

CHALMERS



Challenges in Organizing University-Industry Research Collaboration

A Study of three Research Centers at Chalmers University of Technology

**Master of Science Thesis in the Master Degree Program, Management and
Economics of Innovation**

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CHALMERS UNIVERSITY OF TECHNOLOGY
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Abstract

The ways in how scientific knowledge is produced is changing and research is moving towards becoming more transdisciplinary. This changes the role of the university in how research is practiced. This moreover applies to Chalmers University of Technology. At Chalmers there are almost fifty research centers. A research center is collaboration between academia, industry and government. Although a great part of the Chalmers' research is practiced within such centers, one question remains unanswered: *What is a center?*

This has led to a study of three research centers within Chalmers to be able to understand why this question has not been answered and how the research is organized in practice. Also the question: *What is the Role of the Director?* has been studied. This was done by identifying four challenges for the research center generated from a theoretical background of structures for production of scientific knowledge and of power and politics. The four challenges were: degree of collaboration, focus of Research, the role of the center and also the role of the director. These were investigated in the centers of this study by interviews and also a workshop was conducted to confirm and develop results.

The results showed that to have a structure for research which includes collaborating with industry is valuable but also complex and the four challenges were difficult to separate. Demands in a research center shape the role of what the research center is. The role of the director depends on what the role of the center look like. However, implications which would facilitate the handling of these challenges were presented. Firstly, there has to be better communication with the industry. Secondly, the roles of the different parts in the research center would benefit from being clarified. Lastly, the research centers would benefit from a forum for communication in-between an Area of Advance or in-between the different centers.

Keywords: Research Center, University-Industry Collaboration, Mode 2 Knowledge Production, Triple Helix Model, The Knowledge Triangle, Political Arena, Political Entrepreneur

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Göteborg, June 2011

Vendela Wahlberg

1 Introduction

The following chapter gives the background to the thesis. Also the purpose and research questions, delimitations and the disposition of the report are included.

1.1 Background

At Chalmers University of Technology, a great part of the research is made in research centers. There are almost fifty of them, and from the Chalmers structure, every center includes researchers from several of the university's departments. A research center is a cooperation between academia, industry and government. However, what this cooperation looks like differs at Chalmers. In 2008, Chalmers instituted a routine for how to start a center and also a policy for research centers at Chalmers (See Appendix I). The research centers at Chalmers still look very different at the present day. In some ways the reality corresponds to Chalmers' policy, but the policy can in some respects seem obsolete.

On an international level, from the European Union, there is a goal from the Lisbon Strategy for Europe to approach three percent of GDP for research before 2020. In 2008 Europe had 1.9 percent (European Commission, 2010). This can be compared to USA which has 2.5 percent and Japan which have more than 3 percent when this goal was formulated for year 2020 (European Commission, 2010). From the European Union there are ambitions for Europe to be able to compete with USA and Japan and also to "transform Europe in a vibrant knowledge economy, in order to boost economic growth, create more and better jobs and ensure lasting prosperity in Europe" (European Commission, 2011). In Sweden this percentage of GDP for research is 3.73 percent. This puts us on a second place where Israel is first (4.53 percent) and Finland is third (3.45 percent). (OECD Science, Technology and Industry Outlook 2008)

In the late 2007, the European Union committee for scientific and technical research (CREST) arranged a working group on the theme "Industry-Led Competence Centres – aligning academic/public research with the enterprise and industry needs" (CREST Working Group, 2008). The results were summarized in a report where a number of characteristics were considered core operational descriptors (See Appendix II). Competence centers were from this event described as "investments by Member States made to encourage greater efficiency in the interaction between researchers, industry, and the public sector, in research topics that promote economic growth by their direct relevance to industry agendas." From the report of this event, recommendations to member states to the adoption of best practices for management of industry-led competence centers were given. (CREST Working Group, 2008) Also, in the European Union, there are ambitions to stimulate the interaction between education, research and innovation; the Knowledge Triangle; on a national level (Ministry of Education and Research, 2009).

In 2010, Chalmers introduced the Areas of Advance as a new structure "to visualise and focus on research, education and innovation" (Chalmers Communication and Marketing, 2011). There are eight Areas of Advance. The mission of this new structure is described in below.

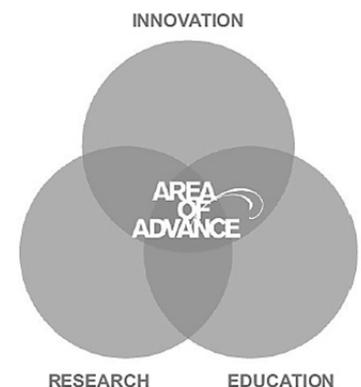


Figure 1-Chalmers' Areas of Advance (Chalmers Communication and Marketing 2011:3)

“Our mission is to create a unique integration of the knowledge triangle – research, innovation and education – by including a new dimension to the existing organisation. Through this strategic instrument, we will concentrate, visualise and advance our scientific excellence by bridging gaps and accelerating the interplay between academia, industry and society. The new dimension creates a virtual matrix organization and enables a powerful working method with an operational bottom-up process combined with a strategic top-down process. The Areas of Advance can thereby provide powerful meeting places across boundaries and form the basis for new interdisciplinary research.”

(Chalmers Communication and Marketing, 2011)

Collaborating in a research center is an up-to-date way of organizing research. These goals and implementations mentioned above are described on a general level. Therefore, there is an interest to see how research centers are organized and what the R&D management looks like in practice within these.

1.2 Purpose and Research Questions

The master thesis is the starting point and a part of a larger research work about research centers at Chalmers. This larger research is made to contribute to the development of the Area of Advance for Transport. The master thesis considers the “internal role” of the research center at Chalmers. This means that the research is done from a Chalmers perspective and aims to create a better understanding of the research center’s role within Chalmers. The purpose of the work is to elucidate the answers to the questions:

What is a Research Center?

What is the Role of the Director?

1.3 Delimitations

The thesis considers the “internal role” of research centers. The larger research project in which this thesis is a part of also sees to the industry’s perspective of research centers. This is therefore not considered in this project. The studied research centers in this master thesis are limited to three centers which all are a part of the Transport Area of Advance and within the profile Sustainable Vehicles and Fuels.

1.4 Disposition of Report

Chapter 1 Introduction gave the background to the thesis. Also the purpose and research questions, delimitations and the disposition of the report were included in this chapter.

Chapter 2 Method describes the research methodology for the research. This chapter also includes a discussion of Reliability and Validity for the report. Furthermore, an ethics paragraph is included.

Chapter 3 Theoretical Background introduces two different theoretical orientations; Structures for Production of Scientific Knowledge and Power and Politics. The chapter is finalized with a presentation of four challenges for operating a collaborative research center.

Chapter 4 Presentation of Studied Research Centers gives a background to the centers which has been inquired into.

Chapter 5 Empirical Results describes the four challenges presented in Chapter 3 by the results generated from the interviews. Also this chapter includes results from the workshop where the concept pairs from

Chapter 3 are considered.

Chapter 6 Analysis presents the results from the theoretical and the empirical collections.

Chapter 7 Conclusions includes the generalizations which are given from the research. This chapter also includes implications.

Chapter 8 Further Research presents possible areas in which research would be favorable.

2 Method

This chapter describes the research methodology for the research, which here includes the research design and a description of the chosen methods; interviews and a workshop. Also it contains a discussion of reliability and validity for the report as well as an ethics paragraph.

2.1 Research Design

The study in this master thesis can be considered as a smaller case study which takes place within three research centers within the same profile in the same Area of Advance at Chalmers. The chosen profile includes four centers, which is directly connected to the profile. However, the fourth center is newly formed and therefore is not studied. There are also a few more centers, which can be related to several of the profiles and areas. These are left out of the case study. Cepeda and Martin (2005) mean that case study research is a viable management research strategy since “First, the researcher can study management in a natural setting, learn about its state-of-the-art, and generate theories from practice. Second, the case method allows the researcher to answer “how” and “why” issues in order to understand the nature and complexity of the processes taking place. Third, a case study approach is an appropriate way to explore areas where research studies are scarce.” (Cepeda & Martin 2005:852-853)

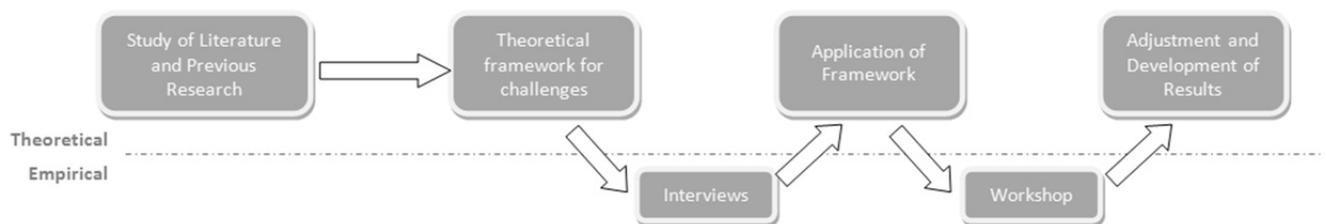


Figure 2-Theoretical and Empirical Research Process for Master Thesis

This master thesis is a qualitative research study. This means that the epistemological position is described as interpretivist, which means that the stress is on understanding the social world through examining the interpretation made by the participants. (Bryman and Bell 2007) In this work, this is illustrated by interviews with members from the three studied centers and also from the participants of a workshop. The ontological position for qualitative research is described as constructionist, meaning that social properties are outcomes of the interactions of individuals, rather than created from someone from the outside. (Bryman and Bell 2007) For this master thesis, individuals from the studied centers have had a central meaning for the results.

The thesis methodology consists of two parts, a theoretical and an empirical. The theoretical part includes the study of literature and previous research, a generation of a theoretical framework for challenges in a research center, the application of this framework and finally adjustment of the framework and the development of results.

The empirical part includes interviews with three members from each of the three studied centers. Also a workshop was carried through where the results from the interviews could be strengthened and further developed. Apart from the interviews with center members and the workshop, there were additional interviews with four people in the initiating phase of the project. These were people chosen for their work with research centers at Chalmers and also for the knowledge of previous research. They included a PhD Student doing research on a research center at Chalmers, an Area of Advance Director, a director of a research center in its first phase and also, one of Chalmers' vice presidents.

2.2 Interviews

A total of nine interviews were made for the studied centers with three interviewed center members for

each center. These interviews were semi-structured interviews with relatively open questions. The question guide can be found in Appendix III. For the interviewees, all the approached members of the three centers accepted to participate in the interview. The interviewees were sampled by their knowledge and position in the research centers. Also the number of interviewees depends on time limitations since all the nine interviews from the studied centers were recorded and transcribed. The results from the interviews were used by categorizing different answers into four subjects - the four identified challenges. The transcriptions were made with simple symbols for who was speaking or any other interaction. Transcriptions written this way are designed to be read by human readers, who have little difficulty interpreting the information contained in the text. This can be used for qualitative studies since for example computers are not as good as human readers in interpreting texts. However, this encoding takes time. (Cencini 2002)

2.3 The Workshop

Since the study is qualitative and concerning social phenomenon, it is recommended to use triangulation where more than one method is used (Bryman and Bell 2007). Triangulation can help to better define and analyze problems in organizational research. The mix of methods allows researchers to be more confident in their results. (Jick 1979)

For this master thesis, a workshop was used to verify the results of the interviews. The workshop included an introduction to the research and to the function of the set-up and the content of the workshop. This was followed by discussions in two groups where twelve concept pairs were discussed, see Chapter 3.3, and later presented and discussed in the whole group of participants. Thereafter the participants voted for the two most important concept pairs. For these two, action plans were discussed.

