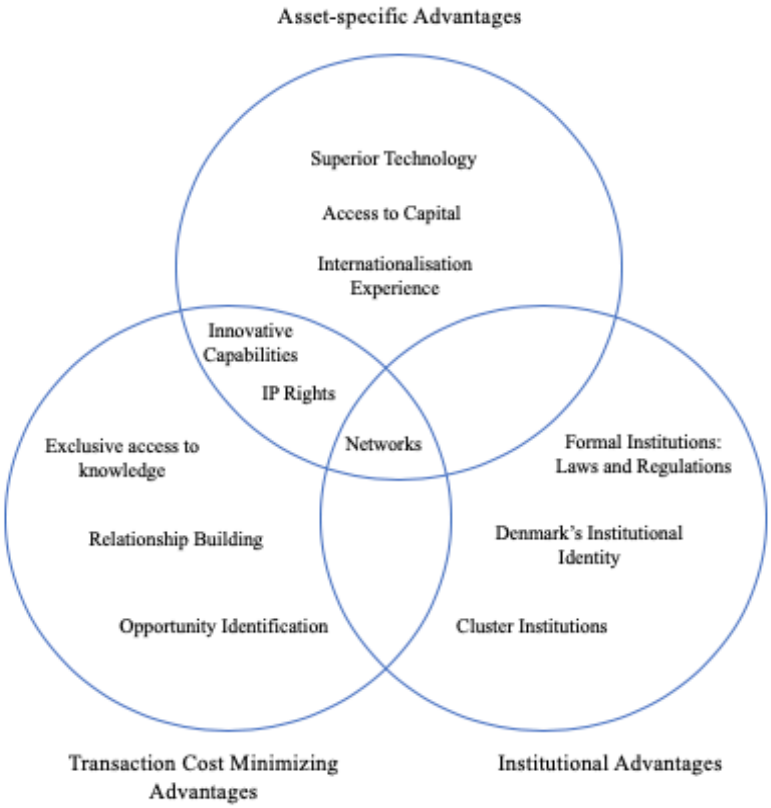

Figure 11: Ownership Advantages of the Firm (Own Design)

As depicted in figure 11, the asset-specific advantages (Oa advantages) of the firms have been considered to include the competitiveness of technology, access to capital and internationalisation experience. The transaction cost minimizing advantages (Ot advantages) include organisational resources available to the firm, relationship building and opportunity identification. Lastly, the institutional advantages (Oi advantages) include both formal and informal institutions that may affect the companies such as laws and regulations, regional industrial identity, networks and clusters. What is furthermore shown in the model is the resources influencing more than one of the sub-categories such as networks.

The cluster and its influence on the three sub-categories of the O advantages has not been explicitly shown in the model, but will be assessed according to each advantage throughout the analysis.

5.3.2.1.1 Asset Specific Ownership Advantages (Oa)

As visualised in figure 11, this section will firstly address the firm's' technology, innovative capabilities and IP right, secondly the internationalisation experience, thirdly the networks and lastly the access to capital. This will be analysed to determine the Oa advantages of the SMEs. Throughout the analysis, CLEAN's impact on the development of said Oa advantages will be investigated.

5.3.2.1.1.1 Firm Specific Technology and the Competitive Environment

Competition and the superiority of technology are important Oa advantages as they affect the company's potential to infiltrate new markets (Dunning, 1993). Therefore it is relevant to consider the novelty and competitive aspects of the three firms' products, to establish their comparative advantages abroad.

When assessing the individual products and solutions provided by the three firms in combination with the global traction that they each have received, it can be argued that all three firms base their business on technologies which are somewhat superior to the alternatives currently existing on the market. As mentioned by the CEO of STAC: "By using our method, you can save up to 90% on electricity. And you can avoid the emission of all sorts of things into the atmosphere. So there is vast potential for impact". Thus, in addition to producing a more sustainable solution to cooling, the clients are able to cut up to 90% of the costs. The STAC systems are furthermore compatible with district heating systems, and can therefore be incorporated directly into the already existing infrastructure (STAC interview). This allows STAC to overcome the cleantech industry barrier that many technologies require large initial investments to establish a sufficient infrastructure for the technology (Day & Shoemaker, 2011). Moreover, it means that the firm is not inhibited by the path dependency that is inherent in many aspects of the industry, as the solution fits with the existing configuration (McCauley & Stephens, 2012).

Such compatibility effects also exist for ReMoni, as the firm's solution allows clients to measure their energy use without having to cut open cables and pipes (ReMoni interview). The ReMoni measuring solution can thus be adjusted to accommodate a range of different systems, which equally to STAC allows the firm to avoid being restricted by path dependency of the established system. Furthermore, by eliminating the expenses related to installation and service, ReMoni is able to cut 90% of the related expenses and some of the risk of installation (ReMoni interview). STAC is "not the only ones who do what we do, there are thousands who do the same thing, but the cheapest of the others are simply 10 times more expensive than us" (ReMoni interview). One can therefore argue that both STAC and ReMoni have a comparable advantage as their products can be considered relatively technologically novel and carry considerable cost advantages which in turn enables them to attract price sensitive customers. Similarly, Visblue has a relatively strong competitive positioning, as the firm does not have a lot of competitors within their preferred markets. The CEO states that VisBlue "don't really have that many competitors within our exact products, and the competitors that we do have focus more on the

big markets for Megawatt and Gigawatt, so that of large solar power plants, windmills and cities. We focus more on the medium and smaller market within what is called kilowatt" (Visblue interview 2). The different focus among energy storage companies is enabled by coexisting the technologies (Day & Shoemaker, 2011). This industry characteristic of coexistence thus positively affects VisBlue by allowing the firm to target a different type of customers domestically and abroad. Moreover, it potentially enables the firm to serve a market that has previously been overlooked. Furthermore, as with the products of both STAC and ReMoni, VisBlue's products have a modular structure which allows for flexibility and compatibility as they can be integrated into several types of systems. All three firms have secured their technology by taking out necessary IP Rights. As these prevent competing firms from copying, using or offering the protected technology for sale, they can be great assets when entering foreign markets, provided that they are internationally effective (Schilling, 2017).

Closely connected to the superiority of the technology, the firm's innovative capabilities are critical for the Oa advantages as they enable continuous development (Dunning, 1993). This is determining for the competitive position as it is important for innovative SMEs to secure an understanding of new developments within their technology and the industry. STAC has several development partners, through which the firm is able to achieve higher levels of innovative capacity and product development (STAC interview). Furthermore, as one of the three parts of STAC's commercialisation strategy is co-creation, the firm has a continuous focus on enabling the product to integrate into different business situations in collaboration with different companies (STAC interview). This furthermore allows STAC to engage in exploration, which positively affects the firm's ability to be ambidextrous. The STAC founding team furthermore has a very large network and strong ties to research institutions such as Harvard University, Oxford University, University of Beijing. This direct connection to research institutions may prove beneficial to further advance the innovative capabilities (Alcacer & Chung, 2007).

Similar connections to universities are evident for VisBlue. Namely, two of the founders are professors at Aarhus University and the University of Portugal (VisBlue interview). This provides a significant Oa in terms of academic input supporting the innovative capabilities (Alcacer & Chung, 2007). This direct connection to the universities, allows the firm to access to knowledge and research only available in knowledge institutions (Visblue interview 1). As asserted by Visblue: "We have a research strategy that we share with the Universities, and then we develop together with the universities to prepare for what is going to happen in 4-5 years" (Visblue interview 1). Having a separate strategy for research, indicates a wish from the firm to continue to prioritise technological advancement throughout their growth through a systematic plan for continuous improvement. Through this separate strategy VisBlue ensures agility, which may also relate to the firm's limited size, enabling it to make adjustments based on new

research developments. It furthermore provide an example of VisBlue engaging in exploration, which indicates traits of organisational ambidexterity (Raisch & Birkinshaw, 2008). Visblue further enables product development and improvement by participating in a range of international research projects. An example of such research project is the ORBATS project, where VisBlue collaborates with The Technical University of Denmark (DTU), Vestas, Lithium Balance, Harvard University and Aarhus University (Cleeman, 2020). The goal of the project is to replace the acid in flow batteries with a liquid based on "safe, earth-abundant, stable and inexpensive organic materials" (Cleeman, 2020). This project will, if successful, become a game changer within the world of energy storage, as it will create a more sustainable and cost-efficient energy storage solution which in turn may alleviate the issues of inflexibility in the grid (ibid.). The outcome of the project will in turn have a vast impact on Visblue's products by increasing superiority. Furthermore, by being a part of the development process, VisBlue is able to gain important knowledge, and the collaboration project thus constitutes a crucial learning process which adds to the firm's innovative capabilities. These projects may thus also facilitate knowledge spillovers and in certain cases contribute to further technological development, sequentially enhancing the innovatory capabilities of the firm (Davies, 2013; Delgado et al., 2016).

Contrary to Visblue and STAC, ReMoni does not have a direct connection to universities or other research institutions. The firm has therefore utilised CLEAN to establish such connections in order to engage in technological advancements and experimentation. This is done by participating in the FIE Project, which seeks to promote innovation within the energy technology sector within the Region of Mid Jutland. By participating in this project, the firms are able to develop new products, access new markets, investigate new areas of business, access expert knowledge and establish new partnerships (CLEAN, n.d. c). For ReMoni, the FIE project has established a direct connection and partnership with Aarhus University, where a researcher is working full time to solve a challenge identified by Remoni. This enables Remoni to improve the firm's technology and solve a technical challenge they would not be able solve internally (ReMoni Interview). CLEAN is furthermore helping Remoni reducing the associated cost and is thereby reducing ReMoni's economic risk of engaging in this exploratory project. This supports the logic presented in a white paper on clusters' role in the green transition published by CLEAN. In this whitepaper, CLEAN argues that clusters can accelerate sustainable development by enabling the needed experimentation in initial phases where individual firms, and especially SMEs, are unable or unwilling to take on the risk individually (CLEAN, 2019b). Through this project, CLEAN has further enabled ReMoni to develop the technology in a way that is compatible with the existing energy system, thereby easing scalability by following the existing path dependent development (McCauley & Stephens, 2012). This project facilitated by CLEAN is thus instrumental in increasing the innovative capabilities of the company by facilitating a direct connection to Aarhus University (Alcacer & Chung, 2007). The enabled experimentation in this project furthermore provides an example

of ReMoni utilising CLEAN to engage in exploration, and thus contributes to the firm's ability to be ambidextrous.

Given the young age and size of these SMEs, it is worth considering the competition originating from the larger firms within the industry. Specifically, the competitive environment within the cleantech industry is dominated by very large companies such as Grundfos, Danfoss and Vestas and the success of new entrants therefore often depend on their ability to attract the attention of the industrial giants (Leonhard, 2018). This dynamic between the giants and SMEs was also highlighted by the interviewees. He suggests that the large firms de-risk companies like VisBlue in the initial stages of the development phase until the associated risk has decreased (Visblue interview 1). In order to illustrate this dynamic between small and large firms in the cleantech industry, he compares it to the telecommunications industry where the aim for small new firms "...is not to make big business, but to become big enough to be attractive for the large firms which then acquire them" (Visblue interview 1).

Given this industry characteristic, it is considered an Oa advantage for the SMEs to be able to attract the attention of these larger firms and ultimately engage in partnerships. The CEO of Visblue states that larger firms like Vestas and Siemens are keeping an eye on them, and he argues that these firms are to likely consider VisBlue to be an attractive partner to cooperate with in the future (Visblue interview 1). He further elaborates that these collaborations may reduce the perceived risk of novel technology and subsequently therefore increase the sales potential abroad. As novel and unproven technology is often perceived more risky investments, the partnerships or consortias may thus contribute to reduce the perceived risk of the young firms by sheer association to more established or well known firms in the market. VisBlue has experienced this in the Netherlands, as the Dutch partner is a well-established player on the market, which have positively affected VisBlue's sales potential (ibid.).

Similarly, the CEO of STAC explains that Danfoss, Grundfos, Tetra Pak and Arla Foods, as well as international giants, have expressed interest in the firm and keep an eye on STAC's progress (STAC Interview). As SMEs do not have the same resources and capabilities as the larger corporations, it can be difficult for the smaller competitors to scale up on different markets (Coviello & McCauley, 1999). Therefore, as the SMEs are lacking resources and the giants are lacking innovation, collaborations between the two can prove very useful for both parties. An example of such a collaboration is STAC's distribution agreement with Alfa Laval. As noted by STAC's CEO: "If we offer them a collaboration rather than competition, where they achieve the benefits we have, and we have developed everything so they can implement it from day one and then just get started with, is that not the way to go? I have reached the conclusion that it is, and that this is the way to overcome these push-backs and barriers" (STAC interview). Hence, STAC is an example of how SMEs can seek to overcome the path

dependency by engaging in partnerships with domestic or international giants and thereby use their capabilities for scalability of new and innovative sustainable technologies.

