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Mads Bruun Ingstrup*

Facilitating Different Types of Clusters**

This paper focuses on cluster facilitators and their efforts in facilitating the development of clusters. At present, the vast majority of literature presents a uniform image of cluster facilitators despite the fact that different types of clusters influence their role and purpose. Thus, the aim of this paper is to explore how the roles and purposes of cluster facilitators change when facilitating various cluster types, and the impact of those changes on the cluster facilitation performed. The findings show that cluster facilitators in Marshallian/Italian industrial district type of clusters play the role of match makers and organisers; in the Hub-and-spoke district type of clusters, the cluster facilitators perform the roles of developer and organiser; cluster facilitators in the Satellite industrial platform type of clusters are promoters and organisers; and in the State-anchored industrial district type of clusters, the cluster facilitators fulfil the roles of integrator and organiser. This conclusion is based on a multiple case study as well as on a selection of literature on clusters and cluster facilitation.

Key words: **cluster facilitator, cluster, cluster type, case study**
(JEL: O14, O20, R11, R58)

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1. Introduction

Over recent decades, clusters have emerged as a vital and often-used concept to describe and explain topics such as the competitiveness of firms, regional development, and the geography of innovation (Cruz & Teixeira, 2010). Clusters have been studied using several theoretical perspectives, among others, a strategy and competitiveness perspective (Enright, 1998; Porter, 1990, 2000), an institutional perspective (Cooke et al., 1997; Lundvall, 1992) and a knowledge and learning perspective (Bathelt et al., 2004; Malmberg & Maskell, 2006), which are embedded in different research disciplines, for example business studies, economic geography, and economics (Cruz & Teixeira, 2010). These and other theoretical perspectives illustrate that the research on clusters is essentially interdisciplinary. Spun out of this interdisciplinarity comes an emerging perspective focusing on cluster governance and cluster facilitation that draws on policy studies in addition to management and facilitation studies (Borrás & Tsagdis, 2008; Ingstrup, 2010; Ingstrup & Damgaard, 2012; Jungwirth et al., 2011; Nauwelaers, 2001). The central objective in this emerging theoretical perspective is the investigation of governance structures within and around clusters, including the role and purpose of cluster facilitators in the process of cluster development.

Cluster facilitators can take the form of individuals, firms and private consultants, local associations and knowledge institutions, and public authorities and government agencies that assist in the development of clusters through trust building, in order to promote cooperation and sharing of activities and resources among the participating actors (Ingstrup & Damgaard, 2012). An extensive literature review showed that the vast majority of reporting on cluster facilitators presents a uniform image of this actor, see for example Christensen and Stoerring (2012), Coletti (2010), Jungwirth et al. (2011), and Ketels (2003), and thereby comes short of describing and analysing how the roles and purposes of cluster facilitators change in relation to the cluster type being facilitated and how the changing roles and purposes affect the facilitation executed. This is problematic, as it is well known in cluster research that different types of clusters exist with specific attributes; both strengths and weaknesses (Barkley & Henry, 1997; Markusen, 1996), and that these attributes have a noticeable effect on the role and purpose of cluster facilitators. This gap of knowledge calls for further examination of cluster facilitators, because of the significant value of this actor's impact in developing clusters of excellence i.e. clusters with a high degree of productivity, growth, and innovativeness (Europa InterCluster, 2010; zu Köcker & Rosted, 2010). By way of response to this call, the following research questions are posited: 1) how do the roles and purposes of cluster facilitators change when facilitating various cluster types and 2) what influence do the roles and purposes of cluster facilitators have on the cluster facilitation performed? Based on these research questions, the paper sets out to investigate cluster facilitators, seated in cluster secretariats within clusters, through the use of a multiple case study involving four different clusters: AluCluster, Medicon Valley, Offshore Center Denmark, and RoboCluster. Each of these clusters is similar in key characteristics to one of the clusters in Markusen's (1996) typology: Marshallian/Italian industrial districts, Hub-and-spoke districts, Satellite industrial platforms, and State-anchored industrial districts. Following this case study, a concep-

tual understanding is developed, which not only improves the insight into the role and purpose of cluster facilitators, but also questions some of the previous conclusions drawn about this actor.

The rest of the paper is structured as follows. Section 2 provides a brief overview of the literature on clusters and cluster facilitators, which serves as the theoretical base of the paper. Section 3 contains a description of the methodological techniques applied for creating and executing the multiple case study and constitutes the empirical base of the paper. In Section 4, the case study is presented and, in Section 5, the case study findings are discussed. Finally, the paper concludes with Section 6.

2. Defining clusters and cluster facilitators

This section aims at creating the theoretical base of the paper and provides a brief overview of clusters and cluster facilitators to set the scene for the discussions later in the paper.