The workshop had six participants although 28 people, who work with center-related activities at Chalmers Areas of Advance Transport, Energy or Materials Science, were invited. These areas were chosen since the studied centers were related to these and also since the funding of these have received substantial strategic governmental funds (Chalmers Communication and Marketing 2011), which gives them similar requisites in this sense. The invitation was sent with email and also one reminder was sent. All the three directors from the studied centers participated in the workshop.

2.4 Reliability and Validity

Internal reliability concerns whether there is more than one observer and if members of the research team agree about what they hear and see (Bryman & Bell, 2007). For six of the nine interviews in the centers, there were two interviewers participating. Also for the workshop there were two observers. This is favorable since the results can be agreed of. This is also good in the beginning when one of the interviewers has less experience in interviewing as was the case during this thesis. In this sense and since the interviews were recorded and transcribed and the workshop could confirm the interview results, this contributes to a stronger internal reliability.

The external reliability is built on to what degree the study can be replicated (Bryman and Bell 2007). A qualitative research study is much harder to replicate than a quantitative research study where there are more strict frames. While the triangulation of methods was a help for the confirmation of results and thereby for the internal reliability, it was not for the external reliability. Jick (1979) means that with triangulation the replication of the study becomes more difficult.

The internal validity concerns whether there is a good match between researchers observations and the theoretical ideas they develop (Bryman and Bell 2007). This has been quite true for the research made. However for the internal validity to be stronger, the research could have been going on for a longer time to ensure congruence between concepts and observations (Bryman and Bell, 2007).

Finally, there is the external validity which refers to the degree the findings can be generalized across social settings (Bryman and Bell, 2007). For this it has to be highlighted that the interviews are few, which makes it hard to say anything about a larger picture. From the workshop there were additional participants supporting the results of the interviews. The external validity can in this sense be seen as low if research centers in general is considered. However, the results are still relevant to elucidate challenges for a research center at Chalmers.

2.5 Ethics

Fontana and Frey (1994) say that since the objects of inquiry in interviewing are human beings, extreme care must be taken to avoid any harm to them. They include informed consent, right to privacy and protection from harm. For the interviews and the workshop in the master thesis, all participants have been informed of the research work and the recordings. Furthermore, the interviewees have had the possibility to review their quotes which have been used in the report. Bryman and Bell (2007) mean that qualitative research is very open-ended and therefore research questions are either loose or not specified. Therefore they say that it is doubtful that the information given to the participant is accurate about the nature of the research.

Although the participants have been informed, the ethical aspects are still difficult to handle in such a situation as this master thesis implies. This is since it is such a small study and the different interviewees from the studied research centers could in this sense be easily identified. Also the questions in the interviews can be sensible to answer for the interviewees.

3 Theoretical background

This section gives a review of literature of two areas. Firstly, structures for production of scientific knowledge are considered. Secondly, the power and politics angle is discussed. The chapter also includes a presentation of four challenges for operating a collaborative research center.

3.1 Structures for Production of Scientific Knowledge

Styhre and Lind (2010a) claim that a recent trend in the knowledge economy is that the university is repositioned as a source of competitive advantage. They pose that there is an interest for using the academic knowledge more effectively as a source of innovation and renewal in the industry. This lies under the growing interest for the entrepreneurial university. Etzkowitz (1998 cited in Styhre and Lind, 2010a:911) refers to the entrepreneurial university as a university capable of integrating economic development as an academic function along with teaching and research. Styhre and Lind (2010a) distinguish between the entrepreneurial university and a research center. The former concerns what role the university is going to play in the knowledge economy, while the latter is considered a specific form of organization used within the entrepreneurial university (Styhre and Lind, 2010a).

Styhre and Lind (2010a:910) describe a research center as “a joint venture between the university, industry and governmental funding organizations, identifying some domain of research where industry and academy can benefit from collaborating”. They further explain that apart from product development projects, the center should also produce qualified academic research as well as contributing to the advancement of innovations and strengthen the competitiveness of the industry. Holmquist (2009) claims that collaboration and joint knowledge creation between researchers and practitioners is beneficial for academia since it can develop more relevant research questions when it is developed with practitioners. Also results can be validated by direct testing and implementation in practice.

Below, three perspectives on collaborative research are presented. These are the new production of knowledge in Mode 1 and 2, the institutional arrangements in a Triple Helix model, and the Knowledge Triangle, where three key drivers for knowledge based society interacts. These three structures are chosen since they are established concepts within the collaboration area and often used in literature.

3.1.1 Mode 1 and Mode 2 Knowledge Production

Cooperation stimulates competition. This paradox are the words of Gibbons et al. (1994) in the book *The New Production of Knowledge* and can be explained by moving knowledge creation from the traditional Mode 1 to Mode 2; the new production of knowledge. Mode 1, the authors argue, is the mode that can be found in universities and is characterized by disciplinary research. Mode 2 is found in more heterogeneous and socially distributed systems and is characterized by transdisciplinarity. They present a view that the knowledge is more tacit and that Mode 2 creates a new environment and within this, knowledge flows easier across disciplinary boundaries. Also the human resources are more mobile and the organization of research is more open and flexible. When the mode moves towards Mode 2 Gibbons et al. mean that this imply new challenges for governments since national institutions then need to be de-centered. This is for them to be more permeable to promote change through policies. It is important for the national innovation system to be competitive and the authors mean that sooner or later collaboration must turn into competition. To manage this to a national advantage is a challenge for the government. In Table 1 on the next page, the characteristics of Mode 1 and Mode 2 is summarized. (Gibbons et al. 1994)

	Mode 1	Mode2
Knowledge	Problems are set and solved in a context governed by the, largely academic, interests of a specific community	Knowledge is carried out in a context of application
Field of Academic Study	Disciplinary Discipline-based and carries a distinction between what is fundamental and what is applied	Transdisciplinary Constant flow back and forth between the fundamental and the applied, between the theoretical and the practical
Composition	Homogeneity	Heterogeneity
Organizationally	Hierarchical and tends to preserve its form	Heterarchical and transient
Quality Control	Determined essentially through peer review judgments about the contributions made by individuals	Determined by a wider set of criteria which reflects the broadening social composition of the review system
Creativity	Individual creativity is emphasized as the driving force	Creativity is mainly a group phenomenon

Table 1- Mode 1 and Mode 2 Scientific Knowledge Production (Gibbons et al. 1994)

In 'Mode 2' Revisited: The New Production of Knowledge, Nowotny et al. (2003) mention that among the least developed context in which they applied the idea of Mode 2, was the management of Mode 2 knowledge. They say that the production of knowledge, no matter how widely, heterogeneous or reflexive it is, it still needs to be managed. Gibbons et al. (1994) describe the traditional management style as too inflexible and mean that the management style of a distributed knowledge production process has to increase the permeability of boundaries and brokering. Permeability of boundaries as in creating openness, building teams and facilitating efficient communication and; permeability in brokering as something which requires skills to handle individuals from the many different institutions and organizations working with innovation, geographically spread and with individuals which may only be able to work on a problem part-time.

3.1.2 The Triple Helix Model

Etzkowitz and Leydesdorff (2000) use a Triple Helix concept to describe the institutional arrangements of the innovation system of university-industry-government relations. They refer to that the Triple Helix overlay provides a model at the level of social structure for the explanation of Mode 2 as a historically emerging structure for the production of scientific knowledge, and its relation to Mode 1.

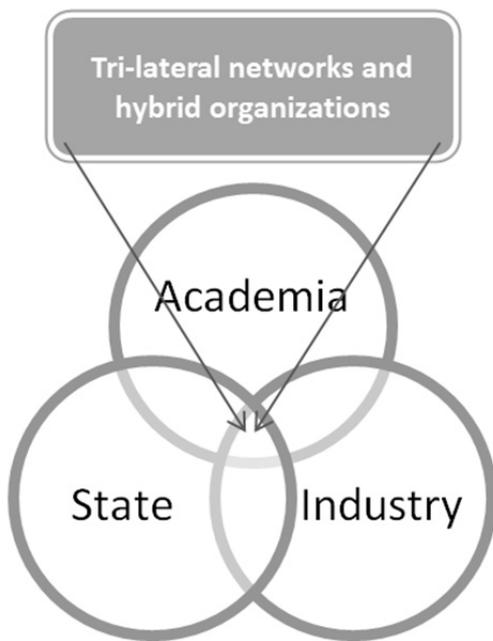


Figure 3 - The Triple Helix Model of University-Industry-Government Relations. (Etzkowitz & Leydesdorff 2000:111)

The Triple Helix model in Figure 3 with equivalent, overlapping spheres emanates from two models. First, the central state model where the state controls both the academic world and the industry. Secondly, the laissez faire model where the university, industry and government act separately with clear borders and limited interplay. (Etzkowitz, 2005) Etzkowitz and Leydesdorff (2000) refer to the Triple Helix as not just being about the relationship in-between the university, industry and government but also that there is an internal transformation within all of these three spheres. For instance the university which has been transformed from a teaching institution to also combining this with research. Something that generates tension but are more productive and cost effective to combine.

Etzkowitz (2005) refer to that the transition from a central state model or a laissez faire model, takes place gradually. He also refers to that an increased interaction with the university, industry and government as three equal parties, the new development of innovation strategies and applications of these is the core of the Triple Helix model, which is concentrated on an economic and social development.

3.1.3 The Knowledge Triangle -shaping the future of Europe?

The Knowledge Triangle concept refers to the interaction between education, research and innovation, which can be seen as the key drivers for knowledge based society (Swedish National Agency for Higher Education, 2010). In 2009 there was a conference by The Swedish Ministry of Education and Research and The Swedish National Agency for Higher Education as a part of the Swedish presidency of the EU (Swedish National Agency for Higher Education, 2009). The use of the Knowledge Triangle in this sense was to improve the impact of investments in the three parts of the triangle and that higher education institutions should be given a central role in building a Europe, where the impact of knowledge building can be measured in terms of social and economic progress.

