Social and Symbolic Capital in Firm Clusters:
An empirical investigation of relational resources and value creation

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Abstract

Cluster initiatives are a popular instrument of public policy everywhere in the world. This development
acknowledges that the organisational units that create added value are not isolated individual businesses,
but networks of actors. Our research has the objective to better understand value creation of single firms
embedded in clusters in terms of overlapping value adding webs of single firms. The main focus of the
paper is on how to describe and operationalise and how to manage social and symbolic capital in clusters.
The fact that the main source of value creation is rooted within networks raises the question of the impact
of social capital on relational rents. The main objectives of this paper therefore are to investigate how
value creation on the relational level of a cluster can be systematised to come to a better understanding
of valuable resources on the cluster level. Empirically the study refers to a regional cluster in Southern
Jutland in Denmark. We found that the horizontal actors in the cluster see the core of initiated cluster
activities rather on the edge of their business activities. The paper develops implications for the cluster
firms as well as the cluster management in its role as a broker and a moderator.

1 Introduction: Value Creation in Firm Clusters

In the last decade cluster initiatives have appeared as a new instrument of public policy. Business
development, universities and private as well as public consulting firms have founded cluster initiatives in
order to bring the aims of public policy and private businesses together. Economic operations such as
innovation initiatives or other kinds of strategic activities are embedded in social relations and structures
(Granovetter 1991, Hagedoorn 2006). Therefore, the organisational units that create added value are not
isolated individual businesses, but usually networks of actors. From a resource-oriented perspective,
networks hold a variety of advantages for their members in the form of access to valuable resources such as information or knowledge.

To link into the analysis of value creation, clusters in the context of this research are understood as overlapping value adding webs around single cluster actors (Brown et al. 2010, Festing/Royer/Steffen 2010). We understand a cluster as a certain number of value adding webs around single firms overlapping each other and being “constituted by a connection of horizontal, vertical and lateral value adding activities contributed by different actors in proximity to one another which all act in relation to a specific industry sector. The actors have relationships characterised by interdependencies of different strength and quality that define the boundaries” (Brown et al. 2007: 20). This underlying definition does by purpose take the perspective of the single firm embedded into a value adding web. It makes an evaluation of valuable resources on different levels possible and is linked into the understanding that networks of actors and not single firms as such are the relevant unit of analysis regarding value creation.

Value creation may result from the process of creative destruction and the implementation of new combinations of production factors. In this context knowledge often is the central variable (Schumpeter 2006). Drucker (1999) coined the term of the “knowledge worker” in this context. However, when the aspect of new combinations is accentuated, the perspective changes and the relational level of the entrepreneur – on the individual or the corporate level of the organisation – becomes relevant. In other words, from this point of view it is not only knowledge and human capital, but also the social capital of the organisation that is of interest (Matiaske 2010). A central motivation of single firms to participate in collaborating networks and/or regional clusters is the access to valuable resources of partners which they cannot exploit otherwise (Muizer/Hospers, 1998). The knowledge about the structure of resources and the ability how to combine and develop resources is a meta-competence and is related to social capital (Gretzinger/Matiaske, 2000; Penrose, 1959; Coleman, 1990).

Due to the sketched constellation, cluster managers may become brokers in the process of resource exchange respectively joint use. One of their main tasks may then be the management of social relations and structures in which the resources are embedded. It can be differentiated between initiated and organic clusters. Initiated clusters are combining the advantages of networks and hierarchy for the organisations involved (Duschek 2004). Initiated clusters of are coordinated by a cluster management while this is not necessarily the case for organic clusters.

Especially small and medium sized enterprises (SMEs) are considered to be dependent on the social capital of networks, because of the limited resources they have under direct control due to their size (Kaufmann/Tödtling 2003). In organic clusters (i.e., clusters which have not been initiated but developed and grown to important business agglomerations) it has been observed that SMEs have better opportunities to overcome their disadvantageous position when they are situated in the centre of or even close to such an agglomeration (Biggs/Shah 2006, Havnes/Senneseth 2001, Piore/Sabel 1984). These SMEs have better opportunities to develop social and symbolic capital (Zhou et. al. 2007). Symbolic capital – or reputation – is one type of social capital and important for signalling core competences, acquiring capabilities and for developing and fostering relationships (Porter 1998, Fombrun 2008).
Our point of reference is the following: In clusters social capital will develop, if coordinated and managed by a central actor or not. But the quality of social capital and therewith the potential of supporting the process of value creation may be influenced by the management (Diez 2009, Tsai/Ghoshal 1998). The question, how to describe and operationalise and how to manage social and symbolic capital in clusters, is neglected in the literature until now. Therefore, it is the main objective of this paper to further investigate this aspect of clusters with regard to cluster development and management. To come to a better understanding of cluster resources that lead to social and symbolic capital for the cluster members, the following questions are therefore posited:

1. How can value creation on the relational level of a cluster be systematised and described?
2. How operational are the described and systematised resource concepts in terms of possibilities to identify these in real world clusters?
3. What are the lessons learnt with regard to the understanding of cluster resources that lead to social and symbolic capital for the cluster members?

To answer the posited questions the remainder of this paper is structured as follows: In the first part a resource-oriented perspective of clusters is sketched. The focus is on resources relevant on the relational level and adherent on value creation so that question 1 is addressed. The second question then is in focus in the next part of the paper where it is discussed how to translate theory into a measureable concept. Subsequent in the empirical part the case of a mechatronics cluster and related sub-clusters in South Denmark is described and discussed with regard to the investigated resources and adherent relational rents, specifically social and symbolic capital. The paper ends with suggestions for businesses operating in a cluster context as well as the management of cluster initiatives, so that the lessons learnt question 3 is about are addressed here.