2.1 Clusters

The literature on clusters is broad and, since the surge of the cluster concept in the early- and mid- 1990s instigated especially by Porter (1990, 1998), it has grown considerably, with new topics, ideas, and notions being added (Cruz & Teixeira, 2010; Maskell & Kebir, 2006). This development has challenged and broadened the understanding of clusters, but the cluster concept is still rooted in the explorative research of Marshall (1920) into industrial districts in the late 1800s, which later gave rise to cluster studies that focused, in particular, on Italian industrial districts (Brusco, 1986; Pyke et al., 1990), Porterian-inspired clusters (Porter, 1990, 1998, 2000; Enright, 1998), and regional innovation systems (Braczyk et al., 1997; Cooke, 2001).

These studies highlight the major defining characteristics of clusters: proximity, linkages, interactions, and critical mass. Derived from this, a cluster in this paper is comprehended as an inter-organisational configuration, with a closeness that makes it possible to pool resources and share activities for a common goal, between a sufficient number of actors in order to obtain positive spillovers. Within the frames of this definition, clusters come in different types and, to illustrate the range, Markusen's (1996) cluster typology is applied because of its clearly outlined cluster archetypes that cover the spectrum of clusters. The typology consists of five cluster types or, as Markusen calls them, industrial districts; Marshallian industrial districts, Italian industrial districts, Hub-and-spoke districts, Satellite industrial platforms, and State-anchored industrial districts, and each of them manifests a certain economic logic, influencing whether cluster growth and dynamics are externally or internally determined (Pandit & Cook, 2003). However, due to their many similarities the Marshallian industrial districts and the Italian industrial districts, are combined in this paper and that then limits the focus of this paper to these four cluster types: (1) Marshallian/Italian industrial districts which are predominantly centred around small and medium-sized firms linked together by activities and resources along the path of cooperating and competing; (2) Hub-and-spoke districts which start from the location of one or a few large, vertically integrated hub firms and their network of suppliers; (3) Satellite industrial platforms characterised by the presence of branch firms and by a relatively small degree of intra-

cluster trade and cooperation, but with many links to firms outside of the cluster; and (4) State-anchored industrial districts which are a product of government initiatives and investments and organised around institutions such as universities, ports, and military bases and their separate networks of suppliers.

2.2 Cluster facilitators

The literature on cluster facilitators is limited compared to the literature on clusters, as there are only a small number of contributions that shed light on the work performed by cluster facilitators. The concept of cluster facilitators has, however, extensive roots linking to other concepts such as the concepts of brokers (Hanna & Walsh, 2002; Provan & Human, 1999; Snow et al., 1992), intermediaries (Young, 1972), and hubs (Jarillo, 1988). Within this theoretical framing, cluster facilitators have been studied under different names, for example, cluster leaders (Casson, 2003; Sydow et al., 2011; Zagorsek et al., 2008), clusterpreneurs (Christensen & Stoerring, 2012), cluster facilitators (Ingstrup, 2010; Ingstrup & Damgaard, 2012; Ketels, 2003), cluster animators (Gagné et al., 2010), cluster drivers (Hallencreutz & Lundequist, 2003; Lundequist & Power, 2002), and cluster managers (Coletti, 2010). However, despite the variation in names, the image of cluster facilitators presented in the vast majority of literature is strikingly uniform, which is exemplified in Table 1 which includes a list of frequently used definitions of cluster facilitators.

In the listed definitions and in the contributions where they can be reviewed in their entirety, there is an emphasis on the basic characteristics of cluster facilitators; for instance who they are and what they do to achieve successful cluster facilitation and, ultimately, clusters of excellence. Interestingly, there seems to be agreement across the various definitions of cluster facilitators that trust and alignment are important prerequisites and outcomes when facilitating clusters, in order to build a platform for collective and cooperative actions. Continuing from this understanding of trust and alignment being prerequisites and outcomes of cluster facilitation, McEvily and Zaheer (2004) state that, for cluster facilitators to promote these issues they should focus on identifying shared interests and developing common expectations among the participating actors in clusters, as well as leveraging a critical mass and compressing the network inside clusters in space and time. Nevertheless, it has proved challenging to build trust and alignment in clusters, as they are typically recognised as communities with actors that are simultaneously cooperating and competing, see Porter (2000). To overcome this situation, McEvily and Zaheer (2004) further argue that cluster facilitators should, through their social capital, unfold the wider network of the separate clusters and get the participating actors to not merely understand, but also acknowledge their relational interdependencies and mutual context.