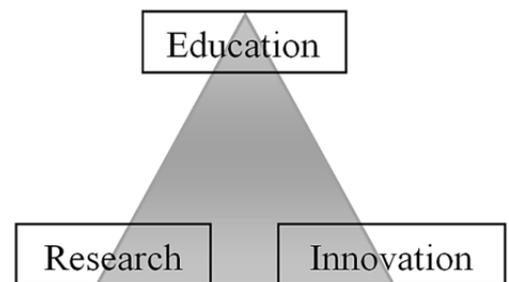


Figure 4 - The Knowledge Triangle (Swedish National Agency for Higher Education, 2011)

In the late fall of 2009, there was another meeting, this time a council meeting in Brussels for Education, Youth and Culture, where representatives from the member states of the European Union gathered to develop the role of education in the knowledge triangle. In the council meeting, the following seven

priorities for action were recommended to be established in the member states:

- Developing more coherence between policies in the fields of education, research and innovation
- Accelerating pedagogical reform
- Partnership between universities and business and other relevant stakeholders
- Measures to develop an innovation culture in universities
- Creating incentives for universities to develop transferable knowledge
- New approaches to quality assessment
- Developing the EIT¹ as a model for the future

(Council of the European Union, 2009)

The wishes from these meetings resulted in a formal letter to the principals of Swedish universities from the Swedish Minister for Higher Education and Research in the Swedish government at the time. He expressed his wish to gain an understanding of what every member state in the European Union could do to stimulate the interaction between education, research and innovation; the Knowledge Triangle; on a national level. (Ministry of Education and Research, 2009)

3.1.4 What do we learn from these models?

The three presented structures for production of scientific knowledge are described on a general level in how the cooperation is organized. There are however people who have raised questions about whether this relationship in reality is good and what the consequences will be in practice.

Adler et al. (2009) mean that while models such as Mode 2 and Triple Helix are spread in use, they have not attracted an equal amount of interest when it comes to studying the implementation of these. They say that the management of research and research leadership has been neglected. Also they mean that knowledge about issues such as leadership; organization and strategy formation have become old when looking at the situation today in research settings. This is due to “a growing number of stakeholder concerns, the intensified contacts between industry and universities that take many different forms, the growth of international research programs and the growing number of multi- and trans-disciplinary as well as boundary spanning research milieus” (Adler et al., 2009:1138).

In the article Industry Induces Academic Science to Know Less about More, Evans (2010) shows that company-based science is less theoretical than university-based science. He means that industrial research is less interesting to academic researchers than academic science. Industry science rests on much less prior knowledge and Evans says that “industry science pushes experiments down paths that an academic project of incremental confirmation and generalization would have no reason to travel” (Evans, 2010:55). Also he suggests that industry science is more speculative and that when science-based industry injects innovations into academia, it is more likely to shape the next generation of academic science than the one which academia is working with now. He submits that if industry would sponsor the academic science without the government, we would know less about more. In this case the network of science would include more loosely connected elements, which otherwise could have benefit from the relationship with findings replicated and theorized.

Lim (2009:1280) means that there is a “need to better understand how various types of absorptive capacity are related to knowledge flows within the firm, including the role of interfaces and gatekeepers.” He says

¹ The European Institute of Innovation and Technology

that there are three forms of absorptive capacity and that these allow a firm to capture different knowledge types. These are disciplinary which is explained as general scientific knowledge; domain specific which is explained as solutions to specific technical problems; and finally encoded knowledge types where knowledge is embedded in tools and processes. In this he believes that organizational capabilities and the managing and the role of external linkages in the building of these absorptive capacities should be emphasized.

3.2 Power and Politics

The three general descriptions of university-industry collaboration structures can be helpful to understand how research centers work. The raised questions from the consequences these imply in practice may be better understood and explained by the concepts of power and politics.

“Organizational politics may irritate us, but it also serves us” (Mintzberg, 1985:152)

Organizations are arenas where interests frequently collide and align and managers spend their time and emotional energy negotiating these interests. Butcher and Clarke (2003) means that it is this we mean by politics and that therefore managers are in fact politicians. Jeffrey Pfeffer defines power as the potential ability to influence behavior, to change the course of events, to overcome resistance, and to get people to do things they would not otherwise do (Pfeffer 1981 cited in Pfeffer, 1994:30). Henry Mintzberg (1983) defines power as the capacity to effect (or affect) organizational outcomes. In Buchanan and Badham (1999) they settle with the definition that power concerns the capacity of individuals to exert their will over others. So while power can be considered a capacity, political behavior can be seen as the practical domain of power in action, worked out through the techniques of influence (Buchanan and Badham, 1999).

3.2.1 Formal and Informal Power

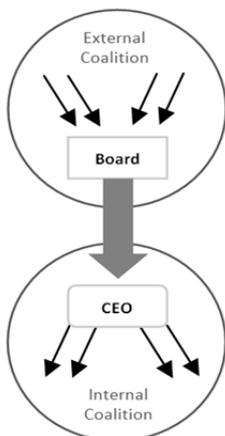


Figure 5 - Symmetry of Formal Power between the External and Internal Coalition (Mintzberg 1983:113)

When describing power in and around organizations, Mintzberg (1983) discusses the power of the External Coalition and of the Internal Coalition (See Figure 5). The External Coalition is represented by the board of directors, which also is seen as the formal coalition. The board is supposed to control the behavior of the organization, although Mintzberg means that the board must appoint a chief executive officer (CEO) to take formal charge of the organization. The CEO represents the Internal Coalition. The chosen individual is given the freedom of action but can be replaced by the board. The formal power therefore passes through the board to the CEO. Seen this way, the board represents the formal power of the External Coalition and the CEO represents the formal power of the Internal Coalition. Mintzberg therefore refer to that the CEO functions at a critical point in the process by which influence is converted to action. This means that on the one hand, there are the demands from external influencers which formally come from the board and informally from external means of influence. On the other hand, the CEO is responsible for the actions of the organization.

3.2.2 The Organization as a Political Arena

The system of authority defines power that is formal and is allocated in an explicit and legally sanctioned basis. The system of politics however, can be described as reflecting power that is technically illegitimate. (Mintzberg, 1985) The board is seen as a center of legitimate power (Mintzberg, 1983). Mintzberg (1983) describes a Political Arena as an organization captured in whole or in part by conflict. This is due to conflicting demands either imposed by important challenges to its existing order or between its existing influencers. Political activity in organizations is sometimes described as 'games' (Mintzberg, 1985).

Buchanan and Badham (1999) define the turf game as a game in which individuals and groups seek to defend and to extend their turf. Further, the authors exemplify several varieties of this. These are areas of influence and power, status and reputation as well as access to and control of resources. Along with Mintzberg, Buchanan and Badham describe that a political entrepreneur as a change driver sometimes needs to act politically, or in other words without a formal warrant to actually obtain one. Further they explain that a formal written warrant to act politically can never be received. Instead, a warrant to act politically can be based on a number of interacting factors: the benefits to be derived from change; personal career goals; reactions to past changes; and the anticipated responses of other stakeholders. (Buchanan and Badham, 1999)

3.2.3 The Political Entrepreneur

Schneider and Teske (1992) describe an entrepreneur as an individual who change the direction and flow of politics. Buchanan and Badham (1999) equalize the political entrepreneur with a change agent and claim that suchlike who is not politically skilled will fail. Also, they say that to maintain one's reputation, it is therefore important to “be able and willing to intervene in the political processes of the organization, to push particular agendas, to influence decisions and decision makers, to deal with criticism and challenge and to cope with resistance”.

Popkin (1988, cited in Storper and Scott, 1992:181) defines a political entrepreneur as “an innovator who solves collective action problems not by offering selective incentives, but by persuasion and changing beliefs, beliefs about the value of the collective good and expectations about the behavior of others”.

In both industry and university, there is a need for qualified specialists capable of seeing a picture that is broader than their individual research interests and concerns (Styhre and Lind, 2010b). Lam (2007 cited in Styhre and Lind, 2010b) refers to these kinds of individuals within a university system as entrepreneurial professors. These are capable of handling both Mode 1 and Mode 2 research and in this sense able to deal with research governed by theoretical and paradigmatic interests, but also coproducing knowledge that is both theoretically solid and practically relevant.

3.3 Four Challenges for Operating a Collaborative Research Center

From the two presented theoretical orientations: The Structure of Knowledge Production and Power and Politics, there are some extremes which stand against each other. These extremes are not necessarily contrasts, but are seen as possible difficulties or challenges when operating a collaborative research center. Four challenges have been identified: Degree of collaboration, Degree of research, The role of the center, and The role of the director.

Degree of Collaboration

Gibbons et al. (1994) stated that cooperation stimulates competition. In the Knowledge Triangle, the interaction between education, research and innovation, is seen as the key driver for knowledge based society (The National Agency for Higher Education, 2009). With the different stakeholders this implies together with Mintzberg's (1983) political arena as an organization captured in whole or in part by conflict the degree of collaboration is indeed relevant. Styhre and Lind (2010a) identify for a research center, the importance of finding some domain for research where industry and academy can benefit from collaborating.

The concept pairs related to this section are:

1. To pursue research by oneself-To pursue research with the industry
2. Independent research (driven by curiosity)-Task oriented research (motivated by need)

3. Open innovation-Closed innovation
4. Industry holding the center back-Industry pulling the center forward

Focus of Research

Collaboration can be seen as an advantage when more relevant research questions can be developed and formulated (Holmquist 2008). Gibbons et al. describe a knowledge creation moving from the traditional Mode 1 to Mode 2 which is characterized as transdisciplinary, heterogeneity and more heterarchical and transient. It also includes a more temporary set of practitioners, collaborating on a problem defined in a specific and localized context. (Gibbons et al., 1994) Evans (2010) shows that company-based science is less theoretical than university-based science and that industry science rests on much less prior knowledge. The core of the Triple Helix model is the new development of innovation strategies and applications of the increased interaction of university, industry and government (Etzkowitz, 2005). Lim (2009) suggests that there are different absorptive capacities for capturing different types of knowledge. Also he means that the role of external linkages and how these are managed should be emphasized. Buchanan and Badham (1999) define the turf game as a game in which individuals and groups seek to defend their turf. The degree of research is part of defending the turf. The following are the related concept pairs:

5. Assemble all research – Pursue selective research
6. Applied research- Basic research

The Role of the Center

Etzkowitz and Leydesdorff (2000) refer to the Triple Helix as not just being about the relationship in-between the university, industry and government but also that there is an internal transformation within all of these three spheres. Styhre and Lind (2010a) mean that a research center is not just about product development projects. A center should also produce qualified academic research as well as contributing to the advancement of innovations and strengthen the competitiveness of the industry. Finally the Knowledge Triangle symbolizes the wish that every state in the European Union should emphasize the stimulation of the interaction between education, research and innovation (Ministry of Education and Research, 2009). To handle the different parties, much depend on what the role of the center is and how it is organized. The following concept pairs relates to this.