To support the collaboration between SMEs and the giants, CLEAN arranges networking initiatives to establish connections between them. Moreover, when facilitating consortia establishment, CLEAN seeks to include both SMEs and large firms. According to the senior project manager in CLEAN; "We quite like to at least see how we can match up an SME with a bigger already established Danish organization" (CLEAN interview 1). One of the key reasons for this decision being, that if a consortia exists exclusively of SMEs, it is likely to struggle and require a lot of more time and resources from CLEAN as the facilitator, and these resources are simply not available. Such consortia establishment through CLEAN however also often couples a large foreign company with Danish SMEs. In example, CLEAN closely collaborates with both the Norwegian and Swedish cleantech clusters through the Nordic Solutions for C40 Project. This project is focused on establishing and nurturing collaboration between nordic cleantech companies to collaboratively solve challenges presented by C40 cities (CLEAN, n.d. c). This collaboration further enables CLEAN to establish international consortias across the Nordic countries. According to the senior project manager, "That's one of the reasons we have this Nordic Project, as Sweden has a lot of strong companies looking for innovation that we can connect to Danish SMEs" (CLEAN interview 1). This strategy towards international partnerships once more highlights the strong focus in CLEAN to facilitate growth for Danish SMEs, as they are in focus when trying to establish either Danish or international consortias (ibid.). This approach also exhibits how CLEAN addresses the issue of improving the diffusion of innovation between large firms and SMEs, which was highlighted on the macro environment as a central problem on the Danish innovation scene (European Commission, 2019c).

In conclusion, all three companies have the potential for a fairly strong comparative advantage on the global market. They also show organisational ambidexterity, as the firms all adopt a combination of exploration and exploitation of current resources in their research and development strategy. However, despite their relatively strong competitive position, they still might benefit greatly off of collaborations with the larger more established organisations, as it can help decrease the associated costs with new research and development, shorten the innovation time and allow them to explore technological complementarity and additional technological opportunities (Hansen, 2014). Through the initiatives provided by CLEAN, the three firms have great opportunities to partake in partnerships with large organisations through consortias, research or funding projects. This may help them further grow on the market, because of the mutually beneficial outcome of the partnerships caused by the exchange of innovation for resources.

5.3.2.1.1.2 International Experience

Previous experience with internationalisation constitutes an important intangible asset, as it may affect the efficiency and potentially the approach utilised for future international initiatives (Johanson & Vahlne, 2009). The SMEs' previous experience with internationalisation will thus be analysed to evaluate how this tacit know-how may contribute to the asset specific ownership advantages.

When looking to analyse ReMoni's internationalisation experience through the firm's past cross-border value-adding activities, it is evident that ReMoni has established considerable experience within both production and commercially-oriented partnerships. This is based on the many production sites and development projects (ReMoni interview). When assessing the commercially-oriented foreign partnerships, the Eurostars project is a great example as it allows ReMoni to gain experience within the distance related challenges that can arise when having to collaborate across three different countries, namely Denmark, Iceland and Bulgaria.

STAC also has considerable internationalisation experience which has been developed through partnerships in the US, the Netherlands and the UK. As the partnerships are geographically dispersed, it can be argued that STAC has gained considerable experience in markets both geographically relatively close. Furthermore, through licensing and co-creation, STAC's network and collaboration experience is expanded continuously through new inter firm agreements. The long list of partnerships may have provided STAC with intangible know how in terms of identifying and evaluating potential partners as well as establishing trust and controlling the contractual agreement. Thus, through the range of partnerships that STAC has created abroad, a considerable Oa advantage lies in the accumulated experience from the partnerships.

Similarly to both ReMoni and STAC, VisBlue has international experience with foreign partnerships through the collaboration with the Dutch partner. Despite not following the strategically decided trajectory for the internationalisation strategy, it has furthermore allowed the firm to gain valuable knowledge regarding what to consider when establishing future partnerships abroad to ensure the creation of a mutually beneficial contract. VisBlue's experience compared to the other SMEs can however be argued to be considerably less extensive, as it is solely based on the experiences of one foreign partnership.

As all three SMEs have previous internationalisation experience, the accumulated experience gained through these cross-border value-adding activities can support the firms' abilities in terms of establishing mutually beneficial contracts, finding the right partners and working together across borders. This ultimately constitutes important Oa advantages (Dunning, 2008).

5.3.2.1.1.3 Network Dynamics

According to a range of scholars, networks are an important resource for SMEs and play an important role in the combined ownership advantages of SMEs (Coviello & Munro, 1995). Hence, if the firms are able to utilise their networks appropriately in their internationalisation strategy, the size and strengths of the relationships within their network can prove a great advantage in foreign markets. Thus, the better the network available to the firm, the more cost and time effective the subsequent market entry will become. Therefore, the three firm's networks will be analysed below to understand what role the network plays in their overall internationalisation strategy and how they utilise the strengths of said networks.

As previously mentioned, STAC has a very large international network which is established through the management team and the advisory board's combined personal and professional relations (STAC interview). As mentioned by the CEO: "I've been so lucky at a very young age, to find out that it is not always what you know, but who you know that is important, and that networks are essential for how quickly you move down the field" (STAC interview). STAC's network thus proves vital in the firm's strategy, as it is used to establish additional partnerships and market the solutions worldwide. This is evident in STAC's partnerships with both the UK company Naked Energy and the US company Brayton Energy. Namely, the partnership with Naked Energy proves the firm's ability to use network in creating business opportunities abroad, and the partnership with Brayton Energy moreover proves the ability to create valuable development partnerships (STAC interview). The partnership with the UK company Naked Energy furthermore led to large project opportunity in Dubai. Together, the firms are initiating a large cooling project in Dubai in the summer 2020. This will be one of the largest projects that STAC has partaken in and the opportunity was created solely through the network. The CEO further emphasises this importance of networks: "So this again is an example of how we want to grow our business into the world. It is this part with networking and presence through other companies' presence" (STAC interview).

Because of this strong Oa advantage, STAC has made little to no use of CLEAN in trying to establish additional partnerships or gain access to new markets. One can however argue that since STAC's network presents similar capabilities as that of CLEAN, it has up till now not been necessary for STAC to utilise CLEAN for this purpose.

Similar to STAC, networks and partnerships are deemed very important for the future growth of VisBlue. As mentioned by the CEO; "We have a clear partner strategy, and do not want to grow the company to one hundred employees… we will look into further development and potential sales channels, and sell to partners in different countries" (Visblue interview 1). The focus of VisBlue's

strategy is to develop partnerships through the current network, as they often receive opportunities from different companies worldwide. The firm therefore does not feel the need to extend these effects through specific networking activities initiated by CLEAN (Visblue interview 1). However, the firm has participated in a C40 project and a trip to respectively Stockholm and South Korea through CLEAN, which inherently adds to the firm's network by introducing VisBlue to foreign actors (ibid.). The strategies employed by STAC and Visblue are thus evidently positively influenced by their large network which facilitates access to a large group of "like-minded people" (STAC Interview).

ReMoni's strategy also reflects vast focus on the use of network opportunities to grow the business. However, unlike STAC and VisBlue, ReMoni has utilised CLEAN to broaden its network and establish partnerships with the goal of commercialisation and development. An example of this is evident in ReMoni's participation in the delegation trip to New York, arranged by CLEAN, with the objective of meeting with potential partners, customers and government officials (ReMoni interview). Theoretically, ReMoni would be able to arrange the same meetings with both companies and government officials, but it would have required a lot of time and resources to reach out to the large number of companies in New York. According to ReMoni's CEO: "They (CLEAN) help make the process around new markets more efficient, and thereby the risk and the economic assets required decrease" (Remoni interview). Thus, ReMoni is able to use CLEAN to extend the network in a more efficient and less risky way, making the process surrounding new international partnerships more efficient.

As argued in stage model theory, the liability of outsidership can be a significant barrier to internationalisation which can only be overcome by inclusion into relevant market networks (Johanson & Vahlne, 2009). In this context, the identified networks of the companies are important Oa advantages. CLEAN, and the cluster's connection to a large cluster network through ICN, can further be supportive in this process if the firm's network does not extend to the location of interest, as the cluster may be able to include the SME in the relevant network. Hence, this may thus allow the firm to save considerable resources.

In conclusion, both STAC and VisBlue have considerably strong networks that have proven to positively influence and accelerate their internationalisation process. To achieve similar advantages, ReMoni have utilised its CLEAN membership to expand the firm's networks, thus exemplifying CLEANS ability to help SMEs establish relevant relationships and networks abroad.

5.3.2.1.1.4 Access to Capital

A recurring theme in the three firms' technologies, innovative capabilities and networks is that the size of the firm is often a determining factor for the barriers they face and the way they approach these barriers. Hence, an overarching barrier throughout the above sections is the liability of smallness, which

is significant within the cleantech industry, as the long innovation cycles and large required initial investments make it difficult for cleantech startups to access funding through traditional funding methods (Leonhard, 2018). As mentioned by VisBlue's CEO "if you look at capital funds, they require their money back 7-8 times within 5 years. So in regards to early investments, if you are a young firm like we were a few years ago, you will never get those types of investors on board. Because they do not expect us to be able to make that kind of money in 5 years." (Visblue Interview 1). Therefore, alternative funding methods and support from a cluster may prove significant in the early years. Hence, in order to assess the impact that CLEAN has on the SMEs' potential for internationalisation, it must be analysed whether the SMEs have leveraged the cluster network to mitigate the liability of smallness. The firms' individual approach to accessing funding without the support from CLEAN will not be addressed.

While VisBlue has not used CLEAN to access financing, the two other firms have in some cases relied on CLEAN to achieve financial support (VisBlue interview 1; STAC interview; ReMoni interview). For STAC, support for access to funding has been a key contribution from CLEAN. STAC's CEO states that CLEAN "made us aware that we had the possibility to apply for OPI which is a grant from Syddansk Vækstfremme (Southern Denmark's Growth Promotion) back in 2018" (STAC interview). Hence, CLEAN initially contributed by identifying financing possibilities that were suitable for the firm. He further elaborates that CLEAN has provided valuable inputs for the application process for the OPI grant as well as for other funding processes such as the EUDP (Energy Technology Development and Demonstration) application and an accelerator program called Cleantech Impact Accelerator. This acceleration programme is available to firms that match specific parameters and operate within the sectors of Transportation, Water & Wastewater, Air & Environment, Materials, Manufacturing/Industrial, Agriculture, Recycling & Waste (CLEAN, n.d. f). The overall aim of the project is to contribute to a sustainable transformation of the food sector, and STAC was accepted as a participant due to the novelty of the water cooling solution and the primary aim for STAC's participation in the accelerator was to strengthen the firm's capabilities to access funding. Hence, by enabling participation in this programme, CLEAN supported STAC's network to investors and learning processes by enabling the firm to engage in tailor-made business development training and tap into an international network of investors and other actors (CLEAN, n.d. e). Hence, CLEAN enabled STAC to strengthen the Oa advantages in terms of access to capital, but the actual financial support, both in the OPI grant, the EUDP application and the accelerator, originated from external sources. In order to gain this funding, STAC was evaluated based on the firm's own capabilities and technology. CLEAN has thus contributed indirectly to STAC's ability to overcome the financial barrier within the cleantech industry as identified on the macro level. This support has been vital given that the capital obtained through these programmes has contributed to the firm's ability to survive despite the long lead time that is required to develop the technology (McCauley & Stephens, 2012).

Remoni has also used CLEAN to somewhat overcome the liability of smallness through access to capital, most significantly through the previously explained FIE project. In this project, the participating firms were able to apply for financial support for the inclusion of the knowledge institution, the cost of including an external consultant and 25% of the salary for the participating SMEs, corresponding to approximately 50% of the project costs (CLEAN, n.d. c). According to the CEO, "this helps us lower the risk. It is simply cheaper for us to try it out… This project, where we develop something entirely new, we would not have been able to touch otherwise. So it helps us lower the risk to a point where we can engage, and where we can get our investors on board." (Remoni interview). In short, Remoni would not have engaged in this project without this financial support, because the risk would have been too high. Hence, participation in this type of project can be used to mitigate the liability of smallness by providing access to funding which in turn allows the firm to build O-advantages. Moreover, it exemplifies how cleantech SMEs sometimes need public involvement in order to engage in experimentation and how CLEAN can facilitate this involvement through the triple helix dynamics in CLEAN (Alcacer & Chung, 2007).

In conclusion, while VisBlue primarily relies on internal capabilities to attract financing, STAC leverages the cluster membership through indirect network and learning based support for funding applications and acceleration programmes. Moreover, ReMoni utilises CLEAN for project based financing. These contributions from CLEAN are thus generally indirect and/or project based and help the firms to overcome the cleantech industry barrier of large capital needs and in turn the liability of smallness.

To conclude on the various types of Oa advantages residing in the three case firms, as well as CLEAN's influence on these, the main takeaways have been summarised in table 5.