Table 1: Frequently used definitions of cluster facilitators

Author	Definition
Aziz & Norhashim (2008, p. 361)	"More important, majority of the clusters have identified dedicated facilitators for their various initiatives. Significant numbers of the facilitators have offices and spend time to develop frameworks for clear identification of benefits and processes. [...] These facilitators, which may be either government or private organizations, provide a structure for cluster governance."
Christensen & Stoerring (2012, p. 142)	"Clusterpreneurs may be further grouped in different ways. One possible distinction is between, on the one hand, private individuals and organizations devoted to promoting local business through enhancing networking in clusters and, on the other hand, regional government represented by government agencies and other public bodies."
Coletti (2010, p. 681, p. 686)	"CMs [cluster managers] should facilitate the establishment of strategic alliances and networks, identifying core people with already established mutual trust, attracting potential partners and helping them to create relationships which will bring enhanced cooperation." "The CM is hence a networker and a facilitator of relations. She manages weak and strong ties with cluster members, potential members and stakeholders and, when a shared vision emerges, she encourages its collective realisation."
Fromhold-Eisebith & Eisebith (2005, p. 1253)	"This requires participative approaches involving various public and private actors and calls for a new type of regional economic promotion officer, coordinator or 'cluster manager' who is capable to co-ordinate support across organizational boundaries and to integrate various instruments and interests."
Ingstrup & Damgaard (2012, p. 7)	"[...] cluster facilitators are defined in this paper as individuals or a team of individuals who are seated in a formal cluster secretariat within a cluster, facilitating and coordinating cluster development through trust building in order to promote cooperation and sharing of activities and resources among the participating actors of the cluster."
Ketels (2003, p. 17)	"In almost all cluster initiatives surveyed, a critical role was played by the individual leading the effort, called the cluster facilitator. This individual tends to be an industry insider with a strong network within the cluster. He or She leads the overall effort and guides individual working groups that tackle specific topics."
Ketels et al. (2006, p. 9)	"We use the term cluster facilitator to identify the individual that manages the cluster initiative."
Mesquita (2007, p. 73)	"Trust facilitators are individuals, governmental agencies, or independent organizations that leverage their reputation and abilities in gridlocked interfirm relationships and, given appropriate process structures, conflict profile, and firm leaders' propensities to trust, help create momentary opportunities for trust to resurface and shift firms out of their noncollaborative inertia. Case examples of trust facilitators include business associations, private consultants, governmental and multilateral agencies, and even large, common customers, who offer clustered firms entrepreneurial leadership and conciliation support [...]."
Sydow et al. (2011, p. 330)	"In line with this reasoning, cluster leadership translates into an individual or organization leading a cluster. It is mainly based upon cluster rules and resources, cuts across organizational and sometimes even network boundaries, and often aims at mobilizing large numbers of individuals and/or organizations that – together with their relationships – make up the regional cluster."
Zagorsek et al. (2008, p. 102, p. 104)	"Cluster leadership can be exhibited by many different individuals or even groups. [...] The leadership role in clusters can be explicitly given to a specific person, however, the leadership role emerges spontaneously." "The cluster development process is usually led by a cluster leader – a person who takes a crucial role in the formation and development of a cluster. The leader facilitates trust-building among cluster actors, helps them define a common vision, encourages and organises them to work towards achieving their vision. The actual leader may or may not be a formal manager of the cluster."

These issues of trust, alignment, relational interdependencies, and mutual context are also important in other parts of the literature on cluster facilitators, especially in relation to three aspects: (1) goals of cluster facilitators with a dominating focus on creating cooperation, cluster externalities, and a shared vision among the participating actors within clusters (Gagné et al., 2010; Ingstrup & Damgaard, 2012; Jungwirth et al., 2011; Mesquita, 2007), (2) activities for cluster facilitators to oversee when facilitating the development of clusters such as organising training activities, undertaking projects, and providing support services (Coletti, 2010; Molina-Morales, 2005), and finally (3) attributes and competencies that cluster facilitators should be in possession of when facilitating clusters, for example being a networker, being a communicator, being innovative, and being a problem solver (Ingstrup & Damgaard, 2012; Mesquita, 2007; Zagorsek et al., 2008). In addition to these academic contributions, several practical guides and manuals on cluster facilitation have been published, for example *Cluster Management: A Practical Guide*, *Cluster Management Guide: Guidelines for the Development and Management of Cluster Initiatives*, and *A Practical Guide to Cluster Development*. These and similar guides and manuals focus on providing practical tools to help cluster facilitators in their daily work when developing their respective clusters, by giving advice and examples of activities and focus areas that they can make use of. These contributions are mainly built on accumulated experiences based on reflections by cluster facilitators themselves, and they aim at spreading best practices. However, they share with the vast majority of academic literature, the uniform image of cluster facilitators, and to date only a few studies have challenged this image.

One of the challengers to this notion of uniformity is Ingstrup (2010) who has developed a cluster facilitator framework that, through the use of five dimensions, identifies three generic roles of cluster facilitators; the framework-setting facilitator, the project facilitator, and the all-round facilitator. The framework-setting facilitator focuses on the external environment of clusters and has an indirect approach to facilitating the actors, resources, and activities in clusters. On the other hand, the project facilitator engages in the projects inside clusters through a more direct and interfering approach towards the actors, activities, and resources of clusters, and finally the all-round facilitator, which is the sum of the two previous roles, takes actors, resources and activities, external and internal to clusters, equally into consideration during the entire facilitation process. Further, Sydow et al. (2011) explain, based on a comparison of four photonics clusters, that the role and purpose of cluster facilitators, regardless of whether the cluster facilitator is appointed or emergent within centralised or decentralised cluster structures, are greatly influenced by the specific cluster context of historical, political, and cultural aspects, on top of the technological milieu of the region in which the cluster is located. In addition, Ingstrup and Damgaard (2012) have, through a multiple case study of nine clusters, discovered that cluster facilitators working with clusters in their early development stage focus on establishing a platform on which these clusters can stand in terms of building cohesion and improving framework conditions. Later in the development process, the focus is switched to initiating cooperative activities to foster interaction and improve the critical mass of the clusters. Finally cluster facilitators, affiliated with well-established clusters, try to facilitate business creating activities and enlarge the sphere of the clusters.