2 The resource-based view of clusters and the network level

Building on Brown et al. (2007 and 2010) we base our analysis on the resource-based view of clusters. From a resource-oriented perspective on cooperation the pooling of resources between two or more partners is central (Kogut 1988, Das/Teng 2000, Lavie 2006). Resources on different levels may be of interest in this context: resources on the level of the firm, the level of the relationships between the cluster members as well as the level of the actual cluster location (see Brown et al. 2010 for this and the following elaboration of relevant relational resources in firm clusters). Regarding the research questions addressed in this paper the relational level (Dyer/Singh 1998) is of special interest for our analysis. Therefore in the following we focus on the description of the resources on the relational level of a cluster.

On this level relational or network level joint activities as well as the quality and strength of the underlying relationships between horizontal, vertical and lateral actors in a cluster do form relevant resources. The relational view can be regarded as an extension of the resource-based view with a focus on inter-firm relationships and routines as valuable resources. Relevant resources to generate joint competitive advantages from this perspective are investigated in this paper on the basis of Brown et al. (2010) who
suggest taking relationship-specific assets, knowledge-sharing routines, complementary resources and capabilities as well as effective governance (based on Dyer/Sing 1998) into account.

With regard to the quality and strength of the investigated relationships we build – according to Brown et al. (2010) – on Thompson’s (1967) categorisation of interdependencies. Thompson differentiates between pooled, sequential and reciprocal interdependencies and thereby takes into account that value creation is not stopping at the borders of a firm but transcending these borders (Thompson 1967: 25). Brown et al. (2010) transfer Thompson’s understanding that the quality of interdependencies is depending on how critical resources are distributed between horizontal, vertical and lateral actors to their resource-oriented perspective of value creation in clusters.

Interdependencies in Thompson’s work are characterised as pooled when it is referred to “one in which each part renders a discrete contribution to the whole and each is supported by the whole” (Thompson 1967: 54). Such interdependencies appear in the cluster context where involved cluster actors are competing for certain resources such as qualified employees or the budget of the customers (Brown et al. 2010: 23). For Thompson sequential interdependencies describe asymmetrical situations in which a firm supplies inputs to another (Thompson 1967: 54). Transferred to the cluster context such sequential interdependencies occur when a cluster actor supplies inputs to another cluster member (Brown et al. 2010: 23). If symmetric relationships with two organisational units exchanging supply inputs are referred to, Thompson calls them reciprocal interdependencies (Thompson 1967: 55). Reciprocal interdependencies in the cluster context are situations with a mutual exchange of inputs and outputs taking place between the members of a cluster (Brown et al. 2010: 23).

Picot et al. (2008) building on van de Ven and Ferry (1980: 166-168) next to Thompson’s categories suggest to further differentiate team-oriented interdependencies. They are not only reciprocal in nature but refer to activities which cannot be fulfilled by one actor alone but just when actors work together and thus bundle their resources, therefore they reflect the highest extent of interdependency. Transferred to the cluster context team-oriented interdependencies refer to situations where a certain activity can only be fulfilled by two or more cluster actors jointly. According to Brown et al. (2010: 23) taking into account this strongest form of interdependency is useful for a better understanding of value creation on the relational level of a cluster.

Building on that, we use the outlined extents of interdependencies ranging from rather low (pooled interdependencies) to very high (team-oriented interdependencies) to investigate the relationship-specific resources for the analysed Southern Danish cluster actors. The extent of achievable relational rents is expected to be higher with the increasing extent of interdependencies. However, jointly exploiting resources may also lead to spillover rents (Lavie 2006: 644). Such rents come into being when cooperation partners act opportunistically and appropriate rents from the resources jointly used in a cooperation or the other non-shared resources of a partner. These are rents which have not been intended (Lavie 2006: 647).
Social resources facilitate knowledge exchange and refer to “personal relationships that bind together members of an organisation as well as relationships that link organisational members to other external sources of human capital” (deNisi/Hitt/Jackson 2003: 6). Social resources may be valuable with regard to the exchange of knowledge in a cluster. Tallman et al.’s (2004: 259) findings regarding “how stocks and flows of knowledge drive differences in performance between regional clusters as groups of firms while supporting differences in firm-level performance within any single cluster” are a point of reference to come to a better understanding of these. Their suggestion is that organisations with a similar stock of knowledge can relatively easy exchange knowledge, i.e. knowledge is mobile in these constellations (Tallman et al. 2004: 263). Building on that it seems relevant to find out more about the different characteristics of such knowledge exchange respectively knowledge spillovers as well as of the processes of knowledge evolution on the network level of a cluster. In this context it is not only relevant to understand how valuable knowledge evolves and what special characteristics it shows but also to gain knowledge how imitation barriers are built up regarding actors outside the cluster.

Thus, we want to understand the knowledge-sharing routines applied in the investigated cluster. Such knowledge sharing routines (for the following also see Brown et al. 2010) play a central role when tacit knowledge is to be exchanged. Such knowledge cannot be verbalised or formalised in contrast to explicit knowledge (Polanyi 1966). Regarding the exchange of knowledge it also seems useful to differentiate between component and architectural knowledge. Component knowledge is related to industry characteristics and specificities and can be rather easily exchanged between the actors from the same industry environment with similar technological backgrounds, while architectural knowledge is firm-specific and more difficult to be shared even in a cluster context (Tallman et al. 2004: 263).

Next to understanding the interdependencies and the knowledge-sharing routines as relevant network resources, we also want to get an understanding of pooled resources of cluster actors. As Brown et al. (2010) we here further build on Das and Teng (2000: 41) who differentiate between property-based and knowledge-based resources. While property-based resources such as machinery or patents imply clear property rights for the owners as well as legal protection, this is not the case for knowledge-based resources. Such resources are rooted in tacit knowledge and skills of organisations and are therefore hard to access from outside the organisation without being able to acquire them in learning-by-doing processes.

To further specify Brown et al.’s thoughts regarding this we suggest taking the ideas of social and symbolic capital into account. Analysing relational resources and rents still is a challenge due to missing concepts to use in empirical studies. By including social and symbolic capital in the fashion suggested above we try to contribute to overcome this deficit.