	Asset specific Advantages		
	ReMoni	**STAC**	**VisBlue**
Product Innovation	Novel Technology	Novel Technology	New markets
Internationalisation Experience	Split Production, Eurostars	International Development Partners	Sales partner in the Netherlands
Networks	Large Network	Large network	Large network
Access to capital	Yes	Yes	Yes
	CLEAN influence		
	ReMoni	**STAC**	**VisBlue**
Product Innovation	FIE project	No	No
Internationalisation Experience	No	No	No
Networks	Trip to US	No	Trip to South Korea and Stockholm
Access to capital	FIE project	OPI, EUDP, Cleantech Impact Accelerator	No

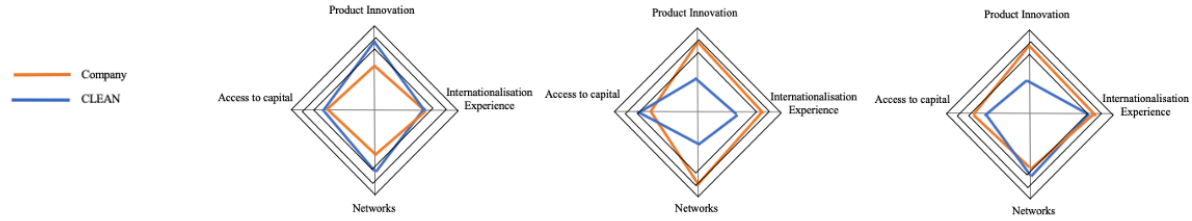

Table 5: Asset-Specific Advantages of the Firm

From the table it can be concluded that all three companies overall possess relatively strong Oa advantages, but that the specific advantages vary greatly. ReMoni has made extensive use of CLEAN in order to develop and acquire the necessary assets to improve the comparative advantages, access project based capital and enlarge networks globally. Contrarily, STAC has primarily used CLEAN for learning and networking related to gaining access to capital and restrained from engaging in other networking activities because the firm's own network already includes a considerable amount of potential partners and customers. Similar to STAC, VisBlue has primarily made use of the firm's own network to develop Oa advantages, but has utilised CLEAN in certain areas, to increase the international network and gain access to new project opportunities. The three firms thus illustrate the varying role that the cluster plays in the acquisition of Oa advantages and how the specific firm's characteristics and already existing Oa advantages are determining for the utilisation of the cluster. In order to further assess the cluster's influence on the SMEs' O advantages, the specific contributions in terms of cost minimization must be investigated.

5.3.2.1.2 Transaction cost minimizing ownership advantages (Ot)

A central aspect to address when analysing transaction cost minimising assets is the scope and specialisation of the firms, originating from their size and experience as well as the diversity of their product portfolio (Dunning, 2015). Given that the three firms are relatively young SMEs, they do not possess the transaction cost minimizing advantages that their larger counterparts have. Hence their small size does not allow for resource sharing across divisions, between parent company and subsidiaries nor economies of scale. At this early stage, the firms are all highly specialised and each

produce only one component to be implemented into larger system of products provided by other suppliers. This is in stark contrast to the giants in the industry who posses a more diversified product portfolio potentially covering a larger part of the total distribution system. Due to this lack of transaction cost minimizing advantages in terms of size, experience and scope, the three firms are more dependent on their network and their cluster membership to reduce transaction costs and share industry knowledge. How their network and partnerships strategy can lead to transaction cost minimizing O advantages will be analysed firstly in terms of the SMEs approach toward partnership strategies, secondly through exclusive access to knowledge and thirdly in relation to opportunity identification as visualised figure 11.

5.3.2.1.2.1 Transaction Cost Minimisation in Partnerships

All three companies have to some degree adopted a partnership strategy as their primary method for distribution and internationalisation. The firms' networks plays an important role in this strategy as they may enable the firm to reduce the transaction and coordination costs related to identifying potential partners and opportunities for collaboration both domestically and abroad. Despite the fact that the initial transaction costs related to establishing partnerships may be high, due to the development of mutually beneficial contracts and control mechanisms, the associated costs may be reduced in the long term by the establishment of trust between the parties (Dyer & Singh, 1998). More specifically, if both parties trust that the other honors to the contractual agreement, the need for extensive control mechanisms is reduced. Another way to reduce the transaction costs of said partnership is through the establishment of mutual incentives. An example of this is seen with Visblue, where a fundamental criteria when selecting partners is that the parties provide complementary products to VisBlue's redox flow battery. VisBlue's Dutch partner produces containers which can be combined with the batteries in a joint storage solution. Other partnerships of this type include joint solutions where the partner provides solar cells which can be combined with VisBlue's battery. Thus, according to VisBlue, selling a solution that combines the firm's product with the distribution partners' is more valuable than arm's length transactions or having an agent which merely sells VisBlue's product. More specifically, such an agreement aligns the incentives of the partners which increases trust and reduces the need for vast and costly control mechanisms (VisBlue interview 2). Similar mechanisms are foundational for STAC's distribution agreement, where STAC's components are sold in combination with partner products which again establishes a mutual incentive for sales. Furthermore, STAC installs 3D printers at the different international partner sites to produce STAC components, which reduces the ongoing transactions between STAC and the partner, as it removes the need for STAC to regularly transport components to these countries.

This reliance on partners is also present in the firms' approach to risk diversification. Risk diversification as a factor for internationalisation is especially evident for Remoni, as the firm has spread

the production over several different domestic and international sites (Remoni Interview). According to the CEO, the firm has made this decision in order to mitigate the risk of malfunction etc. and thereby avoid being dependent on only one specific production site (ibid.). The decision to reduce production risk by setting up an additional production site is very resource heavy and requires vast amounts of both human and financial capital, which indicates that ReMoni prioritises the long term goal of risk diversification over the short term transaction cost minimizing objectives (Dunning, 2000).

It furthermore reduces the transaction costs related to partnerships that all three companies possess the necessary IP rights. This helps reduce the risk of a partner company acting opportunistically. If the SMEs did not possess these IP rights, the transaction costs would increase drastically, due to the increased need for control mechanisms between the parties.

5.3.2.1.2.2 Exclusive or Favorised Access to Knowledge

Another Ot advantage is the exclusive access to important resources such as information. As determined in the previous section regarding superiority of technologies and the competitive situation, all three firms' possess a comparable advantage on the global market because of the novelty of their technology. The O advantages of such novel technologies rely on the knowledge sources that the firms have access to, and whether their access to this knowledge is exclusive or favorised for them alone. Exclusive or favorised access to such resources constitute important Ot advantages (Dunning & Lundan, 2008). STAC has exclusive access to information and research since one of the key people in the firm, Gunnar Minds, is the inventor of the core technology for water as a coolant (STAC interview). Similarly, the CEO of VisBlue states that "Two of our founders are professors i Aarhus and Portugal, so we have access to the knowledge bank which exists in the academic world" (Visblue Interview 1). The fact that the companies have this exclusive access to the knowledge reduces transaction costs since they do not need to acquire it through market transactions (Dunning & Lundan, 2008). Both VisBlue and STAC are additionally participating in projects and similar collaborations with Universities, which enable them access to additional knowledge spillovers and exclusive research within their respective fields.

While STAC and VisBlue possess this Ot advantage through their founders, ReMoni leverages CLEAN to minimise the costs of access to knowledge. In example, the knowledge that is generated through the FIE project is exclusive for ReMoni. Through this project, CLEAN is covering approximately 50% of the associated costs, thus reducing the transaction costs related to buying similar access through the market. Hence, because CLEAN enabled the collaboration and cover 50% of the associated costs, the cluster allows ReMoni to reduce the costs related to accessing external knowledge and establishing relations to research institutions.

5.3.2.1.2.3 Assessment and Identification of Markets and Opportunities

Another cost that is significant for firms when internationalising is the cost of assessing the potential of foreign markets and identifying opportunities. Within transaction cost theory, this is regarded as search and information costs, which may be reduced if the firm is able to effectively utilise its networks (Hill, 1990). As Katharina Laursen from VisBlue noted, this is particularly important for smaller firms, because committing employees to exploring markets take up a significant part of the firm's resources (VisBlue interview 2). Hence, making the process of market research more efficient brings substantial value by minimising the related costs and resource commitment - especially for SMEs where capital and resources are scarce. As mentioned by ReMoni, by utilising the membership in CLEAN, the firm is able to work more efficiently and reduce some of the risk when looking to identify new opportunities. CLEAN is able to make the opportunity identification more efficient for the members, as the cluster identifies opportunities that might fit into the companies strategies and helps facilitate meetings with potential clients and government officials abroad. For example, by participating in Clean's trip to the US, ReMoni reduced the costs related to exploring opportunities in that market (Remoni interview). Similar to ReMoni, VisBlue utilises its membership in CLEAN to identify potential business opportunities without having to commit vast resources to market research. This is evident in the trips the firm participated in in both South Korea and Stockholm where CLEAN informed the company about the potential opportunities. Reducing these initial transaction costs by sharing information and foreign connections is thus another key part of clusters' role in supporting its member firms (Davies, 2013; Delgado et al., 2016). However, STAC has yet to make use of the initiatives presented by CLEAN, as the firm is driven by opportunities arising from its own network (STAC interview).

In conclusion, when evaluating the transaction cost minimizing advantages it is once more evident that the firms experience vast differences in their Ot advantages. The findings have been summarized in the table below.

	Transaction cost minimizing Advantages		
	ReMoni	**STAC**	**VisBlue**
Partnership Strategy	Current partners in their production sites	Several global partners	Dutch partner
Exclusive access to knowledge	Project connection to research institutions	Direct connection to research institutions	Direct connection to research institutions
Networks and Opportunity Identification	Internal market analysis and network approach	Network approach	Internal market analysis
	CLEAN influence		
	ReMoni	**STAC**	**VisBlue**
Partnership strategy	No	No	No
Organisational Resources	FIE Project	No	No
Networks and Opportunity Identification	FIE Project US trip	In terms of funding	Potential Opportunities abroad

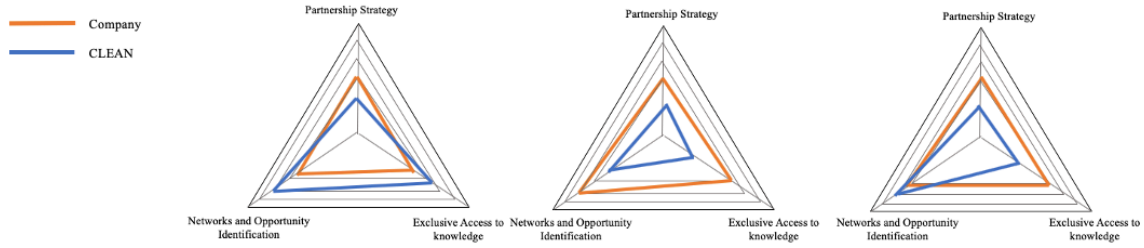

Table 6: Transaction Cost Minimizing Advantages

As illustrated in the table above, the interview data exhibits a clear tendency among the firms to utilise their respective networks to build Ot advantages in terms of distribution and production. While these interfirm distribution and production partnerships are mainly built through bilateral relationships between the firms and potential partners, CLEAN contributes by supporting the firms in identifying the right partners and potential opportunities abroad. Moreover, exclusive or favorised access to knowledge is key for the three firms. While STAC and VisBlue inherently avoid accessing this knowledge through market transactions, CLEAN enables ReMoni to lower the transaction costs of access to knowledge. The fact that both STAC and VisBlue up until now have somewhat avoided accessing knowledge through market transactions or CLEAN initiatives may stem from their access to triple helix actors through their founding team and networks. This indicates that the firms with this direct access are less dependent on the cluster's triple helix aspects and the benefits that arise.

In order to further assess the three SMEs O advantages, the following section will investigate the firm's institutional advantages and thus how different institutions affect the firms in their internationalisation process.

5.3.2.1.3 Institutional Advantages (Oi)

A crucial aspect within O advantages is the influence that formal and informal institutions have on the firms' activities as well as their internal processes and interactions with external actors. These institutions largely exist on the macro level, and the analysis of Oi advantages thus addresses the

influence that these macro level aspects have on the firms on the micro level. The following section will therefore first address the influence that formal institutions, such as laws and regulations, have on the firms' O advantages. Thereafter, the role of networks and clusters will be investigated and followed by an assessment of the regional industrial identity as an Oi advantage, as visualised in figure 11.

5.3.2.1.3.1 Formal Institutional Environment

As previously described on the macro level, legal and political institutions can both hinder and accelerate the trajectory of a firm's development. Hence, the macro environment such as political support or restrictions has a direct influence on the firms on the micro level. In order to investigate the influence that this heavily regulated cleantech industry has on the three firms, these formal institutions are particularly crucial to address.