Summarising the literature review, the concept of cluster facilitators is emerging and uniform, and as outlined above, the literature, except for a few contributions, falls short in describing and analysing how the role and purpose of cluster facilitators change in relation to the cluster being facilitated, including how the changing roles and purposes affect the facilitation executed. In order to advance the literature on this matter, a multiple case study has been completed, investigating the impact of cluster types on the role and purpose of cluster facilitators.

3. Methodology

To research the role and purpose of cluster facilitators, a multiple case study has been chosen as the research strategy in the quest for both analytical depth and comparability (Yin, 1994). The rationale behind choosing this particular research strategy also relates to the explorative nature of the research questions as well as the author's intention to alternate between empirical knowledge and theoretical knowledge (Yin, 1994). Also important for the choice of research strategy is Acs and Varga's (2002) statement about case studies being preferable and state of the art for researching clusters and cluster-based phenomena. In terms of execution, the multiple case study is performed according to the guidelines set out by Robson (2002), and is built around four types of clusters and their respective cluster facilitators. The clusters have been selected as they each relate, in terms of their key characteristics, to one of Markusen's (1996) cluster types (introduced earlier in Section 2.1) and because they all are mature and well-established clusters.

The data for the multiple case study stem mostly from qualitative, open-ended, and semi-structured interviews with cluster facilitators from each of the four clusters (see Table 2), from an interview survey previously conducted with 13 actors from the four clusters, and from document and literature studies. The interviews served to shed light on how cluster facilitators fulfil their roles and purposes, and what characterises the type of facilitation they conduct. Aiming to align the interviews in order to compare the data, and to provide flexibility in the interview situation, the interviews were completed using a theme-based interview guide with sub-questions. The themes applied are rooted in the theoretical base of this paper and they are as follows: type of cluster, cluster characteristics, and cluster facilitator characteristics. The interviews lasted between 40 and 50 minutes and were recorded with the intention of writing case descriptions. Upon completion, the written case descriptions were sent to the interviewees for approval and clarification, which only led to a few insignificant changes. This review by the interviewees was made to ensure the validity of the collected data and the conclusions made by the author.

Table 2: List of interviewed cluster facilitators and their respective clusters

Name of cluster	Name of cluster facilitator
AluCluster	Michael Nedergaard
Medicon Valley	Peter Nordström
Offshore Center Denmark	Peter Blach
RoboCluster	Bjarke Nielsen

For the purpose of analysing and discussing the data collected for the multiple case study, a grid-analysis (Gammack & Stephens, 1994) was applied as data categorisation approach. The idea of using this data processing technique was, first, to identify relevant data for the central research questions and, second, to find similarities and differences regarding the roles played and the purposes fulfilled by those cluster facilitators that had been interviewed. This categorisation was undertaken in line with the pre-established themes from the interview guide, as well as by using new themes developed whilst sorting the data. Finally, this process was also a part of validating the identified cluster facilitator roles and purposes.

4. Case study

Following the rationale of this paper and within the methodological framework above, four cluster cases are presented that illustrate how the role and purpose of cluster facilitators change in relation to the cluster type being facilitated, and how the changing roles and purposes affect the facilitation executed. The case study aims to describe the historical background and the current status of the selected clusters as well as the main activities performed by the respective cluster facilitators in these clusters. Basic information about the four clusters is provided in Table 3 and this is followed by presentation of the cases.

Table 3: Basic information on the four clusters

Name of cluster	Type of cluster	Industry	Location	No. of actors	Triple helix represented	Member of the Danish national innovation network program
AluCluster	Marshallian/Italian industrial district	Aluminium processing	Region of Southern Denmark	~ 73	Yes	Yes
Medicon Valley	Hub-and-spoke district	Life science	Region of Copenhagen	~ 600	Yes	No
Offshore Center Denmark	Satellite industrial platform	Energy	Region of Southern Denmark	~ 230	Yes	Yes
RoboCluster	State-anchored industrial district	Robots and intelligent mechanical systems	Region of Southern Denmark	~ 350	Yes	Yes

4.1 AluCluster

The southern part of Denmark is the geographical home of AluCluster, and from this location, the cluster supplies products and services to a range of diversified industries, for instance wind energy, construction, health care, shipping, and packing. The cluster was spun out of an initiative in 2001 by four leading firms in the aluminium processing industry. Together with three local municipalities and the regional vocational college for trade and industry, they joined forces, aiming to establish a knowledge hub for supporting and upgrading the flourishing aluminium processing activities in southern

Denmark, and to promote the use of aluminium as a material. The four leading firms were Sapa Profiles, Maersk Container Industry, Danfoss, and Hydro Aluminium, which due to their national dominance in the aluminium processing industry were able to attract new firms to the cluster and raise awareness of the cluster in general. Initially the cluster maintained a predominantly local focus, but this changed, firstly in 2007 when it became part of the regional cluster programme sponsored by the regional government, and then in 2009 when it was included in the national innovation network programme launched by the Danish Agency for Science, Technology and Innovation. These events were part of AluCluster's transformation into a national cluster with a major focus on innovation and business creating activities.