We regard social capital as a precondition for the process of managing valuable resources in the context of clusters. Exchanging, combining and developing knowledge is not possible without social capital (Adler/ Kwon 2002). Symbolic capital is supporting the process of developing social capital and by the same time is developed and fostered by social interaction (Fuller/Tian 2006, Coleman 1991, Bourdieu 1986). We define social capital as the sum of (1) network based resources like relationships to actors (persons as well
as companies, other kinds of organisations and the access to resources via these ties for example knowledge to the network), (2) trust and (3) norms and values which are creating reciprocal behaviour (Paxton 1999).

Due to the fact that firms – especially SMEs depend on collaboration and thus on networks - Foss (1999) stresses the necessity of overcoming the contradictions of the resource-based view and the network perspective. In this context Duschek (2004) suggests that the relational view is associating both approaches but until now the relational view is normative according to network arguments. To overcome this deficit, Duschek (2004) is sticking to Burt, Granovetter and Coleman and accentuates that from the relational view two types of supernormal resource-oriented rents will accrue to firms by participating in networks or clusters (Dyer/Singh 1998, Duschek 2004). These are the so-called Burt rent and Coleman rent. Relational competitive advantage is generated via institutional arrangements like initiated or organic clusters. The supernormal returns are essential structural characteristics of networks respectively clusters and not attributable to single enterprises (Duschek 2004, Coleman 1994).

The Burt rent literally results from bridging structural holes (Kogut 2000). Social structural advantages derive from the brokerage opportunities created by an open social structure (Burt 1992). Several recent studies have indicated that the positions of firms in inter-organisational networks influence firm behaviour and outcomes (Ahuja 2000, Powell/Koput/Smith-Doerr 1996). Actors can benefit from building relationships with multiple disconnected clusters – or sub-clusters – and use these connections to obtain information within this collaboration and to control advantages in relation to others. On the one hand it is important to bridge holes between the sub-clusters in order to find and to manage new combinations of resources. On the other hand it is important to identify and to foster holes regarding the external network structure in order to exploit and protect the competitive edge (Cooke, 2005; Burt 1992).

Obviously, the process of combining and managing complementary knowledge embedded in a network with asymmetric power structures needs effective governance mechanisms. To make the exploitation of structural holes fruitful it is of relevance to develop governance mechanisms of how to develop and to foster the internal structure and of how to share costs and earnings. Accordingly, one crucial task regarding governance systems is to develop management tools guiding the organisation to develop core competences and at the same time to be able to cope with asymmetric power situations in the process of sharing the added value. In highly innovative clusters the diffusion of innovation was found to be more rapid in central network positions (Greve 2007, Gretzinger et al. 2010). Thus, a cluster management may raise the added value by bridging gaps inside the cluster and stabilising the position regarding external networks and markets. This goes along with fostering the reputation of the cooperation in the cluster. To create such a reputation seems only possible for well functioning clusters. For players with an established “track record” of fair cooperation it should be easier to attract new interesting partners.

The management of a cluster from this perspective is in charge of indentifying structural holes and to develop managerial concepts to foster, to develop and to control or – if necessary – to bridge structural holes (Molina-Morales, F. X., Fernandez, M. T. 2007; Lorenzen, M., Mahnke, V. 2002; Burt 1992). To be able to motivate all members to participate in the process of value creation, it seems useful for the cluster
management to be aware of the structure of the network and the potential of structural holes. Thus, the analysis of the network and the embedded resources is a central task. Another kind of strengthening the social capital and the added value may lie in exploiting new external networks. Regarding to Granovetter weak ties are especially fruitful in the process of creating new ideas as well as in the process of developing reputation (Granovetter 1973, 1983). The strength of ties in this context describes a “combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie relationships” (Granovetter 1973: 1361). Such ties according to Granovetter (1973) can be weak strong or absent. Next to some strong ties a considerable number of weak ties are to be expected to exist in a cluster as well as between cluster members and cluster-external actors.

The Coleman rent systematises a resolution to collective action problems resulting from redundant ties among (cluster) actors (Kogut 2000). Coleman (1988) suggests that value creation bases on dense interconnected relationships. Thus, in the long run stable and trustworthy interaction within a cluster may be of great importance for developing common capabilities. While non-redundant positions are of great importance in the field of developing competitive resources or resource bundles for the transformation of competitive advantage into marketable products, trustful relationship with the business partners are of equally great importance with regard to the development of common capabilities while avoiding the occurrence of spillover rents. Furthermore, reputation in the long run is basing on trustworthiness regarding business partners as well as customers. Due to the fact that a cluster is characterised by the locational proximity of its members and that the cluster is much more perceived as one unit compared to a loose network, the chance of developing a separate image for the cluster is greater compared to looser networks and is supported by trust and cohesiveness (Fombrun/Shanley 1990, McEvily/Zaheer 1999).

Building on these considerations we suggest the following specification of the relational resources suggested by Brown et al. (2010). Regarding the rent creation on the network level we do take into account the outlined interdependencies, i.e. pooled, sequential, reciprocal and team-oriented dependencies and operationalise them according to Brown et al.’s (2010) work. Further, we investigate relational resources with regard to knowledge-sharing routines, complementary resources and capabilities as well as effective governance. In this context we take into account the elaborated Burt rent and Coleman rent concepts. We use these rent concepts to come to a better understanding of rent creation in clusters. Table 1 summarises the outlined considerations regarding the assessment of the relational resources in this paper. This table is used as template to analyse the mechatronics cluster in the next step, they deliver the structure for the data analysis and make it possible to come to a systematic understanding of the value creating relational resources in the investigated cluster.
Table 1: Network-level resource assessment for VAW analysis