7. The center as a project organization- The center as a Unit
8. The center as a gathering place for projects from the department-The Center as a generator of projects
9. The center as a form of collaboration within Chalmers-The center as a form of collaboration between Chalmers and the industry

The Role of the Director

When knowledge creation go from Mode 1 to Mode 2, Lam (2007, cited in Styhre and Lind 2010b) appeals to the importance of individuals working as entrepreneurial professors. These could handle both Mode 1 and Mode 2 research and co-produce knowledge that is both theoretically solid and practically relevant. Mintzberg (1983) states that the board in organizations represents the formal power of the internal coalition and that this power passes through the board to the CEO, which is also considered as the critical point of an organization. Mintzberg (1985) refers to a system of politics as reflecting power that is technically illegitimate. The CEO is responsible for the actions of the organization, but can be replaced by the board (Mintzberg, 1983). A research center is not the same as what Mintzberg describes as an

organization, although this highlights some issues. A research center configuration has many stakeholders. Sometimes a political entrepreneur as a change driver needs to act politically, or in other words without a formal warrant to actually obtain one (Buchanan and Badham, 1999). Butcher and Clarke (2003) say that managers of organizations are in fact politicians. Adler et al. (2009) say that the management of research and research leadership is neglected and that the situation today is different than before in research settings. This puts the director of a research center in focus within this area and creates the following concept pairs:

10. The director as an administrator-The director as the head of operation (who leads and develops)
11. A director with broad knowledge of the field-A director with specific knowledge of the field
12. One director-One director and one deputy director

4 Presentation of Studied Research Centers

This section presents three research centers at Chalmers University of Technology, which have been the focus for the study in this master thesis.

The three studied research centers all lie underneath the Transport Area of Advance within the structure of Chalmers University of Technology in Gothenburg, Sweden. The centers are funded by the Swedish Energy Agency (STEM), industrial partners and Chalmers University of Technology, each contributing with a third in cash and in-kind. STEM contributes solely in cash. The three centers each constitutes a cost center within Chalmers and has no staff liability. Instead, the members of the centers are employed under the different departments. Every center has a center director and a center board. The board is however in reality a steering group and not a board. The information presented from in this section comes from the three centers' evaluation reports and from the interviews with members of the centers.

4.1 CERC



In Sweden there are three research centers working independently with combustion engines; Combustion Engine Research Center (CERC) at Chalmers, Competence Center Combustion Processes (KCFP) in Lund Institute of Technology and, Cicero at the Royal Institute of Technology. 2009 there was an evaluation by STEM, where it was decided that Cicero was going to be shut down. They are now starting up a new initiative.

CERC was formally established 1995 and consists of center members coming from the departments Applied Mechanics and Signals and Systems. In 2008, eight PhD students and eleven senior researchers were involved in eleven projects. The director of CERC works 40 percent as a director. CERC has a reference group with members from both industry and from Chalmers and also a scientific advisory board with professors and researchers relevant for CERCs research. After the evaluation 2009, CERC also has a Strategy and Coordination Group.

CERC has ten industry partners. In the board of CERC, the industry representatives have always had the majority. Apart from the industry, there is also a representative from STEM and three co-opt members from the university. The representatives from the university consist of members who cannot profit or gain economical support from CERC. Neither are they permitted to vote in a board meeting.

Description of research activity:

“The research at CERC is conducted in five main research programs, each led by one or two research coordinators (scientific leaders) /.../ The research programs are supported by six core competence platforms, with contributions from the departments of Applied Mechanics, Signals and Systems, and Chemical and Biological Engineering. Each research program has a reference group consisting of representatives from all CERC partners. Projects are initiated, discussed and recommended to the board by the programs' reference groups. The reference groups include representatives from all CERC partners and form the base for establishing world class competitive project portfolios. Each program encompasses several projects.”

(CERC Evaluation Report, 2009)

“The overall long-term vision of CERC is to attain, and maintain, world-leading competitiveness in selected areas by carrying out high quality fundamental and applied research of high relevance for the automotive industry to contribute to the development of sustainable energy and transportation systems in the medium term perspective (10 – 15 years). The goal is to provide the member companies with both knowledge and highly skilled, highly educated specialists to enable the Swedish automotive industry to maintain its globally leading position.”

(CERC Evaluation Report, 2009)

4.2 KCK



The Competence Centre for Catalysis (KCK) was established in 1995. Besides the Transport Area of Advance, KCK also lies under Nanoscience and Nanotechnology, Material science Area of Advance. There are three departments involved in KCK; Chemical Physics, Applied Surface Chemistry and Chemical Reaction Engineering. Apart from the KCK base financing coming from STEM, the industrial partners and Chalmers, KCK also receives external funding for projects which are integrated with KCK and included in the financial report.

There are six industry partners collaborating with KCK. In the board there are representatives from the industry, STEM and the university. In contrast to CERC, a center member can still be in the board. The director within KCK works 85 percent as a director. KCK also has a deputy director for the center, working about ten percent. The director and deputy director are both part of a management team, which meets several times per months. The management team includes the senior researchers of KCK. KCK also has reference groups and a scientific advisory board.

Description of research activity:

“The research activity at KCK is conducted within three main programs; i) catalytic reduction of nitrogen oxides in oxygen excess, ii) catalytic oxidation at low temperature and iii) catalytic techniques for sustainable energy systems. The programs are divided into several projects which generally overlap. The project portfolio consists of a blend of applied and fundamental projects. It is the responsibility of the KCK management to maintain a harmonized and balanced mixture between different types of projects. The centre should meet the needs of the member companies as well as maintain and claim strong positions at the international research fronts. The research programs are monitored and updated on a regular basis by the KCK board. New or modified research projects are pursued after thorough internal analysis and recommendations from the scientific advisory board.”

(KCK Evaluation Report, 2009)

“The long-term vision of KCK is to contribute to sustainable transport-, energy- and environmental systems with state-of-the-art catalytic techniques. KCK shall be an internationally recognized research organisation both within academia and industry, and one of the leading centres in the world for research, education and technical development within catalytic emission control and catalysis for sustainable energy systems. KCK aims at maintaining an excellent research environment, which performs high-quality research within these areas.”

(KCK Evaluation Report, 2009)

4.3 SHC



The Swedish Hybrid Center (SHC) was established 2007 and differs from the two other studied centers, since SHC includes three partner universities; Chalmers, Lund Institute of Technology and the Royal Institute of Technology. Chalmers however has the responsibility for management and coordination of the center. SHC also works with two additional universities. At Chalmers, SHC covers three departments from which the center members come. These are Electric Power Engineering, Signals and Systems, and Applied Physics. Besides the Transport Area of Advance, SHC also lies under the Energy area.

SHC has six industry partners. In the board there are five representatives from the industry, one from STEM and three representatives from the university. SHC has three thematic areas, each lead by a thematic coordinator. The thematic areas are each operated from one of the universities involved in the center. Together with the thematic coordinators, the director of the center forms the management team. The director works 40 percent as a director for SHC. SHC also have technical committees. These committees are led by the thematic coordinator and they prepare project proposals to the management team and follow up and guide ongoing projects.

Description of research activity:

“SHC was formed to conduct research on the hybrid vehicle system considering also its impact on the society and the transport system. Although the hybrid vehicle as a system is the main focus, it was decided to specialize on three specific areas of the hybrid vehicle, I) the electric driveline (green), II) the energy storage (yellow) and III) the control of the hybrid vehicle (pink), as these areas were considered both important and where specific research efforts were needed.../.../... Thus, three Themes were established, research projects were proposed by Thematic groups consisting of members from all partners of SHC.” (SHC Evaluation Report, 2010)

“The vision of the Centre is to be one of the internationally leading centres of research and development of sustainable hybrid electric vehicle systems“

(SHC Evaluation Report, 2010)

5 Empirical Results

The following chapter presents the empirical results and is divided into two parts. The first part comes from the interviews and is categorized into the four challenges for operating a collaborative research center, which were presented in Chapter 3.3. The second part includes empirical results, which comes from the workshop. This part also concerns the four challenges from Chapter 3.3, but here the focus is on the concept pairs from the same chapter.

5.1 Results from Interviews - Four Challenges for Operating a Collaborative Research Center

From the three studied centers, there are some indications on what may be challenges for research centers at Chalmers when it comes to degree of collaboration, focus of research, the role of the center and the role of the director. These are presented below and come from the interviews made with the center members.

5.1.1 Degree of Collaboration

In two centers, it is mentioned that there is an understanding among the industry partners that since the projects are mainly PhD projects, they will be longer and it will take time before any results show (#4; #7). The industry has a majority in all of the studied centers' boards. In one center a member pointed out that the industry tries to direct the center more and more and that the industry is involved on a daily basis, which inhibits the academic freedom.

“Every time we have a board meeting, they complain about something. I want us to do this. They want to direct us more. We have two completely different societies; industry and academia, and yes, it feels like they do not have much patience with the academia.” (#1)

Also on a lower level of the research collaboration in the same center, in the reference groups, the industry has tried to steer the research.

Sometimes there is an interest from the center of bringing in new members or collaborating partners from the industry. In these situations the industry can give their veto. In one center a member commented with: “They [the industry partners] are sometimes destructive and do not want to let in all who might have been interested in joining” (#3). In another center the following comment was given: “In the case our companies do not want us to develop such cooperations, we, of course, have to respect the opinion of our member companies.” (#5) This is only explicitly mentioned by two people in two of the studied centers, although all three centers stressed that the industry partners have a great influence in bringing in new members or on what level the research projects can be to assure that there will not be knowledge leakage to the wrong partners. One person even described the relationship between the industry partners as cat and dog (#4). To deal with this, the centers try to adjust the levels of research to be able to include all members in the projects. One person said that they in these situations can look at more general issues and that there is a need for a good technical research question and a good scientific research question so that the situation does not lead to a development of a new product. “This means you kind of avoid the conflict and then all can join in and say this is an important problem to solve, but at the same time they do not give away their own solutions.” (#4)

Interviewees from all three centers mentioned that the in-kind input from the industry partners were somewhat unspecified. The in-kind is important for the centers, since the companies' contributions are resources which the centers do not possess or which would be very expensive for a university to have. One person said “They have promised to contribute a certain part of their own work in so-called in-kind input and it is a little fuzzy what it is. They set their own prices on what it means and what it's worth” (#4). Another said “The greatest concern is probably the in-kind if we would be revised. Not for our part, but I think that for some industry members, I cannot imagine how they will get it together.../.../...It is possible

that they satisfy by saying that the total in-kind should be this size.” (#3) In one case, the in-kind input is resembled with fake money and hours (#8).

5.1.2 Focus of Research

One challenge that arises under the focus of research is the difficulty in finding a balance between academia and industry and between theory and application. This is discussed for all studied centers and one of the center members expresses a need for a goal in his center to be best at combining existing knowledge and make it fit a very specific application (#8). In the two other centers, this challenge is more noticeable from the outcomes of the interviews. One member said “We will not develop production engines, but at the same time we cannot make something so theoretical which they [the industry] will not have any use for” (#2). Another member from the same center pointed out that the research in the center earlier had been much about delivering to the industry. He also said it is not about changing the level of the applied research but rather making it more academic, and much deeper and more focused on the future. In the other center a member expresses that it is always difficult to make proper research projects and that there is a tension in this. That it is up to the university “in our role as academics to try to make research projects out of it which have sufficient width and are deep enough so that it can become research and not just a development phase of something existing. It should be proper research projects and it is always difficult. There is a built-in tension” (#4). He also said that the planning of projects works as a negotiation. Another center member said it is a requirement that everything that they do in the center should be able to be properly researched about. “It becomes very difficult for us if we cannot do research which we are not able to publish in good journals. Then we will lose our base as a university.” (#5) One member described his view of academic research:

“I believe that academic research is much more of an education and a maturity of a researcher than a rapid production of important research results. “ (#8)

In one of the centers, the projects were described as on a sliding scale from projects which are very theoretical to the projects where the center members are at the industry partners doing their measurements. Another center says that they collect a good basic knowledge and provide a discussion forum which can be of value for the industry and for researchers which then can get a general knowledge within the area. Also in a third center, one person said that they have “a blend of science and applied things” (#2). The same person explained that the industry acts differently depending on the conjuncture. In a time of prosperity, the industry may have more financial resources to invest in long-term projects, while if the economy is bad, the industry only wants to make investigations.