Firstly, the formal institutional barriers in the shape of restrictions and regulations are important to address. Here, it is crucial to note that these barriers vary greatly across the cleantech industry because it encompasses a broad range of technologies which naturally means that there is different legislation for each technological branch. For the cooling industry in which STAC is positioned, a central barrier is that cooling systems are typically based on chemicals which are heavily regulated because of the security risk and contamination concerns. In this sector however, STAC has a significant Oi advantage through the nature of the core technology as STAC's solution uses water as a coolant instead of chemicals. Therefore, the firm avoids the institutional barrier of having to apply for product approval (STAC interview). Also ReMoni operates in a less regulated niche, since there is no safety risk or contamination concerns associated with resource monitoring sensors (ReMoni interview). Hence, in light of the specific niche in which ReMoni is positioned, the firm has an Oi in the shape of the absence of restrictions. VisBlue however faces an institutional barrier in that batteries are subject to a range of restrictions, for example regarding the liquid acid inside flow batteries. While STAC has avoided this barrier altogether by basing the core technology on water from the beginning, VisBlue is currently in the process of overcoming the barrier. More specifically, the ORBATS project that VisBlue is engaged in seeks to replace the acid with an organic liquid which may in turn reduce the regulatory pressure (Cleeman, 2020). Although the main purpose of the project is to develop a more cost-efficient and sustainable solution to energy storage, a favorable side effect is that the technology would, if implemented in VisBlue's batteries, put the firm in a better position in terms of regulations. While this concerns the Oi advantages that the respective firms' use to avoid the institutional forces that could hinder their endeavors, it is equally important to assess how they leverage the institutional aspects that can accelerate their development.

For STAC, institutional advantages are important for both the establishment of the firm in the first place and for the current considerations about internationalisation. Initially upon establishment of the firm,

the management team was looking into technologies for heating. However, when talking to potential customers and partners in his network, he noticed that "they would rather talk about cooling" (STAC interview). Because he identified this demand for cooling, he investigated the market further and found that the EU commission in 2016 had issued guidelines stating that cooling should have the same priority as heating for EU residents. Because of this favorable institutional environment in the cooling market, STAC changed its course for the establishment of the firm to focus exclusively on cooling (STAC interview). Hence, formal institutional advantages were foundational for the establishment of the firm because they induced a demand which made it attractive to enter the cooling business. The considerations about internationalisation are also influenced by these formal institutions, since EU countries due to these regulations have a higher incentive for implementing cooling solutions in their district heating systems now than before the regulations were enforced.

While STAC identified these Oi advantages in the cooling market through bilateral interactions with actors in their own network, VisBlue has leveraged their membership in CLEAN to identify potential Oi advantages. For example, the cluster identified South Korea as a potential location for Visblue to internationalise to based on the legal landscape and institutional environment. More specifically, a new law was enforced in the country, forbidding the use of lithium batteries because they are easily flammable and therefore pose a high risk. In connection with this ban of lithium batteries, the South Korean government recommended the use of flow batteries as an alternative because they provide a higher level of safety and because they are more sustainable due to the higher level of recyclable components (CLEAN interview 1; VisBlue interview 1). Since flow batteries is the type of batteries that Visblue produces, this naturally provided an Oi advantage of the location. Hence, CLEAN contributed to Visblue's Oi advantages by identifying a formal institutional advantage. It can further be argued that investments made on the basis of a beneficial legal environment in the receiving country is the opposite of an escape investment in Dunning's (1993) sense. More specifically, the firm does not escape from restrictive policies in the home country, but is instead attracted to the receiving country due to beneficial policies. Hence, this constitutes a pull, rather than a push effect.

These cases of STAC and VisBlue illustrate how networks can be important for identifying new opportunities to achieve Oi advantages. This can be considered particularly important in industries, like cleantech, where formal institutions can provide great advantages and disadvantages. Here, CLEAN can contribute by enlarging the firms' networks as well as identifying formal institutional advantages that can benefit the particular SME in question as it was the case with VisBlue. However, the interview data suggests that the need for cluster support relies on the firm's already existing network, since STAC refrains from using CLEAN to identify legal and regulatory opportunities and instead uses their own network. However, networks do not only contribute to Oi advantages because they can provide

knowledge about formal institutions. They also serve as informal institutional assets in themselves because extensive and high quality relational assets provide an institutional infrastructure in which firms can minimise transaction and organisation costs and improve their activities.

5.3.2.1.3.2 Networks and Clusters as Institutions

Given the importance of the relational aspects of the institutional infrastructure in which firms operate, this section seeks to examine whether and how CLEAN influences the extent and quality of informal relationships.

Firstly, it is important to note that all of the instances in the previous sections where CLEAN has contributed to the firms' relationships and networks show how CLEAN accelerates the extent (and arguably often the quality) of the firms' relational assets. Because these networks provide an informal infrastructure for the firms' cross-border value-adding activities, they are part of the Oi advantages (Dunning, 2008). Moreover, CLEAN contributes to the relational assets of the firms by facilitating relationships between triple helix stakeholders. These relations provide the SMEs with connections to governmental stakeholders such as knowledge institutions and public institutions in Denmark as well as the host countries of their international activities.

In example, ReMoni's CEO argues that one of the primary contributions CLEAN has made to the firm's internationalisation process is to arrange trips to potential receiving countries and attract the right stakeholders to the events on these trips (Remoni interview). For a new company like Remoni, getting in touch with the right governmental stakeholders is crucial for their chances of establishing reference projects in the receiver country. According to the CEO, participating in a trip to the United States facilitated by CLEAN "made a lot of things easier". He elaborates that "It is easier to attract the state of New York when a whole group of firms are participating, than if there was only one" (Remoni interview). Hence, by entering the United States through CLEAN, it becomes easier for ReMoni to establish relations to these actors and thereby gain access to the institutional infrastructure in the country. The interview with CLEAN highlights that gaining reference projects is typically one of the main barriers for SMEs when entering a new country. Therefore supporting the SME's process of building a valuable track record is a main part of CLEAN's role (CLEAN interview 1).

The cluster's facilitation of relationships between triple helix stakeholders is also evident for VisBlue. As described in the previous section, when CLEAN identified a potential opportunity for VisBlue in South Korea and established connections to South Korean networks, the cluster supported VisBlue's learning process about a potential new market. VisBlue's CEO emphasises that the firm would not have been aware of this opportunity, had it not been for their membership in CLEAN (Visblue interview). Namely, CLEAN identified South Korea as a potential market for Visblue because the South Korean

government showed a general interest in this battery type. The cluster arranged a trip for Visblue to meet with South Korean research institutions and potential clients, which established a connection between Visblue and different governmental stakeholders in the country (Visblue interview 1). This somewhat reduced the liability of outsidership for VisBlue, because the firm through this network could gain access to information which would not have been available for outsiders (Johanson & Vahlne, 2009). Hence, CLEAN's support in establishing this relationship shows how the cluster has contributed to the Visblue's Oi advantages.

Another instance where VisBlue has achieved insidership in a valuable network through CLEAN is the case of a C40 project in Stockholm concerning the harbour. The objective of the project was to turn the old industrial harbour into a new and more sustainable one. This included a large scale transformation of several areas including energy, transportation, climate adaptation, eco-cycle systems and sustainable housing (C40 cities, 2015). In this project the municipality and harbour sought new solutions for energy storage in buildings, so CLEAN identified a potential demand for VisBlue's products. As the CEO explains, the relationship between VisBlue and the municipality and harbour is currently informal and VisBlue's role in the project thus far is to provide inputs and suggestions as to how a possible new harbour could use energy storage. The ultimate goal of the project is to develop a concept which can be used similarly by harbours in other large cities around the world (Visblue interview 1). Hence, the relationship to these governmental stakeholders provides VisBlue with an informal Oi advantage in the shape of a relational infrastructure connecting them to a potential market in Stockholm, but also indirectly to other markets which may adopt the concept at a later point in time. This shows how the coherency between Oi advantages and insidership becomes particularly evident when the relationships that are established are relations to institutional actors, since they have a strong influence on the development of new standards. Moreover, it provides an opportunity for VisBlue to be part of setting a standard for this concept in Stockholm and potentially other markets. By being part of this initial standard-setting process, the firm can participate in shaping the institutions that emerge from this process, which is a substantial Oi advantage. This exemplifies a situation where CLEAN facilitates access to public actors in order to implement sustainable solutions, as suggested on the macro level. This is coherent with the notion from McCauley & Stephens (2012) that it is particularly important for clusters within the cleantech industry to establish these connections between the private and public sector. More specifically, in order to support the member firms while contributing to the macro level strategy for sustainable development, cleantech clusters need to establish networks and facilitate trust between micro and macro actors (McCauley & Stephens, 2012). Hence, within the focus on networks and relationships lies also the notion of trust as a determining factor.

The cluster's potential to facilitate trust is also relevant in collaborations between different micro level actors given that trust lowers the need for monitoring and control (Dyer & Singh, 1998). According to ReMoni's CEO, CLEAN does not directly contribute to building trust between the firm and foreign potential partners or customers by functioning as a common trustee, because foreign partners are not familiar with CLEAN. He argues that foreign business partners "understand the royal crown and a blue flag with yellow stars. That, they have seen before, and that works." (ReMoni interview). Hence, in ReMoni's experience, CLEAN in itself does not possess sufficient traction to act as a common trustee with foreign partners. Rather, the firm perceives EU and the reputation of Danish cleantech as a quality stamp that the firm can leverage. Moreover, CLEAN does not have any standards or minimum requirements for firms wishing to become members, which means that foreign actors arguably do not consider it to be a quality stamp if a Danish firm is member of the cluster since anyone can participate (CLEAN interview 1).

However, despite the fact that CLEAN may not directly induce trust, several indirect contributions to trust in relationships have been observed. In the case of ReMoni's internationalisation process in the US, the CEO argues that partners largely judge the firm on reference projects, and long-term trusting relationships are established on the basis of the track record they manage to build (Remoni interview). Hence, CLEAN's influence on the process of building a track record by conducting reference projects is an indirect contribution. Similarly, CLEAN has supported five projects in China in order for consortias of member firms to develop reference projects in the country, which is a legal requirement for firms entering China (CLEAN interview 1). However, it is important to note that the need for trust in relationships varies depending on the entry mode. Since CLEAN primarily focuses on time limited non-equity based modes in the shape of export, the amount of resources committed in these projects is relatively low compared to equity based modes. This decreases the risk and thereby potentially the need for trust between the parties (Kumar & Subramaniam, 1997). Thus, rather than contributing to building of trust in these short term international projects, CLEAN's contribution is more directed towards the initial steps of trust establishment since the initial matchmaking and network activities provide a basis upon which the firms can subsequently build trusting relationships. Moreover, the experiences that the firms achieve through export projects, delegation trips and knowledge exchanges, such as VisBlue's Stockholm trip, contribute to the firms' learning processes about foreign markets. Hence, by identifying opportunities for export projects now or in the future and reducing the costs and resources committed to accessing resources such as knowledge through externalised collaborations, CLEAN contributes to the externalised modes of entry that the firms are already pursuing. This contribution is both directed towards the short-term goals of reducing transaction and coordination costs, but also the initial steps of long term imperatives such as building relational assets and facilitating bridges to foreign markets (Dunning, 2000; Coviello & Munro, 1999).

Apart from the Oi advantages that CLEAN facilitates between the members and international actors, the network between the members within the cluster itself also constitutes an institutional infrastructure for cooperation and knowledge sharing. While no specific knowledge sharing activities among member firms have been identified in the case of the three SMEs, CLEAN has in several instances facilitated knowledge spillovers from governments and academia to the firms, and the other way around. This supports the notion from Alcácer & Chung (2007) that knowledge spillovers do not just occur between firms but also between triple helix actors, and the cluster thus constitutes an institutional infrastructure between these actors. When looking at CLEAN as an individual cluster, the institutional infrastructure exists on the national level. However, when assessing CLEAN as part of the ICN, it becomes evident that the meta cluster facilitates an institutional infrastructure across national boundaries (Davies, 2013). In some cases, the infrastructure consists of formal institutions such as the ICN Passport which has the objective to "bring down barriers for cleantech market penetration" (International Cleantech Network, n.d d.). Specifically, member firms of one cluster can use the ICN Passport to gain access to the facilities of another ICN cluster such as office spaces or assistance to identify partners in the country of the other cluster. While some clusters within the ICN, such as the Austrian cluster, rely heavily on the ICN Passport, CLEAN views this formal service as a minor part of ICN (ICN interview). According to the senior project manager, CLEAN prefers to facilitate these benefits for their members through informal channels, and he argues that the passport solution is not dynamic enough because it requires filling out forms and awaiting bureaucratic processes (CLEAN interview 1).

This preference for informal connections exemplifies the importance of employing a definition of institutions, which includes both formal and informal aspects. Moreover, the collective power that the network provides is the main benefit of the metacluster, as combining the clusters into a network creates a much broader SME network (Davies, 2013). This provides more traction when addressing foreign actors outside the network. For instance, the head of the secretariat at ICN argues that, if a cluster approaches for instance South America's largest water utility provider, it provides substantial value to be able to say "amongst our network we got like 1000 water SMEs and then we set up a meet the buyer with that South American partner, then that's a lot more for the SMEs than just being able to use facilities." (ICN interview). This is consistent with Davies' (2013) notion that being part of a meta cluster can help promote individual clusters on a global scale. Hence, these local and global cluster networks provide meta level infrastructures which SMEs can utilise as part of their O advantages.