<table>
<thead>
<tr>
<th>Systematisation of shared resources</th>
<th>Relevant assessment question 1</th>
<th>Relevant assessment question 2</th>
<th>Assessment if resources have potential to generate competitive advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship-specific assets</td>
<td>Duration of safeguards?</td>
<td>Volume of inter-firm transactions?</td>
<td>√/(√)</td>
</tr>
<tr>
<td>Pooled interdependencies</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sequential interdependencies</td>
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<td>Reciprocal interdependencies</td>
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<tr>
<td>Team-oriented interdependencies</td>
<td></td>
<td></td>
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<tr>
<td>Knowledge-sharing routines</td>
<td>Partner-specific absorptive capacity?</td>
<td>Incentives for transparency and against free riding?</td>
<td>√/(√)</td>
</tr>
<tr>
<td>Social resources in terms of skills to exchange (social capital)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) tacit knowledge or explicit knowledge</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>(b) component or architectural knowledge</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Complementary resources and capabilities</td>
<td>Ability to identify and evaluate potential complementarities?</td>
<td>Role of organisational complementarities to access benefits of complementary strategic resources?</td>
<td>√/(√)</td>
</tr>
<tr>
<td>Property-based resources</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Knowledge-based resources</td>
<td></td>
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<tr>
<td>Symbolic capital</td>
<td>Ability to employ self-enforcement rather than third-party enforcement governance mechanisms?</td>
<td>Ability to employ informal versus formal self-enforcement governance mechanisms?</td>
<td>√/(√)</td>
</tr>
</tbody>
</table>

Source: Brown et al. 2010: 25 based on assessment criteria adapted from Dyer and Singh 1998: 663, criteria social and symbolic capital added.
√: further investigation of resources (√): no further investigation of resource

3 Case Study: Network-level resources in the mechatronics cluster in South Denmark

In this section the relational level of the overlapping value adding webs making up the cluster landscape in Southern Jutland/Danmark is investigated. Therefore, first the methodology for the case study analysis undertaken is elaborated and justified. It follows a general description of the (sub-)clusters in the Southern Jutland area which provides the point of reference for the further analysis. The investigated cluster cases are then analysed with regard to the relational resources outlined above.

3.1 Methodology

The mechatronics cluster will be analysed regarding the different rent concepts which have been elaborated in the first part of this paper. The aim was to give comprehensive descriptions of these rents as well as relate them to the field of clusters. In the following, the answers to the second research question regarding the usefulness of the described rent concepts are completed by using the systematised
relational rent concepts as ideal-typical patterns to be contrasted with the reality of the investigated in-depth case study of real world clusters in Southern Denmark.

Yin (2002) suggests the case study method as a useful approach when ‘how’ and ‘why’ questions are addressed and the researchers do not have control over events. For analysing the cluster cases in Southern Jutland the following data sources have been used: expert interviews, newspaper articles, information about the cluster and cluster actors from the Internet in general as well as from the homepages of the cluster actors and the cluster web presence. The aim was a data triangulation which gives us a rich set of data as the basis for analysing underlying resources and resulting relational rents for the investigated cluster cases.

Seven in-depth interviews with experts in the field of clusters and their management have been conducted. The experts are from the mechatronics cluster in Southern Jutland/South Denmark as well as the related “sub-clusters”, i.e., the cooling-, and lean-energy-cluster. The managements of all three cluster-initiatives are settled in Sønderborg in South Denmark. The interviews took place in a face to face setting and based on a semi-structured questionnaire with the focus on resources and rent generation on the level of the relationships. Here a questionnaire has been partly used which has been tested in other projects of resource-based cluster analysis before (see Royer et al. 2009). The experts have been asked for motives, advantages, resources, common initiatives and the role of the cluster management as well as of the role of public policy in that context.

We used the following quality criteria in our research (see e.g. Wrona 2005). By the triangulation of data from different sources we aimed for internal validity of the findings. By the disclosure of the research process we strive for inter-subjectivity of the findings so that procedural reliability is given. The authors have analysed the data separately in a first step, before they compared and discussed them. By this procedure consensual validity has been reached. We integrate parts from the interview material into the case analyse to better illustrate our reasoning regarding the identification of valuable resources on the relational level. The material cited stems from the interviews undertaken in the cluster in 2010 and 2010. All interviews have been conducted in English language by non-native speakers. To improve the readability of the quotes, the language sometimes has been corrected and smoothed. So e.g., when a word is said twice in the conversation because the interviewee thinks about what to say next, the second one has been deleted.

In summary, the reason for choosing the qualitative case-study approach is that a case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin 2003). Especially social capital in clusters has so many different manifestations. So which aspects of social capital are important to systemise and describe rents on the relational level of a cluster should be additional the output of this investigation on social and symbolic capital in firm clusters.
3.2 An overview of the mechatronics cluster

The mechatronics cluster is located in the Sønderborg area. The term mechatronics stands for an integrated approach. Mechatronics is the integration of electronic, electric and mechanic engineering as well as computer technology and control engineering in one “discipline”. In consequence managers and technicians have to adopt interdisciplinary and network spanning perspectives (Bolton 2003). In Southern Denmark the mechatronics and the related industry is very relevant. Together with agriculture and the food industry mechatronics is regarded a main industry in Southern Denmark (Santisteban 2006). Next to the large mechatronics cluster a couple of smaller clusters have emerged which are also related to the mechatronics sector. Main pillars of the cluster are joint activities in research and development of the here located businesses, competence centres and the Syddansk University as well as other research institutions. Common education and training programmes as well as joint recruitment initiatives or joint workshops in the field of research and development or lean production provide examples for joint activities.

In August 2005 an expert group – initiated by the Bitten and Mads Clausen Foundation, guided by the Center for Business Development/Sønderborg - made an analysis of the economic situation of the region. The board decided to found a cluster organisation, the mechatronics cluster, to strengthen competitiveness and to foster the profile of the South Danish mechatronics industry (Stockholm 2005). The working group furthermore sought to identify and bring together stakeholders in order to fully utilise the strong networks which serve as a lever for the members’ knowledge and innovation potential. Upon conducting of a series of interviews the following was concluded: (1) The challenge and opportunity for the industry is to shift from isolated business to integrated clusters and subsequently improve the cluster’s development conditions. (2) The threat to the industry is the lack of a sufficiently qualified labour force in the area (Stockholm 2005).