5.1.3 The Role of the Center

The role of the center is described differently both within the centers and in-between. In one center, one person thought it is “a kind of network where the industry can network with university and have special knowledge of engines” (#2). Another described it as a project organization and “a cluster of projects that try to make something together, but preferably should interact within this cluster (#3). A third comment from within the same center was “We do not produce vehicles here. We develop new knowledge and it is needed” (#1). In one of the another centers, the center was described as “an organization in which knowledge in this area come together to develop and nourish from each other and in the end, to build the knowledge and train the experts needed for this to be developed in a good way for Swedish industry” (#9). From the Swedish Energy Agency's side, one important function of the center is to educate PhD students within the industry the center works. Another member also emphasized another educating role in spreading knowledge to the companies. “We have held classes for engineers at the companies, one-day courses on hybrid or battery systems, and we have had an additional graduate course“(#7). There was also a view within the center that underlines the industry's role:

“There is a huge gap in what is meant by a research center like this and sometimes it is just a way to organize the academy and in our case it is a strong industry interest in it but it only depends on that the industry has such great urgent needs.”(#8)

In a third center, one member (#5) says that it is a research project which is financed with a third each from the Swedish Energy Agency, the industry partners and from Chalmers. Another member (#6) spoke of the center as a very important way of cooperating and that it should be a cooperation between different departments at Chalmers. A third view (#4), also in the same center, stressed the importance of a center to be ethically defensible, that the research should be fun and exciting and that you have to come up with something. That it is knowledge that the center seek.

All three centers spoke of the importance of an identity. Two persons from two different centers mentioned the advantage of having a strong center brand or identity when seeking funding for projects. In another center they were working on how they can build a platform to create a group feeling. In one center a person (#4) said that the center has had an own identity for a long time. In another center a member (#3) emphasized the importance of a Chalmers identity before a center identity. One of the centers had several partner universities. In this center two members spoke of the challenge of an identity when there are several loyalties and responsibilities. One of the members (#8) spoke of the difficulty for professors, when the career is dependent on Chalmers name and when the person still should feel as a center member. Also for several researchers, the reality is participation in several centers. The other member spoke of the duality in having several identities and when there are similar ambitions when promoting yourself through the different forums (#9).

5.1.4 The Role of the Director

The roles of the directors look different in the studied centers. In one center the director (#7) described himself as an administrative director. In this center another member (#9) said that there is a focus for the director to coordinate and lead the activities. In this center the board works as decision-making body and the director as its executor. In another center one member of the center described the role of the director as basically administrative (#3) and since it is administrative, he meant that there would not be a big difference whether the director came from the industry or from academia. In a third center the connection with the industry partners and the rest of the world goes partly through the board but are held together by the director. The members of the centers are employed by the departments and therefore the center has no staff liability. However, the director of this center (#4) said that in practice, it does not necessarily work that way. He himself felt responsible at least for the members, which are part of his group. One of the members of the center described that the director lead the center in how it is organized, how the form of co-operations work and how the lab is managed (#6). In one center a member (#9) meant that the role of the director is very important. He said that in the board meetings, there are many joint discussions which lead to consensus decisions. Since the representatives from the university are executives and not scientific familiar of the center, the director becomes important for the decisions made.

In one of the studied centers, there is also a deputy director. The director and the deputy director in this center are employed by two different departments but work together on a daily basis. The deputy director (#5) meant that it is good to have someone who knows a lot to be able to discuss for example balancing acts. He said that discussions are important to ensure that everyone feels that this is good for them. The director and the deputy director also handle the project management even though this can be connected to the role as researchers rather than as directors. In one of the other centers the director has a close cooperation with the head of the host department of the center. The director described it as “a good team because we complement each other, we do not compete”. In another center the director is supported by one member in the center who is good at seeing the overall matters. When it comes to characteristics of a

director, one member meant that “one person cannot fill the role that the center needs.” (#8) One of the directors (#1) described his style as a director as more academic, and to watch and learn about the work rather than direct the center members. After studying the work, he decides and the focus lies on what is important now. He spoke of trust:

“I'm not the type who wants to direct. I'm starting with trusting them and if they do something wrong, then I have to say something about it, but if they do things that are good in their own way, well, it's the best. So I wait, I'm not trying to direct them so much.” (#1)

In one of the centers, the industry part of the reference groups has lately tried to steer academia more. To stop this, the director now takes part in the reference groups. Also, in the board meetings the industry always was consistent. “Sometimes we have a meeting and I say something and then they all react and say something to me together. They talked about this already. So why not talk to me.” (#1) To handle this problem, the director visited every industry member of the board individually and realized that the industry was afraid that the center was trying to become more scientific.

“They said we want a university which leads much more into the future. What is out there? We have no time. You must tell us. So after I talked to them all individually in the board, I said okay, we're trying to do this more in the future, to do so we must do this and they were a little scared.../.../... I told them no, we want to work on the same level of applied research but we do so much more academic, more in the future, much deeper. It's the same thing but much better. So they were a bit scared but it's okay now.” (#1)

5.2 Results from Workshop - the Concept Pairs

To try out the results of the interviews, a workshop was conducted with participants who work with center-related activities in Chalmers' Transport, Energy and Materials Science Areas of Advance. All the three directors from the studied centers participated in the workshop. The workshop was carried out by discussing the identified concept pairs presented in Chapter 3.3 and also by discussing an action plan for the two concept pairs, which the participants saw as the most important ones for the research center.

In the workshop, the concept pair of the industry holding the center back or the industry pulling the center forward was especially emphasized in the degree of collaboration. There were participants saying that the industry had been good in pushing the center forward in risks and projects or on a higher level as in the board. However one participant pointed out that this does not help if they push for something that is not in the front end of research. Also one participant said that on a lower level, the industry is rather holding the center back by focusing on far too short-term issues. These perspectives were also emphasized in the interviews. In the workshop it became clear that the industry acts differently for different centers, even though in many cases the centers have the same industry partners. In one center, they had EU projects and in another center the companies did not want the center to apply for EU projects. This was something that not all workshop participants had knowledge about and also it had not come up in the previous interviews. In the workshop, task oriented research was mentioned as a way of attracting new companies. The concept pair of open or closed innovation was stressed in that it should be as open as possible but that the industry often has a stronger say in not releasing all the results. The degree of collaboration shows that it can be an issue when the industry is holding academia back. This can be seen from the examples in the interviews and also it is confirmed from the workshop. This has resulted in the identification of two important challenges. The first one is **bringing in new industry partners**. The second is **the fuzziness in the industry's contribution**.

For the focus of research the participants expressed a vision to collect much research within the center but

since resources are limited, it is necessary to prioritize and at least have the knowledge of what is up-to-date and who is doing what. The balance between industry and academia is just as in the interviews, also stressed in the workshop and one participant expressed the need of a diversified project portfolio with some projects which are applied, some basic and some with more risk. Therefore this is identified as challenge number three: **the balance between industry and academia**.

For the role of the center, the workshop confirmed the importance of a distinct identity from the interviews and that the center should be a unit. The opinion was also that the center should be the generator of projects. It was furthermore said that one of the fundamental conditions for being a research center is to collaborate with industry. For the interviews, the descriptions of the center were more varied than for the workshop. However, in the workshop, all the participants were directors or from management teams. This generates two more challenges. Challenge number four refers to the many different descriptions and opinions there was within the center and answers to the question: **What is a center?** The fifth challenge deals with **the importance of a center identity**.

Finally, for the role of the director, the participants unanimously thought that the director should be the head of operation by means of someone who leads and develops the center. One participant said that if the center is considered as a project organization, it is enough with an administrative director. If it is supposed to be a unit, there is a need for a head of operation. For the director knowledge base, one of the workshop groups said that if the center has a narrow base, the knowledge should be specific. If it is a wide center, there can be a need for someone strategic or political. The other group said that the director needs to grasp the center area and that the director needs to be neutral to the areas within the center and see the whole. They also said that it is important that the director has credibility within the center which is gained from

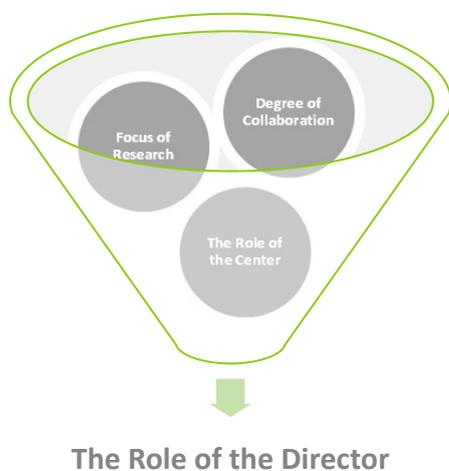


Figure 6 - Handling the Challenges of a Research Center

having knowledge that the center members can relate to. Also this is important so that the director gets a basic understanding for the tasks. Lastly, it was considered favorable for a director to have someone in the center that has the same insight to be able to discuss with. This makes it is easier to keep up and to help each other. These results correspond to the results from the interviews although during the workshop the results were elaborated and refined. The sixth challenge can be considered a summary of the earlier mentioned challenges (See Figure 6). This is since it is mainly the director, which works with taking care of these challenges. The last challenge therefore becomes **handling the challenges of a research center**. The six challenges are shown in Figure 7 on the next page.



Figure 7 - Identified challenges for Research Centers in Practice

After the discussions in the workshop, the concept pairs can be considered relevant to the participants, although two of the concept pairs, number two (independent or task oriented research) and six (assemble all or pursue selective research), was not considered conflicting. Two concept pairs were especially emphasized in the workshop. One under degree of collaboration: **Industry holding the center back – Industry pulling the center forward**; and one under the role of the center: **The center as a project organization - The center as a unit**. For these two concept pairs chosen by the participants of the workshop as especially important, an action plan was discussed and is included in the text below. For the remaining concept pairs, these can be found in Appendix IV. Two additional concept pairs, which had not been included within the four challenges for operating a collaborative research center in Chapter 3.3, were suggested and considered important by the participants in the workshop. These can also be found in Appendix IV. In the workshop the discussions took place in two groups before discussing altogether; Group 1 and Group 2.