Today, AluCluster organises about 75 actors; mainly small and medium-sized firms with substantial inter-firm competition and cooperation, and only to a lesser extent knowledge institutions and public authorities. The above-mentioned focus on innovation and business creating activities is touched upon in the cluster's vision, which highlights its intention to promote a significant commercial view. This view is typically driven by requests from the cluster firms when facing challenges in their production or market segments, or by new cooperation and market opportunities that arise. In the latter situation, the cluster secretariat and its cluster facilitators within AluCluster play a vital role in searching for these opportunities and linking them to the right firms in the cluster. In order to do that, the cluster facilitators spend hours in dialogue with actors from the wider value chain of the cluster, as well as with actors in related industries. Recently this effort has opened the door for supplier cooperation between firms from AluCluster, firms from the German automobile industry, and firms from the Danish offshore wind industry. This particular role, taken on by the cluster facilitators in matching firms, is essential to most of the firms in the cluster as they are small and medium-sized with limited resources and would not be able to seek out these opportunities by themselves. Additionally, the cluster secretariat employs a number of engineers and has contracts with several consultants to provide help and advice for these firms on technological matters. Besides the focus on innovation and business creating activities, the cluster facilitators also arrange networking events, seminars, and various projects e.g. cross-cluster cooperation projects and branding projects.

4.2 Medicon Valley

In 2000, the Region of Skåne in Sweden and the Copenhagen Region in Denmark were linked together by the Øresund Bridge, and one of the many cross-border initiatives in advance of this event was the Medicon Valley cluster project, which built on the existing agglomeration of pharmaceutical, medtech and biotechnology firms, research hospitals, universities, and science parks in the area. From the start, the cluster project was, influenced by regional government and investment institutions, whose aim was first and foremost to brand the existing agglomeration so as to make the region even more attractive to life science firms. The launch of Medicon Valley has its roots in the mid-1990s when initial steps were taken at different political levels on both sides of Øresund, and this process has been supported by several large hub firms, for example Novo Nordisk, AstraZeneca, and Ferring, as well as by the leading regional universities of Copenhagen and Lund. In order to strengthen Medicon Valley,

a cluster secretariat called Medicon Valley Alliance was established in 1997 and, with an annual budget of € 2 million it is set to facilitate the development of the cluster by improving its integration of actors and making sure that the cluster objectives are met.

These efforts have contributed to Medicon Valley organising approximately 600 actors and becoming one of the largest life science clusters in Europe along with the Golden Triangle, located between Cambridge, Oxford, and London, and the German-French-Swiss BioValley. The core of Medicon Valley is a triple helix set-up, but due to the presence of several hub firms that are world leaders within their respective niches, along with their networks of small and medium-sized firms (either suppliers or firms interested in becoming suppliers), these hub firms are agenda-setters. Supporting the cluster and its actors is a group of cluster facilitators employed at Medicon Valley Alliance who coordinate both strategic and operational activities; with the latter mainly in the form of networking events, workshops, and seminars on topics such as patenting and outsourcing targeted to the needs of the small and medium-sized firms in particular. The cluster facilitators are responsible for organising these operational-level events. Strategic activities, on the other hand, are often built around hub firms like Novo Nordisk, Lundbeck, and LEO Pharma and are typically large-scale research and innovation projects with long time horizons compared to the operational activities. Some of these research and innovation projects include a "Beacon-project" aimed at defining future positions of strength for the cluster, a drug delivery project focused on creating a Medicon Valley drug delivery institute, and a cancer initiative to coordinate cancer research. In these projects the cluster facilitators help with project management, fundraising, and market and feasibility studies, among other things. In addition to the operational and strategic activities, the cluster secretariat also facilitates a life science ambassador programme with cluster facilitators posted around the world helping cluster stakeholders in their internationalisation process.