Till 2011, in the cluster a lot of common activities have been initiated and new companies have been founded which could be developed to be competitive in the global marketplace operating from the Sønderborg area. The core of the cluster lies in the tradition of engineering in the area and the companies located there. Activities related to research and development are undertaken in the cluster in close cooperation between businesses, competence centres and the university. The region is meanwhile characterised by an entrepreneurial spirit that has led to the foundation as well as the growth of many enterprises in the Sønderborg area. This also is reflected in the fact that the mechatronics cluster with its tradition of remarkable engineering capabilities in the firms located there has been chosen to be Denmark’s third most creative area (http://www.clusnet.eu/Cluster-SINGLE.64+M5db61dd4574.0.html?&tx_gclusnetcarto_pi1%5Bid%5D=66, last access 15-09-2011). One of the two interviewed managers from MH(1) summarises the current state of the cluster as follows: "So, if I should point at a real cluster in Denmark or Europe around power electronics functions, it is this area here. And it is not only Danfoss. We have Lodam, OJ Electronics, we have a range of companies that operate in this field. And certainly there are synergies.”
Since 2010 the mechatronics cluster is an association under the roof of the newly established Sønderborg Business and Touristcenter (SET). Meanwhile the mechatronics cluster consists of approximately 70 businesses in the Sønderborg area. The head of the organisation mechatronics cluster are the presidents Egon Jensen from Linak A/S and Hans Ørum from Høier og Vendelbo A/S. Linak is active in the field of hydraulic systems for writing desks, beds and professional bedside, etc. (http://www.linak.dk/). Høier og Vendelbo compete in the field of automation components for mechatronics products from leading companies like Siemens, Steute and Omron (http://www.h-v.dk/). Further members in the mechatronics cluster are e.g. the Mads Clausen Instituttet, the Center for Software Innovation, EUC Syd, Agramkow, PAJ Systemteknik, Trimatic, KPCA, Lodam Electronics, Servodan, Focon, Siemens Flow Instruments, BB Electronics, Hannemann Engineering, Banke Pro, Automatic Syd, Danfoss Solar Inverters, Sauer Danfoss, OJ Electronics and Pehama Productions (http://www.mechatronicscluster.com/medlemmer-partners/medlemmer/).

Very close to the mechatronics cluster are the cooling- and the lean energy clusters, they may be seen as elements of the mechatronics cluster as well as spin-offs of the same. All three clusters overlap each other in terms of the enterprises participating. While the cooling cluster (http://www.kvca.dk/pages/) is a special sub-cluster focussing on cooling technologies, the lean energy cluster is also a sub-cluster but has a broader approach. The lean energy cluster is specialised in matters of “intelligent solutions on energy generation” (http://www.energymap.dk/Profiles/Lean-Energy-Cluster).

In the previous paragraphs we have illustrated the general structure of the investigated cluster(s). In the next part we then investigate the relationships between selected horizontal, vertical and lateral actors in the cluster, the adherent relational resources as well as social and symbolic capital.

3.3 Relationships, social and symbolic capital in the mechatronics cluster

In this section we use the framework for analysis which has been introduced in the first part of the paper. This framework will be filled with data collected about the investigated mechatronics cluster so that the valuable resources and created rents on the network level can be identified. The idea of the resource-based view of clusters is to take a single horizontal cluster actor as the point of reference and map the value adding web around this actor. If this is applied to all the horizontal actors, overlapping value adding webs can be mapped that reflect the investigated cluster. This is the approach here in order to investigate the relational level between six horizontal cluster actors, one vertical actor as well as four lateral actors. To guarantee anonymity of the investigated firms, the following abbreviations are used: MH₁ – MH₆ are the horizontal, MV₁ is the vertical actor and ML₁ – ML₄ are the lateral actors in the mechatronics cluster which have been investigated with regard to their relations so far. Figure one sketches the structure of the investigated mechatronics cluster with the two sub-clusters and shows into which of the clusters the investigated actors are members.
Relationship-specific assets are initiated by the outlined forms of interdependencies. For the investigated cluster now it has to be analysed which interdependencies between the vertical, horizontal and lateral actors can be identified. Next to the identification of pooled, sequential, reciprocal and team-oriented interdependencies it is relevant to understand how durable the underlying safeguards are. The more durable mechanisms exist to bring the actors into a quasi-symbiotic, interdependent situation, the higher the specificity. If the specificity refers to many inter-firm-transactions this implies a high degree of interdependence. If the interdependent actors are successful in preventing opportunistic behaviour and keep the mutual dependence in a balance there is a high likelihood of relational rent generation. When investigating the interdependencies between the horizontal, vertical and lateral cluster actors it does become obvious that pooled, sequential, reciprocal as well as team-oriented interdependencies do exist in the mechatronics cluster.

First of all there is a high extent of pooled interdependency with regard to attracting qualified employees. The cluster members have need for highly qualified engineers and all see it as a challenge to make attractive offers to get the highly qualified human resources to Southern Denmark, as becomes e.g. obvious by the statement of MH(2) \(_1\): “It is very important for us to have the right labour pool, to have a qualified and competent workforce around it. And it’s a challenge as well for us, especially here in this region of recruiting the right people.” On the one hand side there are joint activities to be observed in the cluster to overcome the problem by “sharing of experiences [...] campaigns that are done across companies in the region for, so to say, attracting people to this part of the region” (MH(2)\(_1\)) or as MH\(_5\) puts it: “We are doing a lot [...] Sønderborg has making a campaign [...] we are making a campaign all over
Denmark where we tell everybody about how Sønderborg is to live in and how is to work in and so on and try that way to get more people to be interested to live in Sønderborg.”

On the other hand side there is a relatively fierce competition between the businesses to attract the best human resources to their companies in terms of the fact that the companies “are also doing something on [their] own” (MH₁), such as “having campaigns running, we are, so to say, trying to catch the employees from the universities, you know, and trying to market the [MH₁] name very, very early.”