Industry holding the center back - Industry pulling the center forward

Within this area the participants meant that the industry wants to keep a check on what is going on. Also the industry does not want knowledge to be spread outside the center (Group 1). In a higher level of the company and among the researching industry representatives, they want to push forward within certain frames. One participant mentioned that the industry has been good at pushing the center forward in risks and projects they have had. Another participant pointed out that this does not help if they push for something that is not in the front end of research. Another participant said that industry members in the reference groups rather keep the center back by focusing on far too short-term issues. (Group 2) In the discussion it also became clear that the industry acts differently for different center. In one center, they had EU projects and in another center the companies did not want the center to apply for EU projects. One participant said there is a difference in what the board says and what is said in the projects. Often the communication in-between these can be non-existing. Another participant said that the research needs to be more academic and more future-oriented. There are mixed messages, since on one level the industry pushes forward but on a detail level, they pull back.

To improve the area this concept pair considers one group in the workshop wanted to be better in finding forms and areas for collaborating with the industry (Group 1). The other group thought that the industry should help the center to develop towards excellence (Group 2). The following bulleted list is the participants’ action plan for how to reach these goals.

- Create a better understanding between parts
- Work together with Areas of Advance
- Act early stage to increase possibility of openness
- Create other communication channels than through PhD projects
- Use project portfolio for all parts to have an interest
- Show more 'success stories' in working with academia
- Increase the contact with international universities to satisfy industry

The center as a project organization - The center as a unit

When discussing this concept pair, the participants all agreed that the center should work as a unit. One group mentioned that there were more to wish for in this (Group 1). Also the participants said that the centers often work as projects but that that it should work as a unit with an identity.

One participant mentioned two problems. Firstly, for the center he worked for there are projects which are not included in the center, which means that there is a difference in the employees. Secondly, there are people from other departments than the host department for the center, which have supervisors that do not have time to think of this difference in employees. Another participant of the workshop spoke of the problem that there are five universities working within the center. There was also a view that there is a problem when the people within the center also have another belonging. The following bulleted list is the participants' action plan for how to organize the center as a unit and to create an identity.

- Move center members from other departments to the host department's location
- Create activity where issues and improvements can be discussed
- Have a virtual communication platform
- Have joint courses for the PhD students which tie the universities together
- Have different ways of gathering/various activities which tie the center together
- An available communicator from the Areas of Advance
- Look at what role one can take in different circumstances to make it easier for the center members which have different belongings

6 Analysis

In this section the results from the theoretical and the empirical collections is presented.

6.1 Degree of Collaboration

The university no longer plays the same role and we are moving from what has been characterized as disciplinary research to a knowledge creating which reach over traditional limits. Or in other words, moving from a Mode 1 production of knowledge to the new way of producing knowledge: Mode 2 (Gibbons et al. 1994). There have been developed models, which describe the innovation system. The Triple Helix model describes the relation between university-industry-government, and the university has the same influence and an internal transformation as any other player in this triplet (Etzkowitz and Leydesdorff, 2000; Etzkowitz, 2005).

At the same time, there are also external influences on the center. During the Swedish presidency in the European Union in 2009, the Knowledge Triangle was used in the sense to improve the investments in the three parts of the triangle: education, research and innovation (National Agency, University Chancellor's Office, 2010). Later the same year, seven priorities for action were recommended. Two of these were "Developing more coherence between policies in the fields of education, research and innovation" and "Partnership between universities and business and other relevant stakeholders" (Council of the European Union, 2009).

At Chalmers, there is one additional interpretation of how research should be framed. In 2010, Chalmers introduced a profile with eight Areas of Advance in which the research is now operated. Within these Areas of Advance, we find the research centers. Figure 8 shows the many influences there are for the structure of knowledge production. The degree of collaboration is undeniable relevant at present time, especially in how this structure of knowledge production in the research center is formed.

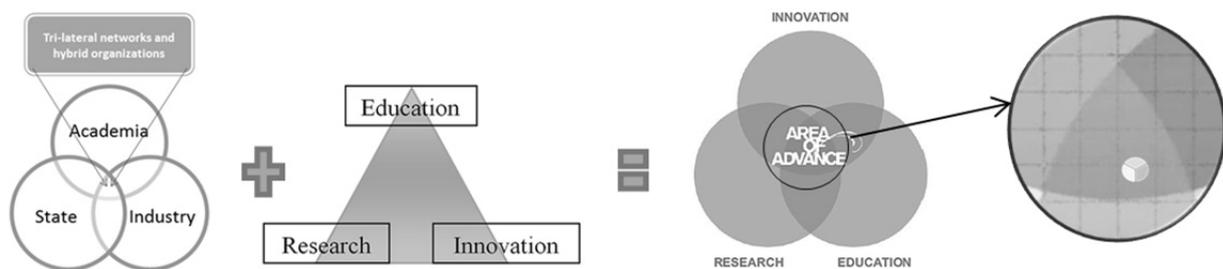


Figure 8-Structures of Scientific Knowledge Production: Triple Helix + the Knowledge Triangle = Chalmers' Structure for Areas of Advance

Butcher and Clarke describe an organization as an arena where interests frequently collide and align. Also they mean that managers spend their time and emotional energy negotiating these interests. (Butcher and Clarke 2003) To influence behavior, change the course of events, overcome resistance and get people to do things they would not otherwise do, there is a need for power (Pfeffer 1962 cited in Pfeffer, 1992:45). In a research center there are several stakeholders involved. Since there is an interest for all parts to align the research to one's own concerns, there is a need to defend or extend the turf, or in other words play the turf game which is mentioned by Buchanan and Badham (1999). They exemplified areas of influence and power, status and reputation and also access to and control of resources as parts of this turf game. It can be realized that the degree of collaboration is a difficult area to handle and that power and politics play an important role for how the collaboration looks like in practice.

The empirical results indicated challenges regarding new industry partners and to the industry's contribution. There is a need for control of how the industry acts, but as the interviews have showed with the mentioned challenges, this is complex.

6.2 Focus of Research

The center should apart from product development projects also produce qualified academic research and contribute to the advancements of innovations (Styhre and Lind 2010a). Lim (2009) describes three forms of absorptive capacities to allow capture different knowledge types. One of these is disciplinary which corresponds to a general scientific knowledge. Gibbons et al. (1994) meant that Mode 1 is found in universities and is characterized by disciplinary research. This implied discipline-based field of academic study where there is a distinction between what is fundamental and what is applied. Transdisciplinary corresponds to a constant flow back and forth between fundamental and applied and between theoretical and practical. Lims's (2009) two other knowledge types were domain specific and where the research is solutions to specific technical problems and the encoded type which was embedded in tools and processes. Mode 2 suggests a move towards a knowledge which is more tacit. Etzkowitz and Leydesdorff (2000) explain Mode 2 as a historically emerging structure for the production of scientific knowledge and that the Triple Helix model provides a model for the level of social structure for this.

The European Union wants every member state to stimulate the interaction between education, research and innovation. Evans (2010) says that company-based science is less theoretical than university-based science and that industry-based science is more speculative. He also means that governmental involvement is necessary when industry is sponsoring academic science. This was because science benefit from the relationship with replicated and theorized findings.

Lam (2007, cited in Styhre and Lind, 2010b) speaks of the importance of entrepreneurial professors which can handle both Mode 1 and Mode 2 research to produce knowledge, which is theoretically solid and practically relevant. Power concerns the capacity of individuals to exert their power over others (Buchanan & Badham, 1999). In a political arena, there are conflicting demands either imposed by important challenges to its existing order or between its existing influencers (Mintzberg, 1985).

From the empirical results, the balance between industry and academia was highlighted. This is considered a challenge for a research center. The forms for generating scientific knowledge in a research center differ from the earlier traditional university setting with disciplinary generation of knowledge. For the focus of research, the power and politics perspective is important since there is a need to handle the conflicting demands from different stakeholders of the center.

6.3 The Role of the Center

On an international level, from the European Union, the Knowledge Triangle is used to improve the investments in the three part of the triangle and also it is said that the university should be given a central role in building Europe (Swedish National Agency for Higher Education, 2010). One of the seven priorities that came from the Education, Youth and Culture meeting in Brussels was to create incentives for universities to develop transferable knowledge (Council of the European Union, 2009). Styhre and Lind (2010a) means that an entrepreneurial university is capable of integrating economic development as an academic function along with teaching and research and that it concerns the role the university is going to play in the knowledge economy, while a research center is a specific form of organization used within the entrepreneurial university. Etzkowitz and Leydesdorff (2000) say that the university has been transformed from a teaching institution to also combining this with research. They mean that this creates tension but that it is more productive and cost effective to combine.

Political activity in organizations can be described as games and a political arena is captured in whole or in part by conflict. This is due to conflicting demands (Mintzberg, 1985). A warrant to act politically can be based on many interacting factors: the benefits to be derived from change; personal career goals; reactions to past changes; the anticipated responses of other stakeholders (Buchanan and Badham, 1999).

In the studied centers there were shifting views of what a center is. The role of the university has changed and there are more stakeholders relevant for the research. Also from an international level the university has a role in building Europe. The conflicting views of what a center is affect how the center is organized and managed. There are many interacting factors which can lead to the need for political action. From the empirical results, one challenge was also the center identity. The many demands in the research center generate a challenge for the identity. Also the fuzziness in what a center is, contributes to the challenge in creating an identity.

6.4 The Role of the Director

Adler et al. (2009) say that knowledge about issues such as leadership; strategy and organization in research settings have become old. They mean that there are more concerns about the growing amount of stakeholders, that the contacts between industry and university is closer now, that there is a growth of international research programs and that the number of multi- and transdisciplinary research milieus is growing. Lim (2009) suggests that there is a need to better understand the different types of absorptive capacities. He also means that this includes the role of interfaces and gatekeepers. Gibbons et al. (1994) argue that the human resources are more mobile and the organization of research is more open and flexible in Mode 2 knowledge production. In Mode 2 the creativity is mainly a group phenomenon in contrast to Mode 1 where the individual creativity is emphasized as the driving force. They also say that the traditional management style is too inflexible. They mean that the management style of a distributed knowledge production process has to increase the permeability of boundaries and of brokering.

A political entrepreneur who is not politically skilled will fail. This person needs to be able and willing to intervene in political processes of the organization. (Buchanan and Badham, 1999) Mintzberg (1983) says that in an organization, there is power of External Coalition and of the Internal Coalition. The External Coalition includes the board, which control the behavior of the organization.

The empirical results show that for the role of the director, handling the challenges of a research center is a challenge. The director needs to handle these and is responsible but does not have a formal warrant to this. However, the board from which the power comes from is in reality a steering group. From literature, there were descriptions in the change of how research is pursued and that the management of research and research leadership is neglected. All the directors from the studied centers and also directors from other centers which participated in the workshop agreed that the director should be the head of operation, by means of someone who leads and develops the center. To handle this new situation in the generation of scientific knowledge, power and politics are important. The three directors in the centers differ in how they handle the politics.

7 Conclusions

In this chapter, the conclusions from the research in this thesis are drawn in light of the purpose and research questions of this report. Also some implications are given.

This master thesis has looked at the “internal role” of a research center at Chalmers. Two questions were asked: What is a Research Center? and What is the Role of the Director? The results in this thesis show that it is very difficult to answer these questions and that there is no one answer. However, the results still contributes to a better understanding of the research center’s role within Chalmers.