4.3 Offshore Center Denmark

Most of the actors involved in the Danish offshore oil and gas industry are located around the city of Esbjerg on the North Sea coast of Denmark, and together they form the cluster Offshore Center Denmark. The oil and gas exploration in the Danish part of the North Sea was begun in the 1970s by a consortium of contractors consisting of Maersk Oil & Gas, Texaco, and Shell. During the 1980s and 1990s, activity increased and more actors, from related industries, joined the cluster. This development boosted the scope and size of the cluster to include firms focusing on, for example, maritime safety and offshore tourism. It also strengthened cooperation with knowledge institutions such as local universities and technical colleges, as well as with public authorities; particularly with the Danish Ministries of Science and Energy. In 2003 a cluster secretariat was established to support the cluster in becoming more competitive, and in 2009 the cluster was included in the national programme of innovation networks under the Danish Agency for Science, Technology and Innovation. The focal point of attention for Offshore Center Denmark has expanded over the last five years, to encompass green offshore activities such as wave energy and wind energy.

As a result of this development, the cluster has grown to around 230 actors who represent triple helix and the whole national value chain related to both green offshore

and oil and gas offshore activities. Offshore Center Denmark is dominated by national and international branch firms that have many relationships external to the cluster. In order to stimulate cooperation within the cluster, between the branch firms and the local small and medium-sized firms, the cluster secretariat and its cluster facilitators coordinate different projects ranging from those of a technical nature to those with a broader scope, such as education and regional development. The technical projects vary in size from designing and building a prototype of a mono tower for drilling oil and gas at inaccessible locations, to smaller projects focusing on developing safety tracking equipment for personnel working at drilling rigs. In these types of projects, the cluster facilitators help with administration, fundraising, and background studies, and promote interaction between the cluster actors, also ensuring that possible actors from outside the cluster are involved if needed. Most of these technical projects are proposed by firms within the cluster and especially by the branch firms that are often the end-users of the innovative products and services. On the other hand, projects of a broader scope, dealing for example with education and regional development, are most commonly suggested by the cluster secretariat and public authorities participating in the cluster. Moreover, these projects are performed together with local knowledge institutions, which among other things, arrange training courses for upgrading the skill base of the cluster. In support of these activities and to improve the knowledge transfer and social capital of the cluster, the cluster secretariat and its cluster facilitators also arrange networking events, study trips, and seminars.

4.4 RoboCluster

Robots and intelligent mechanical systems have been used for the last couple of centuries in industrial production, but in recent years, such technology has spread to sectors like health care, play and edutainment, and biological production. It is within this context that the cluster named RoboCluster has evolved. The cluster has its roots in the robot technology applied at a former shipbuilding yard that was closed down in 2002. Following the closure, a group of actors representing triple helix, came together in a cluster set-up as a means of maintaining and improving the innovative milieu already established in this field of expertise. These actors come mainly from the large network of suppliers to the shipbuilding yard, but also the local university and technical college, the county government, and the local municipality took part. In 2005 the cluster was given the title of regional technology centre and, in 2009, it was appointed by the Danish Agency for Science, Technology and Innovation as a national innovation network.

At present, the cluster consists of roughly 350 actors half of which are firms, approximately 20 are knowledge institutions, and 180 are public authorities at national, regional, and local levels. Together this constitutes a skill base of approximately 500 people working in industries related to robots and intelligent mechanical systems. Moreover, the number has been increasing as a result of, among other things, the innovation and business projects launched within the cluster that focus on intelligent sprayer booms for agricultural farming, blood sample robots, and ergonomic bed transportation. The cluster and its actors are organised around a shared vision of improving life conditions through robot technology, and one of RoboCluster's unique

characteristics is the high level of cooperation that exists between the cluster firms, the local university, and the regional and national technology centres. These knowledge institutions comprise the core of the cluster and work as reservoirs of knowledge and also as an incubation milieu for developing and testing ideas. Vital to achieving the cooperation between knowledge institutions and firms is the cluster secretariat within RoboCluster and its cluster facilitators who are based at the local university and who, on a weekly basis, consult firms and university researchers participating in the cluster on their latest thoughts and proposals, in order to establish future projects. Besides setting the framework for possible cooperation, described above, and through activities like networking events, seminars, and study trips, the cluster facilitators also assist in applying for funding and in screening ideas and markets for commerciality upon request from individual cluster firms. However, their facilitation stops when a prototype is developed.

5. Discussion

The above case study outlines the general characteristics of the four selected clusters in terms of their history, current status, and the cluster facilitation executed within them. Below, these cluster cases are discussed in relation to the theoretical base of this paper, highlighting how the roles and purposes of cluster facilitators change in relation to the cluster type being facilitated, and how the changing roles and purposes affect the facilitation performed.

AluCluster is an example of a Marshallian/Italian industrial district type of cluster dominated by small and medium-sized firms, and the purpose of the performed cluster facilitation is to support and expand the existing inter-firm cooperation based on the needs of the firms and with respect for their resource limitations. Accordingly, the cluster facilitators seated in the cluster secretariat act as match makers, by seeking new cooperative relationships with internal and external actors of the cluster. This they undertake on behalf of the small and medium-sized firms in order to compensate for their limited resources, as well as widening their market opportunities and adding to their competences. Furthermore, the cluster facilitators also fulfil the role of an organiser by arranging, for example, networking events, seminars, and projects within the cluster.