When they are in the region already there is a certain competition for good “minds” between the businesses. However, over the years some informal rules have developed that prevent higher and higher salary demands by employees changing from one business in the region to another regional player. In the interviews it becomes obvious that here are certain limits of this competition for highly qualified personnel. Extremely high salary demands are usually not successful. With regard to such demands, the firms are collaborating to keep conditions manageable or even informal agreements exist not to woe away employees from each other (“And I think there is also rules, that we are not headhunting from each other” (MH₂)).

Sequential interdependencies are also reflected in the data material. Next to supplier-buyer-relationships, it becomes obvious that the larger players give (financial) resources to smaller players to foster innovations in the region. MH₁ in this context for example states: “If the idea is right, they find the right partners. Get hold of a lawyer, sign the contracts about who gets what, who does what, who owns what. And get going, and then they come to the point of where they need money. So, small- to medium-sized companies get the ideas and get the train role so to speak and then we need the big ones to fund the scale of it.”

But also for the larger players sequential interdependencies are of relevance, less of a downstream but more of an upstream nature (MH₁): “so it is less customers, the demand side, it is rather the input side in terms of services, information, knowledge exchange”). Regional suppliers are used when they have relevant competences. MH₂ in this context explains: “I would more say it in a way that we make a lot of development here, then we somehow or sometimes use the expertise of the suppliers on specific, so to say applications [...] Because they are the experts within [a certain] part here. We are the experts in the total application of the product. So we can use the suppliers’ competences within their field.” Sequential interdependencies can be identified between MH₅ and MH₁ for example. MH₁ states that “competition between companies is not an obstacle for cluster activities, because there are so many things that you can work together on that has nothing to do with a marketplace. [...] Our technology for instance [...] finds applications in a range of different companies, which means we sell power modules to [MH₅] as well as use them ourselves.”

Reciprocal interdependencies are especially expected regarding the University and the horizontal or vertical cluster actors. The university here is seen as a relevant partner for different activities documented e.g. in MH₅’s comment that “Universities play a very important role. And that’s [...] our main idea of being part of the cluster. And it is now, that we want a competence level at our university to be high. And we
want our university to both educate and to also do R&D in areas that are of our importance.” When reflecting the original purpose of the cluster foundation MH3 states “One was to set [name of the local university] as a lighthouse for the area - how to create a university and it actually was the technology that is needed in the area. Between the companies in the area that was one of the purposes”. Reciprocal interdependencies however do also link horizontal actors with each other, for example MH6 and MH1 are partners in the field of research and development.

Team-oriented interdependencies do also occur but till today rather on an informal level. One formal project with relevance regarding team-oriented interdependencies may lie in one initiative to foster knowledge sharing that has been started but till now not really brought forward. This cluster initiative is about letting employees rotate between different firms of the cluster. “The reason for having them in different companies was they could be ambassadors for the culture of different companies, they now have a very good network inside the mechatronics cluster and then could act as ambassadors for moving people around between companies and also this flow of employees actually creating this boiling part of having people in and out of companies and first of all I think new ideas and innovations” (MH3). This initiative also is relevant in terms of the knowledge sharing routines to exploit complementary resources and competences outlined below.

The pooled interdependencies dominate in the mechatronics cluster. Sequential interdependencies are also broadly observable. The reciprocal interdependencies are less obvious but still found between especially the smaller and medium sized players (e.g., MH1: “Small- and medium-sized companies are the backbone of every cluster. The reason is that they have no bureaucracy. And they have direct decision capability. They are not scared of sharing knowledge, because they have to share knowledge to survive. And therefore they are very good at informal activities and they are also very good at getting them formalised quickly”). Team-oriented interdependencies are still developing or are below the surface. It can be concluded that the cluster actors of the mechatronics cluster have built up relationship-specific assets to a certain degree. Especially the smaller players are embedded into the regional networks and are not only dependent on the cluster but also generate relational rents because of the cluster. The larger players are dependent to a lower degree and are – even though interested in the regional activities to a certain extent – more embedded into their global value chains. Figure 2 summarises the investigated interdependencies.
Knowledge sharing routines are documented in the fact that a lot of interaction and networking takes place on different levels. It is the case that a lot of exchange happens on the operational level (MH3: “there are about seventy companies represented in the mechatronics cluster and there are about ten thousand employees and it is only for the Sønderborg area. We have made some groups for the employees so they are working together with a lot of people from other companies in those groups and they have a very good benefit out of it because they can talk about many daily things in the groups with people that know what they are talking about, so it is quite good”). But the “glue” of the cluster further seems to consist of the high level of interactive and communication activities on the top management level (ML1: “this basically informal network between companies, it is basically mainly between the top management of companies. It is very important because it is a forum for discussion and actually trying to - where it is possible - to create common activities between companies in the area. How do we attract people, how do we attract new companies, how do we attract technologies and things like that. That is very important”). One initiative to foster knowledge sharing that has been started but till now not really brought forward was – as outlined above - to let employees rotate between different firms of the cluster.

Knowledge sharing routines in our conceptualisation refer to skills to exchange social capital, be it in the form of exchanging tacit and explicit knowledge or component or architectural knowledge. This may be of higher relevance to the smaller players but also plays a role for the larger actors: MH2: “And the advantages that those companies have here in this region is that still a lot of the development, R&D, new
product development is here [...]. So the proximity that they have, that they can easily come to [each other] [...] to test new things, prototypes, etc., that, of course, is an advantage because the proximity here is important in a development project.”

Knowledge sharing obviously links into the complementarities of resources and capabilities. This is also reflected in the following statement of MH: “So what has happened actually was that a group of mechanical engineers from more companies actually found that if they work together they could actually together create more innovative solutions than each of them. So, first of all they got this competence network between them, they were working together so we are, we are not a single competence in a company. Now you have some colleagues to discuss your solutions with and that is another way where if the companies are willing to do it, they can pool their competences and actually we also called some kind of partnerships so companies with different competences actually partner up together to solve certain projects.”

