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Increasing companies' absorptive capacity through participation in collaborative research centres

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Abstract

Norway has developed ambitious goals to become one of the leading environment friendly energy nations. The establishment of Centres for Environment-friendly Energy Research (CEER) scheme is one of the main measures for addressing these goals. The CEER scheme seeks to develop expertise and promote innovation through focus on long-term research in selected areas of environment-friendly energy, in close collaboration between prominent research communities and users like industry and public administrative bodies. The main objective of this paper is to explore and present the potential benefits companies may gain from participation in collaborative research centres like CEER, as well as possible barriers for participation. The framing in this paper is on the development of the absorptive capacity for the industry partners through active participation in the concrete research activities. Based on the empirical material for this paper, collected from one of the eight technological CEERs, we conclude that there are benefits to be gained from companies involving themselves in large-scale research centres. Their potential absorptive capacity is increased by exposure of knowledge and hopefully new positive experience with collaboration over time. However, both this effect, and a potential increase in realized absorptive capacity is very dependent on the active involvement of the company and choosing the right persons to represent the company towards the research centre. By contacting the researchers on a regular, keeping up to date, taking initiative and proposing research projects, combined with some patience, participating industry partners should be well positioned to reap the benefits from their funding.

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1. Introduction

Knowledge is one of the key factors for creating value and sustaining competitive advantage for firms [1-4]. The central idea in the knowledge-based theory of the firm is that the firm's primary role is the integration of knowledge from individual organizational members to organizational capabilities [5]. Since no manager can efficiently integrate the knowledge of his or her subordinates, the key task for the management is to coordinate the integration of the knowledge of several specialists into goods and services [3, 5].

Within studies of knowledge integration many refers to the construct of 'absorptive capacity' by Cohen and Levinthal [6]. They argue that outside sources of knowledge could be essential to the innovation process and to companies innovation capabilities, as well as the ability of a firm to recognize the value of new, external knowledge, assimilate and integrate the new knowledge, and apply it to commercial ends. Absorptive capacity is thus a function of the companies' level of prior related knowledge, including knowledge diversity increasing the probability to integrate new knowledge with what is already known. Zahra and George [7], based on a literature review of the concept of absorptive capacity, suggest to reconceptualise the concept by recognizing the difference between potential and realized absorptive capacity. Potential absorptive capacity includes a company's ability to acquire and assimilate knowledge, while realized absorptive capacity focus on knowledge transformation and exploitation, which in turn generates potential competitive advantages. Zahra and George [7] further proposes several propositions connected to potential and realized absorptive capacity:

- The greater a firm's exposure to diverse and complementary external sources of knowledge, the greater the opportunity is for the firm to develop its potential absorptive capacity.
- Experience will influence the development of a firm's potential absorptive capacity.
- Activation triggers will influence the relationship between the source of knowledge and experience and potential absorptive capacity.
- Use of social integration mechanisms reduces the gap between potential and realized absorptive capacity, thereby increasing the efficiency factor (r). Social integration mechanisms lower the barriers to information sharing while increasing the efficiency of assimilation and transformation capabilities.

When it comes to obtaining external knowledge, there is a range of different partners that firms can collaborate with, and each partner possess different types of knowledge [8]. Numerous policymakers have supported a more proactive and increased interaction between universities and industry as a consequence of the hardening international economic competition over the past decades [9]. Empirical research has followed this policy trend, and university–industry relationships have been extensively studied by academics in recent years. The policy focus on university-industry collaboration is justified largely by the argument that universities and industry links facilitate knowledge transfer between academia and industry, thus enhancing the national innovation performance [10].

In practice, governments engage in the development of new knowledge through supporting universities, research institutions, industries and companies through research programmes and other schemes. One example of these schemes is the Norwegian establishment of Centres for Environment-friendly Energy Research (CEER)[1], which is one of the main responses to Norway's ambitious goals to become one of the leading environmentally friendly energy nations. Innovation is a prominent component and one of the main goals with this scheme. The CEER scheme seeks to develop expertise and promote innovation through focus on long-term research in selected areas of environment-friendly energy, in close collaboration between prominent research communities and user partners like industry and public administrative bodies. It is expected that mainly the company partners will generate innovation and value creation, although another outcome of a centre's activities may be the start-up of research-based companies to commercialise ideas that fall outside the core areas of the company partners. However, it is still an open question how company partners perceive their role in a research centre and how this partnership can generate value.