5.3.2.1.3.3 Regional Industrial Identity

While the cluster and meta cluster facilitate infrastructures on the meso level, the home country provides institutional implications on the macro level. Namely, the Danish innovation system as described in the macro level provides an institutional infrastructure for the firms to develop their innovative capabilities.

The strength of the innovation system and its focus on supporting cleantech provides a significant Oi advantage for Danish firms in the industry. The institutional advantage for Danish cleantech SMEs is also exhibited in the ranking as the best country when it comes to addressing the industry specific barriers and driving demand (Cleantech Group & WWF, 2017). Moreover, the fact that the Danish government expressed a wish to improve the innovation strategy on certain parameters exhibits institutional strength, as the quality of institutions is largely determined by their ability to identify a need for change in themselves and take the necessary action (Dunning, 2015). However, in order to fully understand the impact that Denmark as a home country has on the companies and how CLEAN contributes to this, the institutional advantages of Denmark must be addressed further. In order to do this, Romanelli & Khessina's (2005) term 'Regional Industrial Identity' serves as an analytical tool.

The regional industrial identity is comprised of the perceptions that residents, local businesses and organisations, foreign investors and external observers share about the region (Romanelli & Khessina, 2005). While it has been out of scope to assess Danish residents' perceptions in this thesis, the interview data from the three firms, clearly suggests that they perceive Denmark their status as a Danish cleantech SME as a strength when interacting with foreign actors due to the international reputation of the Danish cleantech industry. As mentioned by the CEO of STAC; "When we are in the United States for instance, and we talk to people, we can see that Denmark has a good name. When we are in India, we (Denmark) have a good name. So in that area people know that our windmill industry, which is the driving force in this context, is reasonable." (STAC interview). STAC has thus experienced that the institutional identity of Denmark has positively contributed to the internationalisation process in both the United States and India. Similarly, when asked whether the firm is influenced by the Danish cleantech industry's reputation, VisBlue's CEO replies: "Yes definitely…There are also several American firms looking at Denmark within cleantech to see if there are any interesting partners" (Visblue interview 1). He thus emphasises that he has experienced situations wherein American firms have specifically targeted Danish cleantech firms for potential partnerships. Also Remoni acknowledges to have had similar experiences, where the Danish flag and association have proven beneficial in establishing credibility abroad (ReMoni interview). Based on the interview data it can thus be argued that the strong identity that Denmark possesses within cleantech positively contributes to the Oi advantages of the firms, as it contributes to establishing credibility abroad.

This perception is also evident in the way that Denmark promotes the cleantech industry to foreign investors, where the Danish cleantech industry is promoted as a position of strength. For example, on the Danish Ministry of Foreign Affairs' official webpage for foreign investors, it is stated that "Denmark holds exceptional business opportunities for the fast-growing cleantech sector" and that "Successive Danish governments have pledged to sustain one of the world's most conducive business environments

for cleantech. Today, almost 40 years of ambitious energy policies have put Denmark ahead in the renewable energy industry. Our complete cleantech value chain stands on strong foundations – all part of the attractive business prospects we offer investors and international exporters." (Invest in DK, n.d.). Hence, Denmark's identity as a strong cleantech nation is actively promoted through official communication channels to investors. More importantly however, when international actors invest in, or interact with, cleantech firms or other cleantech actors in Denmark, that validates the perceptions that domestic actors have about Danish cleantech which strengthens the regional industrial identity (Romanelli & Khessina, 2005). The heavy interest from international investors and partners that the three firms describe also provides an example of this external validation of the Danish industrial identity.

When analysing this regional industrial identity, clusters provide an approachable unit of analysis, since they exhibit and accelerate the characteristics of the region in which they exist (ibid.). Therefore, CLEAN is the central focus in this investigation of Denmark's industrial identity. When assessing CLEAN as an indicator for the industrial identity, a generalised focus can be observed through the diversity of the member firms. These are positioned in a broad spectrum of different sub-industries within both environmental- and energy technology. Moreover, the firms vary from sub-component suppliers to producers of end-products or systemic solutions, which means that they cover different parts of the value chain. The broad scope also materialises in the three firms chosen for this thesis, which each have very different technologies that address different markets and applications namely; cooling, energy storage and measurement/energy efficiency.

The influence that CLEAN has on the three firms' Oi advantages include the cluster's acceleration of Danish industrial identity. Here, CLEAN explicitly communicates that the cluster aims to support the Danish positions of strength within industry and research related to energy and environment (CLEAN, n.d a). This is done through communication of these positions of strength through marketing of Danish solutions and innovations to domestic and international observers. This official communication naturally increases awareness of Denmark as a strong cleantech nation. More importantly however, the cluster contributes to the strength of the industrial identity by increasing interactions between Danish members as well as between Danish members and international actors. In terms of CLEAN's contribution to the scope of the industrial identity, the senior project manager emphasises that the approach to collaboration between the members aims to accelerate a broad scope (CLEAN interview 1). He describes that the cluster employs a broad scope in international activities such as C40 projects in order for the solutions and findings from the projects to be applicable in other settings as well. By facilitating projects with many different solution providers, and sometimes initiating the establishment of conglomerates consisting of firms from different sectors or parts of the value chain, CLEAN enables

spillovers or convergence between different technologies (CLEAN interview 1). These spillovers and convergence effects are exactly what makes a generalised focus preferable to a narrow one, because it allows for continuous development and keeps the innovative capacity in the cluster from stagnating (Romanelli & Khessina, 2005; McCauley & Stephens, 2012). Hence, applying the notion of regional industrial identity to the empirical data suggests that CLEAN accelerates the strength and scope of Denmark's regional industrial identity which is consistent with Romanelli & Khessina's (2005) notion that clusters not only exhibit the characteristics of a region but also also accelerate them. This finding aligns with McCauley & Stephens' (2012) notion, that by supporting firms and cultivating sustainable technology, clusters can accelerate the cleantech- and sustainability related identity of an area. Besides supporting the sustainable development in the country, this serves as a significant Oi advantage for the firms when they interact with international actors, because the identity of the country from which they originate becomes part of their own identity. Hence, the Danish industrial identity constitutes an informal institution in that it influences the firms' foundation for interactions with other firms (Dunning, 2015).

In conclusion, when evaluating the Oi advantages it is evident that the three firms possess somewhat different Oi advantages based on their individual characteristics, while other Oi advantages are similar since they are based on the Danish industrial identity. The findings have been summarized in table 7 below.

	Institutional Advantages		
	ReMoni	**STAC**	**VisBlue**
Institutional Environment	Less regulated niche	Avoids product-regulation	Faces product regulation
Networks and Cluster Dynamics	Positive	Positive	Positive
Regional Industrial Identity	Strong and generalised	Strong and generalised	Strong and generalised
	CLEAN influence		
	ReMoni	**STAC**	**VisBlue**
Institutional Environment	No	No	Identified formal Oi advantage
Networks and Cluster Dynamics	US Trip	No	Trips to South Korea and Stockholm
Regional Industrial Identity	Accelerating strength and breath	Accelerating strength and breath	Accelerating strength and breath

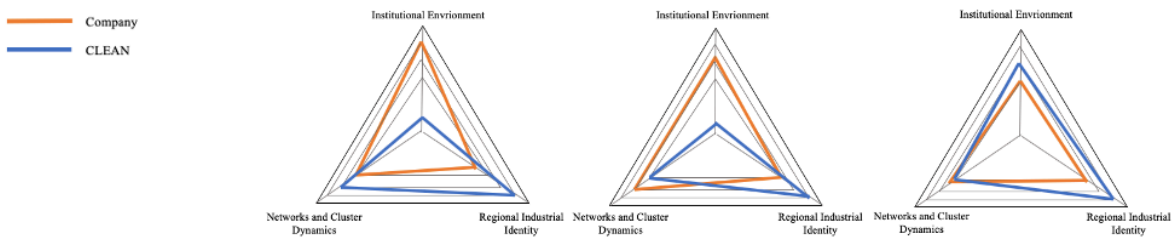

Table 7: Institutional Advantages

While STAC has avoided regulations altogether by founding the company on the technology of water cooling, VisBlue is facing regulations qua the technology. The current ORBATS collaboration may

however reduce regulations by increasing the safety of their solution. Contrary to the two others, ReMoni is positioned in a less regulated niche. Moreover, STAC and VisBlue both have certain Oi advantages in the shape of rules and regulations that favor their specific technology. Where STAC has identified these Oi advantages themselves, CLEAN has supported VisBlue in identifying beneficial formal institutions in South Korea. Additionally, CLEAN contributes to the Oi advantages of ReMoni and VisBlue through the facilitation of relational assets, and especially relations to institutional actors such as governments abroad. For STAC, this type of contribution from CLEAN has not been observed, which may cohere with the fact that STAC already has an extensive network. Moreover, the cluster itself constitutes a national institutional infrastructure for cooperation, inter firm activities and knowledge spillovers between triple helix actors, and the ICN constitutes an international infrastructure for cooperation. In these infrastructures, it has been observed that informal institutions often are preferred. Analysis of CLEAN's scope and the perceptions that the three firms and external observers have of the Danish cleantech industry suggests that the danish industrial identity can be defined as strong and generalised. CLEAN contributes to accelerating these characteristics by facilitating an increased frequency of interactions and focusing on broad and generalised collaborations.

5.3.2.1.4 Ownership Advantages and Cluster Dynamics Summarised

To conclude on the combined ownership advantages of the three case firms, the table below has been created. The table looks to compare the key characteristics of the respective firms' Oa, Ot and Oi advantages.

Ownership Advantages of the Firms

	ReMoni	STAC	VisBlue
Asset Specific	**Comparatively Strong** - Novel Technology - Split production - Large Network - Access to Capital	**Comparatively Strong** - Novel Technology - Int. Development partners - Large Network - Access to Capital	**Comparatively Strong** - New Markets - Sales partner in the Netherlands - Large Network - Access to Capital
	Developed internally and developed through CLEAN	Developed primarily internally but financially supported through CLEAN	Developed internally –limited inclusion of CLEAN
Transaction cost Minimizing	**Average** - Current partners in their production sites - Project connection to research institutions - Internal market analysis and network approach	**Comparatively Strong** - Several Global Partners - Direct Connection to Research institutions - Network Approach	**Average** - Dutch Partner - Direct Connection to Research institutions - Internal Market Analysis
	Developed internally and developed through CLEAN	Developed primarily internally, but financially supported through CLEAN	Developed internally
Institutional Assets	**Comparatively Strong** - Less regulated niche - Positive network links to relevant institutions - Denmark's institutional identity as positive Oi	**Comparatively Strong** - Avoids product-regulations - Positive network links to relevant institutions - Denmark's institutional identity as positive Oi	**Average** - Faces product-regulation - Positive network links to relevant institutions - Denmark's institutional identity as positive Oi
	Positively influenced by CLEAN	Positively influenced by CLEAN	Positively influenced by CLEAN

Table 8: Combined Ownership Advantages of the Firms

As can be deduced from table 8, all three firms possess comparatively strong asset specific advantages. Where both STAC and VisBlue's asset specific advantages have been developed primarily internally and through their existing networks, ReMoni has made continuous use of CLEAN to acquire Oa advantages in terms of research collaborations, potential partnerships and networks. For STAC the cluster has been used to acquire Oa advantages indirectly through access to capital and for VisBlue the contribution from CLEAN has been identification of project opportunities abroad.

Similarly to Oa advantages, the firms all possess relatively strong Ot assets. Namely, they all have strong IP rights. STAC and VisBlue have further succeeded in reducing transaction costs in their partnerships through alignment of initiatives. As both VisBlue and STAC have very strong internal connections to the academic world, they are able to decrease the costs related to accessing R&D. ReMoni on the other hand does not have similar connections, and has therefore utilised CLEAN to minimise the costs of access to knowledge. Moreover, ReMoni and VisBlue have leveraged CLEAN to minimise transaction costs of identifying international opportunities.

Lastly, as the technologies within which the three firms specialise are so different, the formal Oi advantages of the firm are considerably distinct. Where STAC and ReMoni have been able to avoid heavy regulation, VisBlue is currently through the ORBATS project trying to develop a solution to overcome this struggle. If successful, this will have positive effects on these Oi advantages. It is furthermore evident that CLEAN contributes positively to the Oi advantages of ReMoni and VisBlue through the facilitation of relations to triple helix actors. All three companies are furthermore positively affected by the strong and generalised institutional identity of Denmark which is in turn accelerated by the presence of CLEAN.