Differences regarding the size of the cluster firms play a relevant role here. “For being member of the cluster, again small companies might have very few people working with certain competences, so we have a sub critical mass of employees which is not the case of the large companies. So what has happened actually was that a group of mechanical engineers from more companies actually found that if they work together they could actually together create more innovative solutions than each of them. So, first of all they got this competence network between them, they were working together so we are, we are not a single competence in a company. Now you have some colleagues to discuss your solutions with and that is another way where if the companies are willing to do it, they can pool their competences and actually. We were also called some kind of partnerships so companies with different competences and actually partner up together to solve certain projects” (ML).

Large firms give money and other resources to start ups and smaller players (MH): “you can give other resources than money. You can provide manufacturing space, you can provide specific specialists’ knowledge and so on to what they are working on. And that’s actually exactly what happens with [MH].” Further competences are built by integrating other cluster actors into the own company as MH states: “Primarily, these competences are acquired, via acquisitions of competitors, of start-ups”.

Regarding knowledge sharing further the cluster management plays a relevant role. As ML puts it: “The role of the cluster management is to facilitate the initiatives taken by the governing group. We have also one more thing that has been part of the cluster: special interest groups working on exchanging experiences and so on. There is a number of groups that actually still are working but that was one of the main things that the cluster manager actually facilitated, was actually at all times making sure that these groups were working.” The cluster manager has the function of a broker and intermediary in the cluster. In all the interviews it was described that the cluster management should know where which kind of resources are to find, should furthermore analyse the needs and the potential of the cluster and initiate common initiatives to develop and to strengthen the cluster. The management of the mechatronics cluster is also in charge of integrating the management of the other two clusters, the cooling cluster and the lean energy cluster as well as the universities and public organisations like chambers of commerce or
public funded organisations (i.e., the lateral actors ML₁ – MLₙ). The mechatronics cluster is narrowing down all activities to a regional level. The two sub-cluster initiatives have narrowed down the subject from mechatronics to cooling respectively lean energy but refer to the region in a much broader approach. That means that the management of the mechatronics cluster has not just to anticipate the process of coordinating three different areas of topics but also different regional and national structures.

Regarding the symbolic capital reputation plays a central role to attract new companies to the cluster and foster entrepreneurial activities in the region. ML₁ explains that the attraction of other companies should not just be “a local phenomenon, so we have to/would like to attract companies from all over the country, maybe also foreign companies. And that is only to be done if you have a certain reputation of expertise being as solar cluster having given a participating companies something value because you will only participate as a company if you get some value from your participation, so reputation also is the stories of the stories of yes these companies actually got value from being a member.”

Small firms may be able to build up symbolic capital by working together: "Yes and by pooling resources they might actually seem larger to costumer. We have had this in the Danfoss Entrepreneurpark in Nordborg where small companies going and actually have the possibility of utilising some of the production areas in Danfoss, having a costumer coming in to a small five ten people company showing out this huge production area where they can get it also and then being trusted or partner of this large companies" (ML₁). The mentioned Entrepreneurpark is another specificity of the mechatronics cluster to foster entrepreneurial activities.

In summary, exchange happens to a high degree on the informal level since people know each other. Formal communication has been fostered by the cluster management in the past, however, exchange stayed on a level rather relevant for topics that are not directly related to the business of the involved actors. Informal communication and social control between individuals who know each other over long periods of time can be observed in the mechatronics cluster. The cluster actors are located in proximity to each other and thus have theoretical access to property-based resources. However, many of them are global players with related further opportunities regarding this Knowledge-based resources seem to be transferred especially on the employee level and by the job changes in the cluster. Symbolic capital in the form of reputation as a fair cooperation partner plays a relevant role especially regarding the informal exchange between individuals in the cluster.

Effective governance of the mechatronics cluster is not so much manifested in formal institutions; however, the cluster has developed over the years in an evolutionary fashion. "We don't have ten rules written down, but you have to follow the ethical code of business or whatever you would call it. Otherwise you will never be invited in. So, there is an ethical code, of course. But it is not formal"(MH₁). This does also become obvious in the following statement of MH₂: “I actually think that there is a good mentality in the cluster. There is mind-openness. There are few direct competitors; maybe that helps us a lot. There is a very open spirit. People are willing to talk about success and disasters. So that it's probably not a written rule, but it is okay.” Regarding effective governance it is also relevant to take into account that there is a large governing board of the mechatronics cluster (MH₂): “You know, if normally in that type
of business there is a board of maybe two, three, four, five people but here is a board of 22 people. So they show that all what we say, all what we do is very important in the mechatronics cluster, all the groups will employ it. It is very important that you in the groups [...] take the meetings and you hear what everybody says and you learn a lot of things from other people”)

Almost all the companies in the cluster are related to the other cluster companies via the sourcing of pre-products, services or components. Further, practically all companies are related to MH$_1$. Therewith MH$_1$ is a sociometric star in the centre of the network referring to the exchange of components, pre-products and services. Most of the companies are acquiring pre-products or services from MH$_2$. However, MH$_1$ is also benefiting from the many other mechatronics companies in the cluster. For example, some SMEs are selling services in the field of research and development to MH$_1$. Dependencies as well as competition in the cluster become obvious when analysing the data. The competitive elements are not regarded as considerably strong by some interview partners such as ML$_3$: “that is also the characteristic of the area, the companies in the area, they all have very little direct competition, hard fighting competition between companies.” From the data it seems realistic to see the competitive elements in the cluster to consist of intersections of customer target groups and the examples stated above. The fiercest competition among the companies, however, is in the field of human resources. Qualified human resources, especially engineers are scarce in the region and all firms are interested in qualified employees.