The main objective of this paper is to explore if and how companies' absorptive capacity may increase through collaboration in research centres through an in-depth case study of Forrest, one of the eight technological

[1] See the description of the scheme at the Research Council of Norway (http://www.forskningsradet.no/en/Funding/FME/1215006638765)

CEERs. Our aim is to present empirical data that is relevant for both researchers and practitoners. The key method in this study is an in-depth case study based on empirical data derived through 13 qualitative interviews. Regarding theoretical contributions, few empirical efforts have been made to unravel the wide range of benefits that the industry obtain in their interactions with universities [10]. Hence, this paper makes two contributions to university-industry collaboration literature. First, we provide empirical data on benefits that industry partners may gain from interactions with universities. Second, we explore five collaboration aspects in relation to absorptive capacity. By doing this we also contributes to a shortcoming in the existing literature, which have given little attention to the processes underlying absorptive capacity [11], treating the specific organisational processes and routines as a black box [12]. In the following section we will describe the CEER scheme and the research centre Forrest, before we move on to describe our methodological approach. The paper continues with a section presenting the empirical findings from this study, followed by preliminary discussion and conclusion

2. Forrest and the CEER scheme

In 2008 a broad-based political agreement on climate policy were reached in the Storting, the Norwegian parliament, in which promotion of renewable electricity production is perceived as one of the main solution for reducing greenhouse gas emissions. It is also evident that Norway has the potential to become a major exporter of both energy related technology and environmentally friendly energy to Europe and the rest of the world. The Norwegian Research Council proposed the establishment of the CEER scheme as one of the main measures for addressing these goals, which received the necessary funding by the Norwegian Storting.

Innovation is a prominent component and one of the main goals with this scheme, based on the description of the CEER scheme by the Research Council. The CEER scheme seeks to develop expertise and promote innovation through focus on long-term research in selected areas of environment-friendly energy, in close collaboration between prominent research communities and users like industry and public administrative bodies. It is expected that mainly the industry partners will generate innovation and value creation, although new start-up companies also may be a possibility. A further target is to enhance researcher training in areas of importance for user partners and generate research-based knowledge and technology transfer. Finally, the main assessment criteria in the selection and evaluation of centres were and will be the scientific merit of the research and the potential to generate innovation and value creation.

In 2009, the first eight technological research centres were given the status as CEER, and two years later three additional social science research centres were announced. Each centre receives a yearly funding from the Research Council on NOK 5-20 million for eight years, were the funding for the last three years are depending on a favourable mid-way evaluation. The technologies that are covered by this scheme are carbon capture and storage (CCS), offshore wind, solar cell, hydro power and the environment, zero emission building, and bioenergy. In this study, we have focused on the research centre on bioenergy, which we call Forrest.

There are several reasons for choosing this particular research centre as the first case. First, bioenergy is part an established market in Norway, although with huge potential to grow larger. Second, the research centre Forrest involves partners that cover the whole value chain from raw material, to energy and heath producers, consumers, as well as technical providers of combustion solutions for both industrial and private consumers. Third, the research centre is acknowledged by the Research Council to be one of the leading CEERs on understanding and formulation of innovation activities and targets.

At the time of the study, Forrest consisted of two universities, two research institutes, two policy organizations, and 15 industry partners. The collaboration was organized in five sub projects consisting of several work packages each. The five sub projects are Biomass supply and residue utilization, Conversion mechanism, Conversion technologies and emissions, Sustainability assessments, and Knowledge transfer and innovation. In the next section, we will briefly explain the method applied for this paper.

3. Method

This study is a part of a larger investigation of the usefulness of companies' participation in research centre. The larger investigation covers six of CEER centres and consists of 47 interviews with both researchers and company representatives. However, in this paper we wish to concentrate on the theoretical concept of absorptive capacity by going deep within one centre. To further the understanding of the collaboration processes between researchers and industry partners in Forrest, qualitative interviews were chosen as the method for data collection.

The empirical data in this study were collected through 13 semi-structured interviews conducted by one of the authors. In addition, six shorter background conversations were conducted, lasting between 15 and 30 minutes, to gain insight about the bioenergy branch of industry. The interviews lasted between 45 and 70 minutes, and

followed an interview guide covering seven themes: the respondent's background, respondent's work relation and activities connected to Forrest, respondent's motivation for this work, experiences with Forrest, views on the collaboration between the different partners in Forrest, suggestions on steps for improvements in Forrest and opinions on the challenges for bioenergy in general.

The respondents were chosen to cover different kinds of partners in Forrest like energy companies, technology companies, universities and research institutes, interest organization and the Research Council. Snowball sampling [13] was commonly used to identify new respondents, which was particular helpful to identifying the particular contact person in industry partners.

The interviews were taped and additional notes were taken during the interviews. The interviews were transcribed [14], in addition a summary of each interview were formulated. The summary was revised after sending it to the respondents for correction and validation [13]. The analysis continued with an effort to identify common patterns across the findings from different respondents. After formulating a number of patterns, the patterns were systematically checked by comparing the patterns with each other and comparing opinions of different respondents on the same issues through triangulation [14]. In the next section, we will present some of the empirical findings from this study.