Ultimately, all three case firms possess overall strong O advantages, but they vary greatly in their use of CLEAN to acquire or develop these assets. As both STAC and VisBlue have vast internal resources available in terms of their networks and connections to research institutions, the majority of their O advantages have been developed internally or through their own networks, although VisBlue has indirectly expanded this network through trips to Stockholm and South Korea. This is in stark contrast to ReMoni, who has made great use of CLEAN to acquire and develop O advantages. The use of CLEAN is thus reliant on their individual O advantages. More specifically, the firms leverage the cluster to strengthen their O advantages in areas where they are weak, and refrain from doing so in areas where they are strong. This further provides a great example of how the characteristics and resources of the individual firm impact the way in which the company utilises the cluster.

5.3.2.2 Cluster Influence on Internationalisation Strategies

As established through the above section on ownership advantages, CLEAN is able to influence its member firms' abilities to develop and acquire resources, which positively affects the firms' O advantages. This is in turn important for the firms' internationalisation process, given that the O advantages of the firms play an important role in seizing internationalisation opportunities, as the strength of these assets affects their ability to compete in foreign markets. Therefore, the O advantages affect the internationalisation process as further development and acquisition of these assets influence the firm's internationalisation strategy. The following section will thus first look to understand the current internationalisation activities and entry modes chosen and then look to investigate the effects of CLEAN on the three companies' ownership advantages and how it subsequently has influenced their internationalisation strategy.

In their current internationalisation activities, all three firms have pursued non-equity based modes of entry through either partnerships or licensing agreements. This is evident for STAC through the firm's licensing agreements and development partnerships, for VisBlue through the contractual agreement with the Dutch sales partner and for ReMoni through the contractual agreements established with the production partners. As all of the firms have the necessary proprietary protection measures in place, this may help effectively protect them in these partnerships going forward, and thereby minimise the need for control through internalised modes. Given that the firms are restricted in terms of resources, the costs of organising and accessing their O advantages internally are high compared to the resources they have available. Hence, internationalisation through partnerships and licensing agreements allow them to enter foreign markets without having to commit vast amounts of resources (Kumar & Subramaniam, 1997). These externalised modes of entry in terms of production and distribution may further allow the companies to pursue several international opportunities at once by limiting the amount of resources they need to commit to each location. In example, the externalised mode has allowed STAC to target various international markets already from birth, giving rise to the firm's born global characteristics (STAC interview). ReMoni also explores several international opportunities at once as the firm, whilst looking to commercialise the products in Bulgaria and Iceland through the Eurostars project, is also looking into opportunities in New York.

While STAC's strategy is directly based on the firm's individual network and shows no signs of influence from CLEAN, the strategies of the two other firms have been somewhat influenced by the cluster. For VisBlue, despite a relatively limited use of CLEAN in the development of O advantages, CLEAN has influenced the firm's internationalisation activities through the project opportunities in South Korea and Stockholm. VisBlue's participation shows the influence that CLEAN has on the company's internationalisation strategy, as it indicates an ability to affect the order of entry into other

countries. More specifically, while the trip to Stockholm was in line with the already established strategy of targeting geographically close markets first, the trip and project opportunity in South Korea deviated greatly from this strategy and showed that the firm also employs an emergent network based strategy accelerated by CLEAN. Similar effects were evident for ReMoni in the trip to New York. Despite ReMoni not following a similarly structured internationalisation strategy, the company was not ready to pursue America on its own (ReMoni interview). Thus, by reducing the related costs and risk, CLEAN enabled ReMoni to realise the potential of the market before the company initially planned entry. From these two examples it can be argued that CLEAN does not only influence the O advantages of the firms, but also through these project and networking opportunities, the cluster is able to influence the firms' internationalisation strategies.

CLEAN considers its role in the internationalisation process of SMEs to be primarily focused around the initial stages. This relates to facilitating networks, identifying opportunities and providing an institutional infrastructure which in turn supports the firms in building and developing their O advantages. The vast majority of the international opportunities is furthermore based on export projects. As mentioned by CLEAN; "I think the role of CLEAN really is to sort of identify these opportunities, and connect the right people ... but then if it wants to go further, then it really has to run on its own" (CLEAN interview 2). Hence, if a firm wishes to pursue more internalised modes of entry, that is something that the firm can pursue independently on the basis of its specific O advantages. An example of a firm leveraging its O advantages to pursue more equity based modes of entry, after initial introduction through CLEAN, is ReMoni. The CEO explains that non-equity based export projects in the US can be difficult as a newly established firm that is unknown to the stakeholders in the country. In order to properly penetrate the market, ReMoni therefore sought to use the instrument 'Incerta' which is the State of New York's tool to support foreign firms in establishing a presence in the US and supply the State of New York with solutions to reduce resource waste and reach their climate goals (ReMoni interview). The CEO argues that by using Incerta, "we can transfer half of the costs to the companies and public institutions whom we help by reducing their resources. So instead of the project cost being 100.000 dollars, it costs 50.000 dollars." (ReMoni interview). Hence, using this tool reduces the project costs for ReMoni, but requires the establishment of a subsidiary in the state. CLEAN can be argued to have played a key role in this process as the cluster enabled the relation between ReMoni and the State of New York to be established. The cluster further increased the efficiency of the learning process on the new market and facilitated the required networks and relations to governmental stakeholders. CLEAN thus contributed to ReMoni's O advantages in a way that allowed ReMoni to decrease the related costs and enabled asset creation and augmenting, which in turn lead to the firm pursuing internalisation into the US. Due to the liability of smallness, pursuing equity-based modes of entry can prove difficult because of the vast resource requirements, but through CLEAN, ReMoni was able to

navigate around this barrier to find a feasible equity-based entry into the US. Hence, CLEAN contributed to ReMoni's O advantages which the firm could subsequently leverage.

In conclusion, CLEAN shows the ability to influence the timing of entry and the decisions regarding which markets to explore. CLEAN's influence on the SMEs' O advantages somewhat supports their potential to engage in cross-border value-adding activities. Thus, the subsequent internationalisation strategy and decisions regarding how to organise and leverage these advantages lies with the individual firm.

6. Discussion

In previous sections, a range of implications and challenges specific for SMEs in the cleantech industry have been identified. Moreover, CLEAN's influence on the internationalisation processes of ReMoni, STAC and VisBlue has been assessed. The overarching theme within the influence of cluster dynamics is facilitation of networks and relations. How these networks and relations specifically influence the underlying dynamics of internationalisation for cleantech SMEs will be addressed in the following sections. Firstly, the challenges that cleantech SMEs face in terms of development and implementation of new technology, as well as CLEAN's influence on these processes, will be discussed. Here, specific emphasis will be put on risk and path dependency. Secondly, the SMEs' ability to identify international opportunities and establish relations to international actors is discussed, and CLEAN's influence on this potential is addressed. Thirdly, the foundational barrier of access to capital is discussed in terms of CLEAN's potential to alleviate this issue. Lastly, the interrelations between the macro, meso and micro level will be discussed based on figure 3 in order to assess how the analysis has enabled identification of elements that transcend the individual levels of analysis.

6.1 Development and implementation of technologies

The data applied in this thesis implies that an aspect that hampers SME innovation and development of new technologies is the associated risk of development. Namely, a central challenge for SMEs in the cleantech industry is that development of new technologies is risky due to long innovation cycles, large capital needs and the need for long lead times. This means that SMEs face significant risk when engaging in explorative projects because they may not be economically viable in the beginning. Hence, it can be vital for the SMEs to mitigate this risk by engaging in collaborations. However, given that larger firms typically wait to commit to bilateral cooperations with SMEs until the risk of the technology has decreased, such partnerships are often not a possibility in the initial stages of technological development. In these initial stages, CLEAN can therefore provide opportunities for collaborations

between firms and knowledge institutions and thereby contribute to the innovative capabilities of SMEs in terms of exploratory technological development, thus lowering the risk for the SME. In example, by participating in the FIE project through CLEAN, ReMoni was enabled to develop "something entirely new" in collaboration with Aarhus University whilst avoiding 50% of the costs associated with the project (ReMoni interview). Hence, it has been identified that an important part of the cluster's role as an instrument within the Danish innovation system is to enable experimentation in early stage development of cleantech innovations by reducing risk. Moreover, this exemplifies how CLEAN facilitates collaborations between firms and universities and enables knowledge spillovers between triple helix actors. Such collaborations allow new technologies to evolve and mature even though they are not economically competitive at first (CLEAN, 2019b). This illustrates how the facilitation of networks between triple helix actors can be vital for the SMEs' potential to be explorative and build new Oa advantages in the shape of technological assets.

However, it should also be noted that the exploration that CLEAN enables members such as ReMoni to participate in is relatively predetermined because the overall project objectives have already been established. In example, the overall objective of the FIE project is for SMEs to improve and develop innovative solutions that fit into existing energy systems. Thus, while such projects increase the SMEs' abilities to be explorative, the exploration occurs within the boundaries of the specific project which in turn is determined by actors within the innovation system and ultimately the government. This sets certain limitations in terms of which firms that can participate in the projects - both geographically because the FIE project is limited to firms located in central Jutland, but also in the sense that the firms' solutions must fit into the preset goals of the project. Such boundaries for exploration in the development process are less defined for firms like STAC and VisBlue, because they are founded on the basis of university collaborations. This means that they are able to engage in exploratory projects with universities without the help from CLEAN due to their already existing O advantages. This somewhat enables a more independent choice of the direction in the exploration projects. The fact that there is a predetermined direction of CLEAN's projects illustrates the significant political influence in the industry as well as the cluster's contribution to the SMEs. This is further supported by the finding that public policies are a crucial driver and that path dependency is an underlying characteristic within the cleantech industry, which entails that the industry is particularly prone to political lock-ins. It should however be noted that no specific political lock-ins have been identified in this thesis, which may cohere with the strong Oi advantages identified in terms of the innovation system and political will to support continuous improvement of the institutional framework.

Path dependency is relevant for this thesis in terms of the development of new technology as discussed above, but also for the implementation and scaling of the novel solutions. Namely, the implementation

of new technologies is influenced by the path dependency because established standards in the industry often inhibit new technologies from being implemented. CLEAN contributes to mitigation of this barrier by involving SMEs as solution providers in C40 projects. In example, CLEAN has enabled VisBlue to act as a discussion partner, and potentially later a solution provider, for Stockholm municipality and harbour in a C40 project. This particular project aims to transform the old industrial seaport into a modern sustainable city environment by rethinking various integrated systems including the energy system. Given that C40 projects revolve around large scale systemic transformation of e.g. the energy and transportation systems in a city, this type of project enables implementation of novel technologies without being restricted by the existing system. CLEAN's role as a mediator between triple helix actors can thus be considered imperative in such projects because the cluster can facilitate cooperation between a broad set of stakeholders, which is necessary in cases of overarching changes. As a discussion partner, VisBlue provides inputs for the decision process regarding how the harbour's energy system should turn out. This way, the firm gains influence on the establishment of a new standard in Stockholm and subsequently other cities, given that C40 projects aim to develop solutions in one city that can be applied in other cities as well.

Ultimately, the data supports McCauley & Stephen's (2012) notion that clusters can potentially both reinforce and mitigate path dependency and sociotechnical development. However, although STAC, ReMoni and VisBlue offer rather novel technologies, the solutions are compatible with respectively the existing district heating systems, cables and energy sources. More specifically, the broad applicability of the technologies means that they are able to fit into the existing path dependent systems and even allow for significant cost savings which is a universal selling point. This means that they are less hindered by path dependency than firms with more radical and incompatible innovations.

This section has addressed CLEAN's influence on development and implementation of technologies which is determining for the SMEs' potential to build and improve their O advantages and thus subsequently their internationalisation processes. However, it is also empirical to address CLEAN's influence on the specific internationalisation processes.

6.2 International Collaborations and Opportunities

Findings have shown that CLEAN's contribution to the specific processes of internationalisation mainly lies within two main categories. The first includes identification of international opportunities and optimising initiating processes and the second revolves around inclusion into relevant networks. These two areas will therefore be addressed separately below.

6.2.1 Optimisation of Initiating Processes and Identification of Opportunities

In the internationalisation process, the lack of resources that many SMEs experience set somewhat natural limitations to international activities. Hence, as market analysis, identification of international opportunities and building relationships with potential partners requires resources, these preparatory processes may cause the international expansion of the firm to abate. In relation to this, a key finding in this thesis is that the three SMEs seek to overcome this challenge by utilising networks to identify opportunities and potential partners abroad. In example, this approach is evident in STAC's internationalisation strategy, as the firm explicitly utilises its network. However, since not all companies have strong networks, CLEAN can prove useful in assisting the SMEs with expanding their networks and identifying international opportunities. In example CLEAN connects Danish SMEs to foreign private and public actors through delegation trips. This has been seen in the case of ReMoni and VisBlue through their participation in the trips to New York, South Korea and Stockholm. As these trips were arranged and partly financed by CLEAN, they provided the SMEs with the opportunity to meet relevant actors, thus accelerating the individual firm's preparation phase by decreasing the need for extensive initial market research and minimising the related cost. Furthermore, it has been observed that both STAC and VisBlue have used a network approach to identify opportunities created by formal institutions and thus leverage the regulated environment in the industry to their benefit. While STAC identified such opportunities through the firm's own network, VisBlue's leveraged CLEAN's network by participating in the trip to South Korea which enabled the firm to identify the formal institutional advantage of beneficial legislation for lithium batteries. This further created an opportunity for the company to connect with public and private actors in the market. This demonstrates CLEAN's ability to support SMEs in identifying international opportunities by sharing knowledge regarding potential regulatory changes providing favourable market opportunities. However, the formal institutional environment is not equally determining for all firms, as some operate in less regulated sub-sectors. Therefore, identification of such formal institutional advantages varies in relevance, as companies like ReMoni and STAC does not have to make similar considerations in their market selection process given their less regulated technologies.