To generate scientific knowledge in the constellation of a research center funded by the university, the industry and by the government; differs from the ways knowledge has been created in universities earlier. The members of the studied centers all emphasized the value of working in a research center constellation and that this is a good way in how research is done. However, there is a lack of information in how these constellations should be operated in practice. The theoretical concerns did nonetheless correspond to what was shown in the empirical results.

In this thesis, four challenges were identified as areas where there can be difficulties. These were degree of collaboration, focus of research, the role of the center and the role of the director. The challenges are described separately but they are in reality difficult to separate. To have a structure for research, which includes collaborating with industry is valuable but also complex. There are other demands than those coming from the university. The shape and relationship of the collaboration influence the focus of research in what the center actually can do and to what projects are possible to have in the portfolio. Demands in a research center shape the role of what the research center is. The role of the director depends on what the role of the center looks like. From the study of the three centers, it was seen that the directors played their roles differently and used political means in their own way to manage the center. The role of the center and the role of the director are therefore also closely interrelated.

7.1 Implications

There are some implications that would facilitate when handling the challenges which have been presented for the research centers. Firstly, there is a need for better communication with the industry. This is intended for both directly from the centers as well as from a higher instance in the university, for example the Areas of Advance. Secondly, the roles of the different parts in the research center would benefit from being clarified. There is a need for something more than a general model of how the research centers should be organized. This does not necessarily mean creating a problem free organization but rather more visibility for those who organizes research centers, in this case Chalmers. For the industry this concerns their contribution and level of influence; for the research center this implies deciding what a center should contribute with; and finally the director role can be more clarified in what should be expected. Lastly, the research centers would benefit from a forum for communication in-between an Area of Advance or in-between the different centers. In such a forum there could be a natural exchange of ideas and experiences in how certain challenges can be managed.

8 Further Research

This chapter presents possible areas in which research would be favorable.

This master thesis looks at the “internal role” of the research center at Chalmers. This means that the focus has been on people working in the three studied centers within Chalmers. This thesis is part of a larger research project, which aims to contribute to the development of the Area of Advance for Transport. For further research it is therefore of interest to get the perspective of the industry partners as well. Since this master thesis was a relatively small study, there is a need for studies of more research centers. This could imply more research on centers at Chalmers but also at additional universities.

Another suggestion for further research concerns the cooperation form of a research center. What is the academia and industry opinion when it comes to research centers function for collaboration with the industry? Is the research center the best way or are there other more important collaboration forms?

This report has included power and politics in-between members of the centers. For further research it would have been interesting to see how national politics influence how these centers work. This would imply looking at the governmental aspects for who get funding and where the decisions are made.

In the workshop the participants said that there never were any gatherings or forums in-between the centers. This can be seen as an opening for collaborative research. In this situation the different stakeholders of research centers could be involved and engaged in development projects. These projects could at the same time provide the basics for a research project.

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Interviews

- Petter Dahlander (CERC) 2010-03-22
- Ingemar Denbratt (CERC) 2010-03-30
- Bo Egardt (SHC) 2010-03-15
- Anders Grauers (SHC) 2010-02-25
- Henrik Grönbeck (KCK) 2010-03-03
- Lennart Josefson (SHC) 2010-02-24
- Mark Linne (CERC) 2010-02-24
- Louise Olsson (KCK) 2010-03-02
- Magnus Skoglundh (KCK) 2010-03-11

Appendix I

Chalmers' Routines for the establishment of, and Policy for Centers in Chalmers (Chalmers University of Technology 2008)

Datum	Diariumnummer	Exp den
2008-10-06	C2008/985	2008-10-07 OBB
Närvarande:	Karin Markides Sofian Bengtsson Anna Dubois	
Företrädande:	Anna Dubois	

Ärende
Rutin vid inrättande av centrum vid Chalmers samt policy för centrum

Bakgrund
Chalmers har ett stort antal centrum av mycket varierande karaktär. För att bringa ordning och struktur har ett arbete gjorts med att identifiera dessa samt att knyta dem till relevant institution, s.k. värdestiftning. För att skapa effektiva administrativa rutiner och överblick över centrum har en policy för centrum vid Chalmers tagits fram samt en rutin för inrättande av centrum vid Chalmers. Se bilaga.

Beredningsgång
Ärendet har diskuterats vid en workshop i april 2008 samt beretts i en arbetsgrupp. Det har också diskuterats i samband med VPI-dialogerna 2008 samt vid prefektmöte 20 augusti 2008.

Genomförande
En process för att identifiera och strukturera centrum i enlighet med policy för centrum och inrättande av dessa startas omgående efter beslut. En process för att föra över centrum som nu ligger under rektor till lämplig värdestiftning startas också. Ambitionen är att detta skall vara klart under 2009.

Beslut
Rektors beslutat anta Policy för centrum vid Chalmers samt Rutin för inrättande av centrum vid Chalmers i enlighet med bilaga.


Sofian Bengtsson
Pro-rektor


Anna Dubois
Vice-rektor

Expederas till:
Prefekter
Administrativa chefer
Prorektor, viceprorektor
Ekonomisvdelningen
Informationsavdelningen
Planering och uppföljning
Adm. Dir

Rutin vid inrättande av centrum vid Chalmers

Ansökan om inrättande av centrum vid Chalmers skall följa den policy som rektor beslutar. Ansökan om inrättande av centrum skall ställas till prefekt. Prefekt avgör om ansökan skall gå vidare för beslut av rektor. Varje institutionsledning bereder ärendet med utgångspunkt från den gemensamma policyn för centrum vid Chalmers.

I ansökan skall följande behandlas:

- Syftet med centrum beskrivs enligt policy i uppföljningsbara termer:
 - Akademiskt mervärde och nyttiliggörande
 - Fokusering
 - Gränsvetenskap
 - Öppenhet (internt inom Chalmers och "outreach" externt)
 - Samverkan (medverkande och önskade partners)
- Förhållanden till Chalmers strategiska plan:
 - Synlighet: styrkommandeförster
 - Förhållningssätt till "Chalmers Academicus"
 - IP-hantering, enligt Chalmers eller alternativa modeller
- Beskrivning av organisationen med avseende på:
 - Placering – värdestiftning
 - Vetenskaplig ledare
 - Förordnandets uppdrag och mandatperiod
 - Styrgrupps sammansättning (ledamöter och ordförande) samt uppdrag och mandatperiod
 - Ev. förekomst av referensgrupp/-ar och/eller "advisory board"
 - Plan för administration och kommunikation
- Namn anges och motiveras
- Finansieringen beskrivs:
 - Finansieringsplan, projektid, eskaleringsplan
 - Beräknad finansiering för närmaste 3-årsperiod, befintliga och gränkade finansieringar
 - Budget år 1-3
- Plan för uppföljning och utvärdering redovisas:
 - Ansvar för uppföljning och utvärdering (internt och externt)
 - Innehåll i årliga rapporter med avseende på
 - Verksamhet
 - Ekonomi
 - Organisation
 - Utvärderingsprocessen

- Period för utvärdering
- Kriterier för utvärdering
- Process för utvärdering
- Budget för utvärdering
- Redovisning av utvärdering

Rutin för befintligt centrum

Ansökan om att kvarstå som centrum vid Chalmers skall vara rektor tillhands senaste 2009-01-11 i de fall då beskrivning saknas i värdeinstitutionens verksamhetsplan för 2009. En sådan ansökan skall förutom ovan angivna uppgifter innehålla en redovisning av den verksamhet som beskrivits och en beskrivning av hur denna är, eller kan bli, förenlig med Chalmers policy för centrum

Logotyp, hemsida med mera

Centrum ska följa rektors beslut angående användning av logotyp och grafisk profil mm.

Med beslut om inrättande följer också rätt att publicera information i universitetets webbsystem, inklusive länkar från Chalmersgemensamma sidor. Informationsavdelningen bör kontaktras vid utformning av hemsida etc.

Policy för centrum vid Chalmers

- Ett centrum vid Chalmers har sin bas i Chalmers forskning och utbildning och utgör en mötesplats för alla de Chalmersforskare och studenter som kan ge kvalitativa mervärden till verksamheten

Ett centrum vid Chalmers skall fungera som en öppen, och över sin existens föränderlig, mötesplats för forskare, studenter och externa parter som har sina formella organisationsdata hemvistar på olika håll. Detta innebär att ett centrum inte bör frätas om dess verksamhet endast riktar sig till en enskild forskargrupp eller till en i övrigt snäv grupp av forskare

Ett centrum har en begränsad livstid. Etablering av ett centrum får inte resultera i att ett verksamhetsområde utestängs forskare som vill delta i verksamheten genom inkludering eller genom relaterat centrum som funktionellt samverkar med beskrivet centrum

- Ett centrum vid Chalmers skall för externa parter utgöra en portal in till hela Chalmers

Detta innebär att varje centrum även representerar andra delar av Chalmers och att de därmed har till uppgift att underlätta externa parters tillgång till hela Chalmers kompetens inklusive studenter och miljöer för livslångt lärande. Kontakterna skall kunna bidra till såväl fundamentalt nyttänkande som till utveckling av tillämpningsområden.

- Ett centrum vid Chalmers skall ha en vetenskaplig ledare med anställning vid Chalmers

Detta innebär att Chalmerscentrum skall ha en vetenskaplig utveckling direkt kopplad till Chalmers. Vetenskaplig ledare ansvarar för att centrum samverkar med utbildning, forskning och omgivande samhälle inom hela Chalmers och till främst samverka med andra universitet och högskolor. Den vetenskapliga ledningen kan kompletteras med administrativ ledning och verksamhetsledning som inte behövs direkt kopplad till Chalmers

- Ett centrum vid Chalmers skall vara en dynamisk och öppen miljö

Ett centrum skall vara inbjudande och utgöra en plattform där nya samarbeten skapas och där nya utvecklande perspektiv lyfts in över tiden. Detta skall leda till positiva effekter i och utanför dess gränser. Dynamiken skall kunna utvärderas kontinuerligt med avseende på hur samarbeten utvecklas och hur forskarkonstellationer förändras över tiden.

För att främja dynamiken bör ingen forskare eller forskargrupp vara verksam på heltid vid ett centrum under längre perioder

- **Ett centrum vid Chalmers förväntas se möjligheter att bidra till tillväxt i ett eller flera bredare kluster**

Alla Chalmers centrum bör se fördelar i att samspela med andra centrum där nya frågeställningar kan identifieras och utvecklas i gränsytorna. Ett moget centrum vid Chalmers förväntas vara aktör i ett eller flera funktionella kluster och spela en viktig roll i länkandet av forskningsmiljöer och den forskningsinfrastruktur som är relevant

- **Ett centrum vid Chalmers kan finansieras på olika sätt**

Ett centrum kan startas utan specifik finansiering men bör ha en målbild med definierad plan för hur finansiering kan genereras från olika källor över tiden. Forskare och forskargrupper kan koppla enskilda forskningsprojekt och –program till ett centrum finansierat eller bedriva forskningen inom centrumets ram men hantera ekonomin genom kostnadsfällan i linjen.