ML$_3$ summarises the situation by stating that there are vertical relations along value chains and horizontal ones across value chains in the cluster, i.e. “so the companies which are hard competitors in some areas [...] are working together in other areas [...] and that’s why we create value [...] because we can [bring] competitors together without they are fighting.” It becomes clear that the mix of cooperative and competitive elements does characterise the cluster. Further ML$_3$ adds that there is a difference between smaller and larger players which is reflected in the rest of the data material as well: “It is all I think the small [firms], and the huge companies with this have the feeling they can do everything they want and the small companies are more willing to work together.”

Even though the mechatronics cluster has suffered from the world economic crisis in 2008 in terms of a lack of funding, it still is supported by the companies in the region. However, some initiatives that have been planned have not been implemented in the end of the day or cheaper solutions have been taken. This is reflected in the fact that the position of the cluster manager meanwhile is held by a student, when before a highly qualified senior cluster manager has been paid. Activities such as letting employees rotate between different companies in the cluster to exchange and better learn about the culture and knowledge in other firms as not been implemented even though it was completely ready to get started including that the first person to use this opportunity has already been selected when the economic crisis hit. What has survived the crisis next to other elements of the cluster lies in the mentioned strong network of top managers of the firms located in the cluster. For example, when asked about the most important resources in the cluster ML$_1$ stresses that it is “first of all [...] having the network, this basically informal network between companies, it is basically mainly between the top managements of companies. It is very important because it is a forum for discussion and actually trying to where it is possible to create
common activities between companies [...] How do we attract people, how do we attract new companies, how do we attract technologies and things like that. That is very important. One very important, that is also actually having a common place for discussing between companies and the universities, so it is very important that the management of the university participates in the cluster.”

4 Lessons learnt and concluding remarks

Formal exchange and communication takes place in the mechatronics cluster to a certain extent and has been fostered by the former cluster management. However, the interviewees from the horizontal actors in the cluster see the core of these activities rather on the edge of their business activities. Exemplary topics are dual career problems or general engineering conferences. The interviewee from MH(1), e.g. states about the cluster management activities “I call [it] nice to have activities. There are some projects where they share some knowledge about manufacturing or about recruitment and so on. But it is not business development. [...] I see it informally.”

It further becomes obvious that it not only about formal exchange and communication but that it also is of relevance to create a platform for people related to the cluster to meet and build informal networks. One of the triggers to initiate the cluster in the first place was to create such an exchange as becomes obvious from the following interviewee stating that before the cluster has been initiated he “could need to have [...] a group of people [to] join and discuss a lot of business. Out of that we decided to start a mechatronics cluster up because there were very many mechatronics companies in Sønderborg.” And further he elaborates “I know a lot of people there who can help me [...] and I can help them if they need help. I think that the most what you say, the group, they have most value out of mechatronics cluster [...] because they are working in those groups they are working at and they have a lot of discussions with people like themselves” (MH3).

The relationship of the three clusters one to each other is clear in a formal way but the aims and the initiatives are not coordinated. However, since the same people are in different clusters and the informal communication is a strength of the investigated cluster, exchange happens on that level between all the sub-clusters in the mechatronics cluster. From the data analysis it also becomes obvious that there is a conflict regarding the kind of organisational set up which is adequate for the future development. This becomes obvious by the different descriptions of the cluster managers and experts of what the cooperation of the three clusters should look like in the future. All the cluster managers have described their organisation as a unit of competences but there is still no agreement of how to relate the three clusters. The question seems to be if the involved actors are successful in leveraging the business-related cluster activities to a formal level and institutionalise it in a formal way. The cooperation on the informal level works well and is – as shown above – related to many valuable resources on the network level of the cluster. However, it is also highly dependent on certain persons in the region respectively the cluster. The exchange is mainly driven by a group of top managers. To bring it to a more formal level would hold the advantage that it is not so dependent on single individuals in the future. Also – and that is a major issue obviously – when funding of cluster activities from Public Policy is concerned, only documented
formalised cluster activities have a chance to be considered. A wider reputation of the cluster to e.g. attract other businesses also may profit form more formalisation since only such activities are accessible for cluster outsiders as well as the insiders.

All the interviewees on the cluster management level stressed that reputation is important and they are seeing their role as a broker in the cluster. But this aim is rather an informal one till now and the concrete tasks of the cluster managers as brokers are not fixed or clearly structured. One consequence of missing formal aims is that the formal structure and especially the communication structure do not fit with the challenges the cluster businesses have to deal with in their day-to-day tasks. Due to the fact that social and symbolic capital has developed on the informal level the challenge is now to set up a more formal design. As argued above a better formalised and goal-oriented structure could support the process of developing and fostering social capital and would lay open this kind of success. The effectiveness and efficiency could be supported by making this aims formal and relating them to the aims of the neighbouring clusters. Knowledge exchange between firms could be intensified to foster innovative ability and efficiency (as shown above, at the moment many activities which are directly related to value creation happen on the informal level). Some companies have started initiatives of founding R&D-networks without using the resources of the cluster but they would have liked to exploit the resources of the cluster if they were accessible.

It seems that the cluster management is not all the time close enough to their customers (the cluster members on the horizontal and vertical level. This could maybe be improved by the establishment of a better communication system which enables the cluster management to learn as much as possible about the needs of the members. It seems to be that the formal organisation mechatronics cluster and the relation to their members have to be reconsidered and to be developed. E. g. the establishment of an intranet/formal communication possibilities regarding business development for cluster members may have positive effects on the cluster’s value creation. Structural changes should be evaluated since they may impact interdependencies (e.g., development of sub-clusters). The cluster managers could be more aware of their role in the cluster as brokers. To strengthen the reputation the management could intensify marketing and branding e.g. in terms of the MC (=mechatronics cluster) logo as seal of quality (also to get access to public funding).

The mechatronics cluster is rooted in an established organic cluster but still developing in terms of a more formal cluster organisation. The mechatronics cluster seems to be at a point where reflecting the current cluster organisation may bring fruitful outcomes for all members. More firms could be attracted and integrated to exploit the whole cluster potential for value creation. The stronger the cluster becomes and the better the reputation the better the access to human capital as well as funding from private as well as public actors on the regional, national or European level.
References