Alongside CLEAN's work to help extend the networks of the SMEs, the cluster also provides predefined project opportunities through initiatives like the the C40 City Solutions Platform. This platform creates a bridge between the member SMEs interested in internationalisation and C40 cities looking for solutions to specific sustainability challenges. This creates a direct connection between the solution seekers and the solution providers, eliminating the need for extensive market research the opportunity and market demand has already been identified. Moreover, CLEAN is highly focused on including SMEs in large scale projects such as C40 by facilitating collaboration and consortia

establishment consisting of small and large firms, ultimately integrating the solutions of the different solution providers. This can in turn reduce the associated risk for the individual firm of participating in the project and enable convergence.

However, CLEAN's contribution to the firms' internationalisation process lies in the initial stages of the process. The cluster supports the firms in building their individual O advantages, but in order for the contributions to materialise, the firms need to be able to convert the inputs into actual results. Hence CLEAN's assistance can be considered valuable in the initial phases of identifying opportunities and connecting the right actors, but the firm needs to nurture the relationships and take action based on the presented opportunities.

6.2.2 Access to International Networks

Closely related to the challenges of finding potential partners and expanding networks is the liability of outsidership, which can be a barrier of entry for new firms. Entering a market through a partnership with a local partner can be a way to overcome this liability, as the partner has a direct connection to local networks. All three SMEs have adopted this approach as their foreign partnerships provides inclusion into relevant location specific networks. This benefit is highlighted by VisBlue in particular, as one of the key reasons for the firm's partnership strategy is to utilise the partner's market specific knowledge. However, without relevant networks to be able to identify potential partners, entering markets through non-equity based entry modes like partnership strategies can be difficult. Thus, if the firm does not possess the relevant networks to overcome this barrier, CLEAN may be able to facilitate connections to triple helix actors within the market, and thereby positively influence the firm's chances of overcoming the liability of outsidership. CLEAN's vast international network, which is extended through the ICN, constitutes an institutional infrastructure for interactions which has the potential to influence the firms' abilities to build relational assets. However, the ability of CLEAN and ICN to support SMEs in overcoming this barrier naturally depends whether or not their networks extend to the market in question. This somewhat constitutes a limitation to the cluster's ability to support SMEs. The support in this context thus depends on the nature and location of the opportunity, and may not prove beneficial for all SMEs.

The previous sections have thus addressed the development and augmenting of O advantages as well as the specific processes of leveraging them in an international context. However, a fundamental prerequisite for development and implementation as well as internationalisation efforts is whether the firm has the financial capacity to undergo these processes.

6.3 Funding as a Foundational Challenge

The matter of access to capital is a theme that has emerged continuously throughout the investigation of the industry specific barriers that cleantech SMEs face. This issue lies at the heart of many of the other barriers identified throughout the analysis, as it is evident in the inherent characteristics of the three firms' technologies that they all require large capital investments to be developed and commercialised. Hence, in the cleantech industry, the most overarching liability of smallness is the issues concerning access to funding. CLEAN does contribute to the firms' O advantages within this area. In example, CLEAN has contributed to ReMoni's access to funding in the case of the FIE project. However, the support was directed towards funding for a specific project rather than the individual firm in the start-up phase, which is where the largest issue of attracting capital lies (Leonhard, 2018).

Apart from this project based funding, STAC has utilised CLEAN to gain support for OPI and EUDP applications and the Cleantech Impact Accelerator. While this was crucial for the firm's financial situation, it is important to note that the contribution from CLEAN mainly lies in identifying the opportunity to apply for the funding in the first place and the subsequent learning process that occurs when applying for the grants. In the case of the accelerator programme, the contribution from CLEAN resided in the networking and learning aspects of participating, as the purpose was to learn to pitch the technology and build a network to investors. Hence, the funding related influence of cluster dynamics on the firms is rather intangible and directed towards the initial building of the firms' individual networking and learning competencies which can then subsequently be used to access funding. Similar to the contributions from CLEAN outlined in the previous sections, the contribution in terms of access to capital depends on the firm's capabilities to utilise this learning and network contribution and translate it into tangible results. In the case of STAC and ReMoni, their individual competencies and already established O advantages were instrumental in turning CLEAN's support into capital. Hence, the cluster influences the firms' potential to overcome the barrier of accessing capital, but the influence is indirect and depends on the firms' own O advantages.

The aspects discussed thus far have addressed how the internationalisation of cleantech SMEs is influenced by certain characteristics and challenges in their industry, as well as how this can be affected by cluster collaborations and networks. While several dynamics between CLEAN and the SMEs have been identified, some of the dynamics outlined in the theoretical framework have been absent from the findings in this thesis.

6.4 Knowledge Spillovers and Functional Lock-Ins

Cluster theory stipulates that by grouping actors within one or several industries together in a cluster, a range of benefits such as mutual learning and knowledge spillovers between the organisations can lead to innovation and increased productivity (Davies, 2013). Therefore, based on the theoretical framework (figure 3), this thesis has investigated whether the SMEs engage in collaboration and knowledge sharing through CLEAN. However, while there is strong evidence of CLEAN facilitating knowledge spillovers between governments, academia and firms, no inter-firm knowledge sharing activities have been identified. When asked directly in the interviews, none of the SMEs have engaged in knowledge sharing or collaborations with other SMEs through CLEAN. Hence, despite the clear benefits identified in terms of network extensions and increased efficiency in preparatory phases, the analysis shows no examples of knowledge sharing between SMEs in the cluster.

Furthermore, despite the analysis illustrating several instances where the SMEs have participated in CLEAN initiatives, no indication of functional lock-ins have been identified. This could potentially be caused by the relatively weak link between CLEAN and the SMEs and the lack of collaboration between firms within the cluster as functional lock-ins arise from inter firm collaborations. It could additionally be discussed whether the lack of interfirm collaboration and thereby the functional lock-ins are caused by the immense focus on internationalisation within the industry. As illustrated throughout the analysis, CLEAN's main focus is on the initiation phase of the internationalisation process. One could therefore argue that the absence of functional lock-ins are caused by CLEANs focus on the initiating phases of the internationalisation process. Furthermore, CLEAN's focus is primarily on export projects which do not require the same level of dependency between the collaborating parties due to the limited timeframe. Hence, it can be questioned whether the overarching focus on internationalisation in the cleantech industry is causing the functional lock-ins to be of less relevance compared to other industries, as the transnational collaboration is prioritised.

However, the lack of evidence of firm-to-firm knowledge sharing and functional lock-ins, might also be affected by the comparably strong O advantages of the case firms, potentially making them less dependent on other member firms. Hence, firms with comparably weaker O advantages might have a bigger need for knowledge sharing and inter-firm collaboration, which could increase their risk of lock-ins. As this expands beyond the scope of the thesis, opportunities to investigate these dynamics in more detail will be elaborated in section 7.1. In order to fully grasp the underlying dynamics of internationalisation for cleantech SMEs, it is necessary to directly address the interlinkages between the micro, meso and macro level.

6.5 Interlevel Dynamics and Validity of the Holistic Approach

Throughout this thesis, findings have been derived systematically on each of the three levels of analysis, and dynamics between the levels have been addressed continuously. In order to assess the value of employing this holistic approach, as well as the validity of combining the three theoretical pillars; innovation systems, cluster theory and the eclectic paradigm, the interdependencies and dynamics between the levels must however be addressed directly. As depicted in figure 3d, several key aspects and mutually influencing dynamics have been identified.

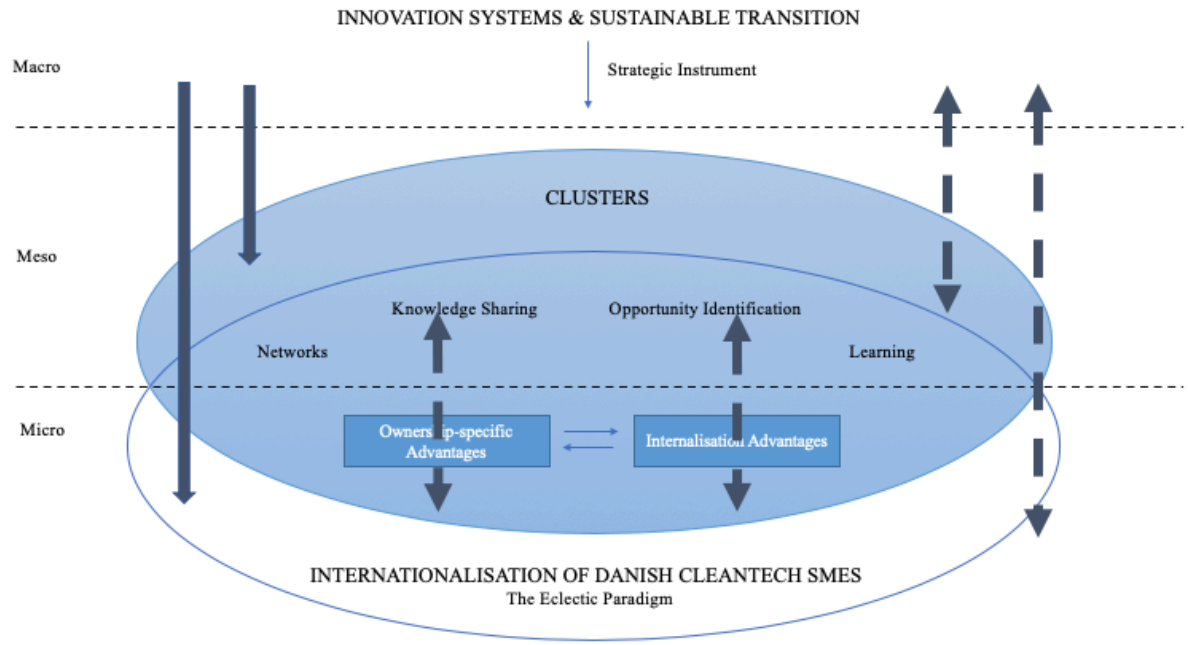

Figure 3d: Interconnected Dynamics Across the Three Levels of Analysis

Throughout the analysis it has become evident that the macro level has a very direct and tangible effect on the meso level. This strong dynamic is evident in that CLEAN is a strategically developed cluster functioning as a tool for the government to help grow and support specific areas within the cleantech sector. Thus, by providing financial support to specific areas within cleantech, the public sector is able to directly influence CLEAN's strategy. This strong influence has been visualised in figure 3d by the bold arrow pointing from the macro to the meso level. Establishing clusters as part of the institutional infrastructure has shown to be beneficial given Denmark's first-place ranking within the Global Cleantech Innovation Index in 2017. This particularly shows in the strong performance within the 'cleantech specific innovation driver' which measures Denmark's ability to drive demand and mitigate industry barriers through public investments in R&D and by providing firms with access to clusters and private-public organisations (Cleantech Group & WWF, 2017). In effect, the meso level has also been found to influence the macro level. This is supported by the findings regarding the cluster's influence

on the regional industrial identity. Namely, by accelerating the breadth and strength of the Danish industrial identity, the cluster accelerates the attraction of a broad range of resources, including financing from international investors, to Denmark. This dynamic from the meso- to the macro level can be considered more indirect, and has therefore been visualised in figure 3d with a dashed line.

The macro level has furthermore been found to directly affect the micro level through regulations. Certain types of technology within the cleantech sector are highly regulated and are therefore widely dependent on any potential changes to the regulations concerning their individual technology. This dynamic has therefore been visualised with a bold arrow in figure 3d. As public actors on the macro level are responsible for creating the institutional infrastructure surrounding the Danish cleantech sector through its innovation systems, this has furthermore been considered an indirect influence from the macro to the micro level. This indirect influence is further supported by the strong link between the macro and meso level which affects the SMEs through CLEAN as a mediator. This coherency illustrates that institutions are central within all three theoretical pillars and thereby influence all three levels of analysis.