Ett moget centrum har flera finansieringskällor och möjlighet att i egen regi initiera en del av de forskningsinsatser som är av betydelse för utvecklingen. Centralt ekonomiskt stöd utgår endast undantagsvis, och då för att möjliggöra inledning av nya gränsöverskridande samarbeten (vidgning av centrum eller koppling mellan centrum).

- **Ett centrum vid Chalmers skall ha sin organisatoriska och administrativa hemvist vid en institution**

V varje centrum skall ha en värدينstitution. Etablering och drift av ett centrum skall inte innebära att ett extra lager av administration skapas i organisationen. Ekonomin hanteras genom att ett kostnadsställe skapas vid värدينstitutionen.

- **Ett centrum vid Chalmers skall upprätta en plan över hur dess excellens och relevans skall utvecklas och bidra till tillväxt och attraktionskraft**

Detta innebär att varje centrum beskriver och årligen uppdaterar sin "livsstrategi" som en del av värدينstitutionens verksamhetsplan.

Endast genom att se och utveckla samverkansformer med kompletterande centrum och forskningsmiljöer kan den excellens och relevans som ett centrum representerar bidra till att stärka attraktionskraften för Chalmers och därigenom bidra till att successivt forma och utveckla våra unika styrkeområden.

- **Alla centrum vid Chalmers inrättas av rektor**

Inrättade centrum får kontinuerligt fokus genom Chalmers initiativ med olika incitament och samordning genom "Chalmers Academies" samt synlighet genom ett eller flera av Chalmers styrkeområden och dess samlande fönster (CEC, GMV m.fl.)

Se: *Rutin för inrättande av centrum vid Chalmers*

Appendix II

CREST characteristics of a research center

“Industry-Led Competence Centres – aligning academic/public research with the enterprise and industry needs” (CREST Working Group, 2008)

Characteristics of a successful Competence Center:

The flexibility of the Competence Centre model allows for adaptability to suit the needs of the industrial and academic partners. As such, few Centres exhibit identical characteristics however the following are broadly agreed as being core operational descriptors:

- Research and training programs focused explicitly on industry future needs under the direction of an Industry-Led board and appropriate management who have significant experience of industry.
- A very strong focus/ethos of generating and assisting industry in exploiting new knowledge as their primary objectives · Significant scale of researchers/principal investigators with further numbers of postgraduate research students both in-house and in associated institutions over the range of disciplines required to deliver on the problem focussed research agenda.
- A multidisciplinary research team covering the range of disciplines required to deliver on the problem focused research agenda.
- A research agenda which is directly relevant to the future needs of the industrial partners – more medium term market focused than technology driven, as witnessed by the clear commitment of the industry partners.
- Close location / relationship with high quality research groups yet independent from Institutional management structures, possibly to the extent of becoming a separate legal entity.
- Formal governance structures, led by a strong, high profile industry Chairman and a balanced and experienced board, supplemented where appropriate with a scientific advisory board 12
- A funding model which enables the Centre to maximise the commercial potential of the IP which it is managing rather than being restricted to a small number of companies.

Definitions and attributes of an Industry-Led Competence Center

The Working Group definition of Industry-Led Competence Centres was agreed as follows;

- They are engaged in collaborative research, typically focused on medium/long term issues.
- The research is conducted on areas of direct industrial relevance,
- The areas of research are focused on gaining competence in areas of technology or innovation which are relevant to the industry stakeholders.
- They are formal organisations, which have a long term but typically finite duration.

To bring greater clarity to the discussion the following attributes of Centres were agreed. Competence Centres:

- are long term collaborative entities harnessing the expertise of publicly funded research performers with strong industry leadership
- are research Centres with a degree of autonomy, physical focus and possessing a critical mass of researchers.

- engage in market-relevant research through close engagement with industry in the development of their research agendas.
- engage in a range of activities with industrial relevance such as strategic research, researcher training and the transfer of knowledge and intellectual property.
- typically they do not carry out extensive contract research but focus on truly collaborative strategic research
- address a market failure in the RTDI landscape whereby the risks associated with the longer term nature of strategic research carried out cannot be addressed by individual companies.
- build over time a core competence in the Centre in the area of technology focus of the members/partners.
- achieve impacts over time in terms of increased industrial activity by the training and transfer of researchers and commercialisation of IP.
- develop strong linkages between researchers and industry defined in a Centre agreement setting out the expectations of the partners and the commitment expected from them, e.g. time spent engaging in collaborative activities in the Centre.
- They also act as a bridgehead for international collaboration through such mechanisms as the Framework Programme.

Appendix III

Question Guide

- 1) Who are you?
 - a) How much time do you spend as a director / within the center?
- 2) Describe this center.
- 3) How is the center organized? (Many stakeholders, several universities, and players and Chalmers in itself)
 - a) Who is your job initiator or manager?
 - b) Financing?
 - c) Stakeholders (industry)
 - i) Does their activity differ?
 - d) Chalmers (as the "owner" and as the environment-to be located at Chalmers)
 - e) The Board
- 4) The Role of the Director and the coworkers
 - a) The role for development of the organization (e.g. new projects)
 - b) Personnel Management
 - c) Economy, operations planning, monitoring
 - d) Quality, delivery
- 5) Efficiency/Effectiveness
 - a) What is efficiency in this kind of activity?
 - b) Are you effective?
 - i) Give examples of effective processes / events
 - ii) Give examples of inefficient processes / events
- 6) Additional thoughts, which I have not asked?

The interviews were made in Swedish. Therefore the used question guide in Swedish is included below.

- 1) Vem är du?
 - a) Föreståndare-hur mycket tid tar det?
- 2) Berätta om detta center
- 3) Hur styrs verksamheten? ((Många intressenter, flera universitet, och aktörer och Chalmers i sig.)
 - a) Vem är din uppdragsgivare eller chef?
 - b) Finansiärer
 - c) Intressenter (industrin)
 - i) Är de väldigt olika aktiva?
 - d) Chalmers (som "ägare" och som omvärld-att finnas på Chalmers)
 - e) Styrelse (board)
- 4) Föreståndarrollen och medarbetarna
 - a) Roll för utveckling av verksamheten (typ nya projekt)
 - b) Personalledning
 - c) Ekonomi, verksamhetsplanering, uppföljning
 - d) Kvalitet, leveranser
- 5) Effektivitet
 - a) Vad är effektivitet i en sådan här verksamhet?
 - b) Är ni effektiva
 - i) Ge exempel på effektiva processer/händelser
 - ii) Ge exempel på ineffektiva processer/händelser
 - (1) situation, vad hände, roll för centret, vilka var inblandade
- 6) Ytterligare tankar, men som inte har blivit frågade?

Appendix IV

Results from Workshop

Degree of Collaboration

1. To pursue research by oneself-To pursue research with the industry

In this concept pair there was opinions saying that the present situation is okay but that there are few initiatives from the industry and a low active participation. There was an aspiration for all parties to cooperate to meet the research center's goals and objectives. Also there was an ascertainment that the research should be together with the industry and that this increases the relevance and ability to be on the cutting edge.

2. Independent research (based on curiosity)-Task oriented research (motivated by need)
and
3. Open innovation-Closed innovation

One of the workshop groups meant that within a research center, the research can never be free or independent since the direction comes from the board, which means that the individual researcher cannot act independently. In this sense they meant that it would have been against the center nature to be independent. However, they said that this works all right within the center. The other group described task-oriented researched as research, which you do not publish. For this to be interesting, it could be a way of attracting new companies, not as the main research. This group combined this concept pair with the third: closed or open innovation. They meant that open research is the goal but that task oriented research also can be contained within the center but a limited part. The opinions from the workshop were that there is a complicated interface, which is tricky for both academia and the industry. And also that it is manageable since there are often rules in the center, which are agreed to. It was expressed that from academia's point of view, it should be as open as possible. This is also a wish from for example the Swedish Energy Agency and for them gladly open to access to the rest of the world. However, the industry often has a stronger say in not releasing all the results. Many projects are partly hidden and the centers differ in how horizontal the projects can be.

4. Industry holding the center back - Industry pulling the center forward

See Chapter 5.2

Focus of Research

5. Assemble all research – Pursue selective research

There was a vision from some of the participants in the workshop to collect much research within the center. However, the resources are limited, which makes it necessary to prioritize. Some companies see it as valuable that the center has collected all the research. One participant expressed the importance of collecting the knowledge of what is up-to-date and who is doing what.

6. Applied research - Basic research

One participant said that many centers are engineering science oriented and in this sense it is applied science. He meant that it still needs to be on a level where there can be a graduate education and where the results can be published. Also he meant that it can never become a product development. One participant expressed the need of a diversified project portfolio with some projects which are applied, some

basic and some with more risk.

The Role of the Center

7. The center as a project organization - The center as a Unit

See Chapter 5.2

8. The center as a gathering place for projects from the department - The center as a generator of projects

The center should be a generator of projects. The participants meant that for the center identity, a common workplace is very important.

9. The center as a form of collaboration within Chalmers - The center as a form of collaboration between Chalmers and the industry

One of the fundamental conditions for being a research center is to collaborate with industry. However, a center is both of the concept pairs. One group mentioned that there is perhaps an unexploited potential for collaboration in-between centers. One participant raised the issue on what level the collaboration with industry should be for the research to be relevant. One more of the participants mentioned that Swedish centers collaborates more with the industry than in the USA. He meant that the industry probably does not know this in Sweden.

The Role of the Director

10. The director as an administrator - The director as the head of operation (as someone who leads and develops the center)

The participants answered unanimously head of operation. The administrative task for the director is quite heavy and there is a wish for an administrative support for the center. One participant said that if the center is considered as a project organization, it is enough with an administrative director. If it is supposed to be a unit, there is a need for a head of operation. Otherwise the center can almost be considered a secretariat.

11. A director with broad knowledge of the field - A director with specific knowledge of the field

One of the groups said that if the center has a narrow base, the knowledge should be specific. If it is a wide center, perhaps there is a need for someone strategically or politically. The other group said that the director needs to grasp the center area. Also the director needs to be neutral to the areas within the center and see the whole. It is important that the director has credibility within the center, which comes from knowledge that the center members can relate to. This is important so that the director gets a basic understanding for the tasks. For the three studied center directors, they handle their own research differently. One of them plays down the research within the center; another of them lays the research outside the center at the host department.

12. One director - One director and one deputy director

To have a director and a deputy director was by one group considered favorable when being able to discuss with someone that has the same insight. Also it is easier to keep up and to help each other. The other group wrote that it should be a management team and someone administrative.

Additional concept pairs

Two additional concept pairs, which had not been included within the four challenges for operating a collaborative research center in Chapter 3.3, were suggested and considered important by the participants in the workshop. These were:

13. Project generation: Open-Closed

This concept pair refers to how open or closed the project generation should be. One participant mentioned that all project ideas should be discussed in the reference groups before moving further. However, the same participant said that there are parties, which discuss the projects outside the reference groups. This implies that the projects can already have been “decided” about when they come up for discussion.

14. Confidence within the center: surveillance and confidentiality - cooperation and transparency/openness

This concept pair concerns trust in-between the parties. This influence how much knowledge is brought to the center and how much that remains on the outside.