> "We are open-minded and search for new opportunities on behalf of the small and medium-sized firms in our cluster. Suddenly, we became aware that there was an opening in relation to Maersk Oil and Gas as to designing unmanned drilling rigs in aluminium. [...] We have also initiated cooperation between firms from our cluster and firms from two clusters related to the German automobile industry. This hopefully helps expanding the customer base of the firms in AluCluster". Michael Nedergaard, cluster facilitator, AluCluster.

Medicon Valley is a Hub-and-spoke district type of cluster organised around triple helix, and in particular around several world-leading hub firms and their suppliers. Furthermore, Medicon Valley is also an example of a cross-border cluster based on a top-down development approach. Here, the cluster facilitation aims, to a great extent, to develop the cooperation already taking place between the hub firms and the small and medium-sized supplier firms of the cluster. This is achieved through strategic and op-

erational activities offering platforms for joint development initiatives. These initiatives include improving the competitive strength of the cluster, upgrading the small and medium-sized firms as suppliers, and broadening the network of actors and resources in favour of the hub firms and other cluster stakeholders in order to enhance the critical mass of the cluster. In this situation, the cluster facilitators seated in the cluster secretariat take on the role of developers who design and run projects to support the above goals, and of organisers, who set-up cluster activities such as seminars, networking events, and fundraising.

> "We help building collective platforms for cooperation in the cluster. One of our prestige projects is the Medicon Valley Drug Delivery Institute in which firms from the cluster can share resources and work together across the cluster value chain. [...] Novo Nordisk is the main sponsor of the Institute but we hope that it will advance all actors in the cluster and attract new actors". Peter Nordström, cluster facilitator, Medicon Valley.

Offshore Center Denmark is an illustration of a Satellite industrial platform type of cluster with many branch firms, and is also an example of how clusters can revitalise themselves through the addition of new focus areas. The purpose of the cluster facilitation in this case, is to improve the limited amount of cooperation between the branch firms and the small and medium-sized firms of the cluster. Such limited cooperation is typically a result of the dependence and strategic links characterising the relationships between the branch firms and their headquarters. To address this challenge, the cluster facilitators, seated in the cluster secretariat, act as promoters by launching projects aimed at lowering the barriers to cooperation and encouraging the branch firms to contract with the small and medium-sized firms as suppliers. Furthermore, the cluster facilitators act as organisers, running networking events, training courses, and study trips for the participants of the cluster etc.

> "The dominating firms of our cluster are branch firms that more than anything else are linked to their global headquarters. We have launched projects on, for example, designing offshore safety tracking equipment and mono towers for oil and gas drilling in order to tap into the knowledge and R&D resources of these branch firms and to create relationships between them and the local small and medium-sized firms of our cluster". Peter Blach, cluster facilitator, Offshore Center Denmark.

RoboCluster is a State-anchored industrial district type of cluster, deeply influenced by the presence of a large, publicly-financed university. The core purpose of the cluster facilitators seated in the cluster secretariat is to establish cooperation and communication between the cluster firms and the university, in order to create relationships that will boost innovation and commercialisation. To do that, the cluster facilitators act as integrators who try to overcome and remove the sectoral boundaries between these two different types of actors and translate their different needs so as to integrate the market knowledge of the firms with the resources and technical knowledge of the university. Moreover, the cluster facilitators act as organisers of networking events, study trips, and seminars within the cluster.

> "A great part of my job is to translate between academia and business. Many good ideas are born in both "worlds" but they seldom interplay with each other. Therefore, I help combining them like for example in the case of developing robots for medical use at hos-

pitals based upon industry and university knowledge of robots in industrial production". Bjarke Nielsen, cluster facilitator, RoboCluster.

These reflections illustrate how the type of cluster and its outset of activities, actors, and resources influence the role and purpose of cluster facilitators. On the surface, the cluster facilitator roles and purposes presented in the case study appear uniform, as they all focus on cooperation. However, as illustrated, the content of these roles and purposes, and later the facilitation itself, actually differs across the four cluster types. Cluster facilitators in the Marshallian/Italian industrial district type of clusters take on the role of a match maker and an organiser to compensate for the limited resources of the small and medium-sized firms dominating the cluster type. On their behalf the cluster facilitators seek new cooperative relationships to widen the existing substantial inter-firm cooperation and the market opportunities and competencies of the cluster. In the Hub-and-spoke district type of clusters, the cluster facilitators play the role of a developer and organiser whose aim is to design and run projects and other activities to accompany the existing cooperation, especially organised around several hub firms and their suppliers. This assists the upgrading of the small and medium-sized firms of the cluster as suppliers, and broadens the network of actors and resources thereby enhancing the critical mass of the cluster. In the Satellite industrial platform type of clusters, the cluster facilitators are promoters and organisers working to improve the limited existing cooperation between the branch firms and the small and medium-sized firms of the cluster. This they do by launching a number of projects to lower the barriers to cooperation and by encouraging the branch firms to contract with the small and medium-sized firms as suppliers. These efforts are made to strengthen the joint linkages in the cluster value chain with the intention of fostering more intra-cluster trade and knowledge transfer. Finally, in the State-anchored industrial district type of clusters, the cluster facilitators act as integrators and organisers who try to establish cooperation and communication between the university and the firms of the cluster, across their sectoral boundaries. This is achieved by integrating the actors' individual resources and potentials in order to develop new relationships and boost the level of innovation and commercialisation. A point of note is that cluster facilitators in all of the four clusters play the role of organiser of networking related activities, which can be explained by the need to create a common platform of social capital in order to facilitate cooperation, see McEvily and Zaheer (2004). For a brief summary of the above cluster facilitator roles and purposes, see Table 4, which is based on analytical generalisations from the investigated cases.