It can be argued that firms, through the mediating effect of clusters, can gain influence on macro level industry standards through large-scale projects such as the C40 project in Stockholm where VisBlue provides inputs for standard setting. In this manner, firms on the micro level can be enabled to influence macro level industry standards, domestically and abroad, due to the influence from the clusters on the meso level. However, the influence from the micro to macro level has not been explored further due to the scope of this thesis, and the key takeaway from the dynamics observed in this C40 project is in fact how the meso level enables it to occur. Hence, the impact of the meso level on the micro level is the main area of investigation and concerns the various effects that CLEAN has on the three firms' O advantages and subsequent internationalisation processes as discussed in previous sections and illustrated in figure 3d. This includes the firms' potential for technological development, identification of opportunities, insidership and funding. These dynamics have shown to be indirect and largely dependent on the SME's already existing O advantages. More specifically, the SMEs' draw on CLEAN in areas where they lack resources and refrain from doing so in areas where they have already built strong O advantages as illustrated in table 5, 6 and 7.

Contrary, the causal link from the micro to the meso level has only been addressed to a limited extent in terms of regional industrial identity, as the firms in a region are determining for the development of industrial identity. Hence, the fact that Danish cleantech firms exhibit strong innovative and commercial capabilities reflects positively on the meso level as well as the macro level by strengthening the Danish reputation within the industry, which in turn has a self-perpetuating effect. Hence, the choice of

applying Romanelli & Khessina's (2005) framework on regional industrial identity has added to the analysis by enabling identification of these dynamics between the respective levels of analysis.

Given that the analytical focus has been directed towards identifying and explaining interlinkages and dynamics as depicted in figure 3, the thesis has bridged gaps between the theoretical pillars which validates the holistic approach. By combining innovation system-, cluster- and internationalisation theory in this particular industry with a focus on SMEs, it has been possible to address internationalisation from different angles and conduct a less generic and more holistic and context specific study. Moreover, this study contributes to the existing literature by confirming several of the positive effects for firms participating in a cluster as outlined by Davies (2016) and Delgado, Porter and Stern (2010;2016).

There are however certain limitations to this integrated approach. For instance, the employed literature mainly concerns naturally emerged clusters although CLEAN is a strategically developed cluster. This limitation has been addressed by emphasising how the fact that the cluster is strategically developed creates stronger causal links from the government to the cluster. Another limitation lies in the fact that the investigated dynamics are not directly measurable in that they are largely indirect and based on intangible network effects. The complexity is increased by the added time element, as influence between the levels is a long and a continuous process. Hence, it can take years from a relationship is initiated by CLEAN until it is strong enough to lead to internationalisation. It has, however, been possible to identify indications of the strength of these dynamics which allows for some degree of measurability. This strength of the respective dynamics is indicated by the thickness of the arrows in figure 3d. Given the indirect and intangible nature of the investigated dynamics, this is the closest indication of measurability that can be employed within the scope of this thesis.

The holistic approach of the thesis further allows for some degree of generalisability. Namely, it may be possible to generalise the findings from the thesis to other strategically developed clusters within the cleantech industry. This generalisability is enabled because the case constitutes a "most likely" critical case, allowing the logical generalisation that if positive dynamics are not found in this case, they will probably not be found in cleantech clusters in less advanced cleantech environments or in countries where cleantech is not prioritised as highly as it is in Denmark. Hence, given that some of the dynamics are indirect and relatively weak in this case, it could logically be argued that the dynamics are unlikely to be more direct or stronger in other cleantech clusters. However, this generalisation is naturally not universal, as clusters in other countries may have different characteristics, for example by being naturally emerged clusters, and may therefore not follow similar logics. Moreover, the objective of this

case study is to illustrate and examine these identified dynamics, as they may be present in other contexts as well.

6.6 Managerial Implications

In the process of investigating how clusters influence the underlying dynamics of internationalisation for cleantech SMEs, the thesis has allowed for the identification of three key managerial implications. These are action points for cleantech clusters to increase the support for the SMEs, but have been based exclusively on CLEAN. The four action points are summarized below.

1. **The use of package deals**: SMEs often face several interlinked barriers such as high risk and the liability of outsidership when building their O advantages and participating in internationalisation activities. This calls for cluster support with a broad and integrated focus to alleviate these barriers. A higher prioritisation of such integrated package solutions, with funding as a key element to reduce the associated risk, could enable more firms to participate in the initiatives, accelerating the cluster's contribution to SME O advantages and subsequent internationalisation.

2. **Increased focus on collaboration between small and large firms:** As one of the key characteristics of the industry, as well as a main focus for CLEAN, is the importance of collaboration between small and large firms, it is important for industry clusters to prioritise such collaborations in order to support SMEs in scaling and internationalising their solutions.

3. **Alternative funding measures:** As funding has been identified as a fundamental challenge for cleantech SMEs, increasing the efforts to support non-project based access to funding could increase the positive influence on the SMEs. As the industry exhibits challenges in attracting venture capitalists, and the current funding support in the cluster is primarily project-based and centered around learning and network, it could be valuable for the cluster to look into alternative methods to support the SMEs in securing funding. An example of such alternative methods for funding could be directed at crowdfunding initiatives.

The insights from the analysis thus provide some degree of managerial implications for cleantech triple helix clusters. However, given that this thesis constitutes a pilot study, it requires further research to make the implications even more generalisable and actionable.

7. Limitations and Further research

In this section, limitations of the thesis are evaluated and based on these, suggestions for further research are presented.

7.1 Expanded Empirical Base

Given the holistic approach of this pilot study, it leaves great opportunity to investigate the dynamics on the macro-, meso- and micro level in more depth. Hence, further research could apply a more strict focus on either one of the levels, to gain a deeper understanding of the different dynamics and how they influence the internationalisation process. A more focused micro level approach could thus be employed. As the cleantech industry is far from homogeneous, the SMEs have very different needs for support. It would thus be relevant to expand the dataset to include SMEs with weaker O advantages. This would allow for a deeper understanding of how the use of CLEAN in the internationalisation process coheres with individual O advantages. It furthermore raises the question of whether cluster dynamics would have been stronger, and lock-ins would have been identified had the thesis investigated other SMEs. A way to investigate this and expand the micro level data sets could be to develop a survey, on the basis of table 1. This approach would enlarge the dataset and potentially help identify these dynamics on a larger scale. Furthermore, by including a survey for data collection, the methodological foundation would be strengthened as the limitations of the interviews could be somewhat balanced out by the strengths of the survey methods and vice versa. Including a broader base of SMEs in the study could further increase the generalisability of the case by employing a dataset with greater variability between the examined firms. By also including firms with weaker O advantages, the dataset would allow the researchers to assess whether such firms utilise clusters more than other firms given their weaknesses, as well as whether they lack the capacity to translate cluster dynamics into tangible results.

The inclusion of the macro level in the analysis has enabled the researchers to conclude that characteristics and barriers within the cleantech industry are highly determining for the influence of cluster dynamics on SME internationalisation. Furthermore, as CLEAN is a strategically developed cluster, the strategy and initiatives initiated by the cluster are directly influenced by the the government. This therefore somewhat limits the generalisability of the case, as the same dynamics may not be present in naturally developed clusters where the influence from the government is likely to be more indirect. Similar limitations to the generalisability is evident when applying the findings to other industries where the macro level is less determining for the meso and micro level. Consequently, a way to allow for broader generalisability could be to conduct a large-scale study with naturally developed clusters or clusters in other industries in order to assess the differences and potential similarities that arise from the dynamics.

While further research could increase generalisability through a broader empirical foundation, it could also look to expand on CLEAN's influence on SME internationalisation by employing a more specific and theoretical approach.

7.2 Including Location as an Analytical Component

While this thesis focuses specifically on the effect that CLEAN has on the O- and to some extent I advantages of the SMEs, the L advantages of Dunning's OLI configuration have been considered out of scope. Hence, this thesis focuses specifically on Denmark as the home country of the firms and does not consider the receiving country. However, as the cluster can be considered a hub for international collaboration, the opportunities arising from the cluster could affect the attractiveness of certain geographical locations and thus influence the L advantages of entering that location. Therefore, further research could employ a focus on the receiving country in order to address how clusters influence the combined OLI configuration for SMEs. Such investigations would need to focus on specific receiving locations to assess their advantages, and could thus employ a more project based scope. Thus, expanding the theoretical base by integrating the L component could allow for a deeper understanding of cluster contribution to specific projects.

8. Conclusion

This thesis has applied a holistic approach in order to investigate how CLEAN as a cleantech cluster influences internationalisation for three cleantech SMEs. This has allowed for a conclusion regarding the effect that the context has on the three SMEs', as well as how CLEAN influences their capabilities for internationalisation. Ultimately, the generalisability of the case study will be addressed to explain how these findings can be valuable in a broader perspective.

Firstly, based on the findings regarding macro level influence, it can be concluded that the three SMEs are heavily influenced by their context. The Danish innovation system exhibits significant strength within cleantech, and a key element of this institutional infrastructure is the presence of CLEAN as a mediator between triple helix actors. Moreover, the strong and generalised Danish industrial identity provides an institutional advantage for the three SMEs. However, the SMEs also face a range of barriers residing from their context including the legislative environment, path dependency, long innovation cycles, long required lead times and on a more foundational level large capital requirements. Through the assessment of the SMEs' individual approaches to internationalisation, it has been identified that

they all employ a network strategy to overcome the liability of smallness and that CLEAN positively contributes to this approach, suggesting that it is beneficial for these firms to be part of the cluster.

Secondly, it has been possible to identify several areas where CLEAN contributes to the O advantages of the SMEs through primarily; Extension of networks, opportunity identification, learning and knowledge sharing which in turn affect the SME's potential for internationalisation. While these areas in many cases overlap, the findings suggest a range of contributions from the cluster within each area. The key contributions within extension of networks is CLEAN's ability to connect the SMEs to potential private or public partners as well as buyers looking for solutions to sustainability challenges domestically and abroad. This enables CLEAN to reduce the liability of outsidership for the SMEs by integrating them into foreign networks. Within opportunity identification, CLEAN contributes to exploratory development processes by identifying opportunities for SMEs to participate in project based collaboration with knowledge institutions. These projects contribute to the SMEs' innovative capabilities and the financial support granted to participants in the projects reduces the associated risk. Such projects can reinforce path dependency in cases where the aim of the project is to integrate the SME's technology into the established industry standard, and where participation is limited to firms that contribute to the existing trajectory. CLEAN also contributes to the identification of international projects by providing predefined project opportunities abroad and thereby minimising the SMEs' need for market research. In these international projects, CLEAN facilitates collaborations and consortia establishment and thereby enables SMEs to collaborate with a broad set of actors, which in turn reduces the risk of participation. CLEAN has furthermore shown to influence the implementation of newly developed technologies by providing SMEs with opportunities to partake in the establishment of new international standards through C40 projects. This can in turn contribute to mitigation of path dependency. The focus on exploration in the development phases as well as implementation of new standards shows that CLEAN can contribute to mitigating path dependency. The contribution in terms of learning is evident in the initiatives for accessing capital, as well as the international activities which increase the SMEs' experience and knowledge about new markets. While the data shows no examples of firm-to-firm knowledge sharing, CLEAN has facilitated knowledge spillovers between governments, academia and the three SMEs. This illustrates that CLEAN facilitates an institutional infrastructure between the actors and thus functions as a mediator.

CLEAN's contribution in terms of expansion of networks, opportunity identification and learning affects the initial asset creation stages of the internationalisation processes. The cluster's focus is thus to improve the firms' foundation for undertaking international activities. This means that the value of the cluster's contribution is highly dependent upon the individual firm's ability to translate the initiatives into concrete O-advantages and international activities. The individual O advantages of the

firms are furthermore also determining for the way that the SMEs choose to utilise the cluster, as firms seek support from the cluster in areas where they lack O advantages, and refrain from doing so in areas where they are already strong. Moreover, this indirect and relatively weak causality from the cluster on the meso level to the firms on the micro level means that while the opportunities provided by the cluster in some instances change the timing of entry and influence the decision regarding which markets to explore, it does not have a direct effect on the overall internationalisation strategy employed by the SMEs.

Lastly, these findings regarding the indirect and but beneficial effects that CLEAN has on the internationalisation of the SMEs can be valuable in a broader perspective. Namely, other cleantech SMEs may experience similar effects from membership in other strategically developed cleantech clusters. Specifically, other clusters with these characteristics may also function as important institutions given their role as mediators between triple helix actors. Similarly, they may also support SMEs in improving their capabilities to internationalise their cleantech solutions. Given the instrumental role of cleantech in the green transition, the collaborative and international approach identified in the case of CLEAN shows how clusters can be important actors in addressing the grand challenge of climate change. However, due to the interconnected barriers in the industry, clusters need to employ a broad scope including a focus on access to capital in their initiatives in order to support the internationalisation of the innovative potential that lies in SMEs. Moreover, the value of clusters also relies on the macro environment in which they are positioned as well as how the SMEs utilise them. This illustrates the need to employ a holistic approach, like the one present in this thesis, in order to understand the interconnecting dynamics between macro, meso and micro levels.

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