In the wake of these case study findings, Figure 1 links the theoretical and empirical bases of the paper, providing a conceptual model for structuring the descriptions and analyses of how the type of cluster being facilitated influences the goals, activities, attributes, and competencies of cluster facilitators, and thereby the role and purpose of cluster facilitators. In particular, the figure stresses the interfaces and contingencies surrounding cluster facilitators and, how exclusion of these aspects in the research on cluster facilitators contributes to the uniform image of this actor found in the vast majority of literature, see for example Christensen and Stoerring (2012), Coletti (2010), Jungwirth et al. (2011), and Ketels (2003).

Table 4: Cluster facilitator roles and purposes

Type of cluster	Cluster facilitator roles	Cluster facilitator purposes
Marshallian/ Italian industrial district	Match maker Organiser	To compensate for the limited resources of the small and medium-sized firms and seek new cooperative relationships to widen the existing substantial inter-firm cooperation and the market opportunities and competencies of the cluster.
Hub-and-spoke district	Developer Organiser	To accompany the existing cooperation organised around hub firms and their suppliers, to upgrade the small and medium-sized firms of the cluster as suppliers, and to broaden the network of actors and resources thereby enhancing the critical mass of the cluster.
Satellite industrial platform	Promoter Organiser	To improve cooperation and foster intra-cluster trade and knowledge transfer by lowering the barriers for cooperative actions and by encouraging branch firms to contract with small and medium-sized firms in the cluster.
State-anchored industrial district	Integrator Organiser	To establish cooperation and communication across sectoral boundaries in order to boost innovation and commercialisation by integrating market knowledge of firms with resources and technical knowledge of universities.

Figure 1: Conceptual model for investigating the roles and purposes of cluster facilitators

Summarising this discussion, the paper demonstrates, based on Markusen's (1996) cluster types, how the role and purpose of cluster facilitators change and, equally important, highlights how the roles and purposes should be comprehended as an outcome influenced by the different cluster types being facilitated. Thus, this paper adds to the contributions by, for example Ingstrup (2010), Ingstrup and Damgaard (2012), and Sydow et al., (2011) in challenging the uniform image of cluster facilitators. In addition, this paper also has implications for the methods by which cluster facilitators are investigated. Furthermore, the findings stress the importance for future studies of including the type of cluster within which cluster facilitators act, in order to obtain a more nuanced understanding of those facilitators, their role and purpose.

6. Conclusion

In this paper, evidence has been presented which highlights how cluster facilitators take on different roles and fulfil diverse purposes depending on the type of cluster they facilitate, which in turn, influences the cluster facilitation performed. Overall, cluster facilitators in the Marshallian/Italian industrial district type of clusters act as match makers and organisers; in the Hub-and-spoke district type of clusters, the cluster facilitators perform the roles of developer and organiser; cluster facilitators in the Satellite industrial platform type of clusters are promoters and organisers; and in the State-anchored industrial district type of clusters, the cluster facilitators fulfil the roles of integrator and organiser. With the identification and conceptualisation of these different cluster facilitator roles and purposes, this paper challenges the uniform image of cluster facilitators dominating the vast majority of literature, and it questions some of the previous conclusions drawn about this actor. This paper also highlights the necessity to improve the empirical research process when investigating cluster facilitators, by including the type of cluster in which they work, so as to gain a deeper and more nuanced understanding of this actor. To meet this recommendation, a conceptual model for structuring the descriptions and analyses of cluster facilitators has been presented.

To reach the conclusions above, this paper started from a theoretical base built on the concepts of clusters and cluster facilitators. Clusters were defined around the cluster typology of Markusen (1996) as being inter-organisational configurations with a closeness that makes it possible to pool resources and share activities for a common goal between a sufficient number of actors in order to obtain positive spillovers. In addition, cluster facilitators were seen as being seated in cluster secretariats within clusters and facilitating the development of clusters. Supplementing this theoretical base, the empirical base of the paper was formed by a multiple case study incorporating four clusters related in their key characteristics to the clusters in the typology of Markusen (1996). However, further research is called for that investigates more thoroughly, either through case studies or statistical generalisations, the identified cluster facilitator roles and purposes and their limitations, as well as testing and challenging the suitability of the chosen cluster cases to represent the clusters in Markusen's (1996) typology.

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