4. Results

In this section, we will present empirical findings on the collaboration within the Forrest research centre. To structure our presentation we will discuss the collaboration in relation to the following five themes: exposure to knowledge, previous experience, activation trigger, contact person and research sponsor and social integration. The presentation of the findings is written in a manner that should be relevant for both academia and business.

4.1 Exposure to knowledge

Because Forrest is among the leading actors within the technology development within their branch, it will be one of the major sources for exposing their participating companies to new knowledge. Several informants from the business world express great interest in the knowledge Forrest has on topics related to their core business activities. However, the informants also explained the difficulties of sorting out relevant information and knowledge from the large stream of communication and information sent out from the research centre. For the industry partners it would be advantageous to have a better and more targeted communication system to highlight what is most relevant for the single organization, as well as providing accesses to all information of general interest for the branch. The communication that Forrest shares with their industry partners increases the companies' ability to acquire new knowledge. However, this effect is reduced if the relevant information and knowledge is difficult to identify or if the industry partners spend too little time on keeping up to date on the activities and information from the research centre.

4.2 Previous experience

It is interesting to note that several of the partner companies involved in Forrest have a long history of working particular close to one of the applied research institutes. From the interviews it emerges a clear picture of positive previous experience with joint technology development, particularly for the smaller and more technology-oriented companies. It is also a perception that the same companies are the most active in contacting the researchers within the centre and asking them to help out solving technological challenges. One company, GK, has a long history of collaborating with one of the research institutes. The CEO of the company confirmed that the long-lasting positive relationship was helpful when the company was in dire need to develop a new afterburner within a short time span. The company took initiative to define a project within Forrest for this purpose, and the new product was developed shortly after. This example illustrates that previous positive experience lowers the barrier for taking contact with the researchers, but it also illustrates that companies with such experience is also the most active ones in developing proposals for defining projects and research. Thus, previous positive experience increases the probability for making contact and engaging more directly with the activities in the research centre. However, the challenge for Forrest is to share and spread the positive experience from some partners to all partners in an effort to reduce the barrier for partner companies to take part in the activities of the research centre.

4.3 Activation trigger

As previously mentioned the company GK received help from the research centre to develop a new afterburner. This urgent request was grounded in failure to meet the new environment requirements needed to receive certification for their fireplace both regarding to efficiency and emissions. Without such a certification, GK was not longer allowed

to sell their product and was therefore in a state of crisis and potential shutdown. The CEO explained that without the long history of collaboration between GK and one of the research institutes, which speeded up the process considerably, it would be impossible to define the problem, establish and finance a project, and solve the problem before the new regulation went into action. In addition to illustrate the importance of previous experience, this also illustrates how an external event in the form of the new regulation, would act as an activation trigger for GK to reach out to the research community, and increase their willingness to adopt the new technology quickly. The challenge for Forrest is their planning process, where they formulate research objectives and targets for many years ahead. This also leads to several research projects initiated by different partner companies to be waiting in line for available resources. However, a waiting time of several years for developing new and essential knowledge triggers by external events can in the most acute instances be far too long, as illustrated by the case of GK.

4.4. Contact person and research sponsor

Forrest is organised with one researcher acting as a research sponsor for each industry partner, an arrangement that is well received by industry partners. Several research sponsors told that they had weekly contact with their contact person in their industry partner, and indicated that the amount of contact, requests and initiatives from the industry partners had multiplied after the establishment of Forrest. However, the researcher also indicated great variety among the partner companies regarding interest, contact and activities. Several companies admitted that ordinary daily work had priority over Forrest projects, resulting in the challenge of spending the required number of budgeted hours as part of their in-kind contribution to the research centre. However, it does not seem to be any consistent difference between the interest and involvement of small and large companies. On the other hand, the research partners indicated that the interest and intensity in the activities from the partner companies were very much dependent on their contact person. The most active contact persons came up with the largest number of suggestions, thus getting a greater share of their initiatives accepted within the common research plan, and in turn also turned up to be the persons most involved in the research being undertaken. The research sponsors suggested that the contact person was more active if he or she worked within Research and Development (R&D), and that it was beneficial for the communication if the contact person had previous experience from research. The obvious down side with this pattern is the potential risk involved for the partner companies in choosing a contact person that remains uninvolved in the activities and information stream from the research centre, making it even harder to get up to date and influence the future research objectivise of the centre.

4.5 Social integration

According to the informants from the industry partners, the greatest advancement of Forrest as a large research centre is the ability to create more momentum, visibility and continuity compared to single research projects. The establishment of the research centre makes the research projects less depended on key persons, and has provided a positive overall framing of the collaboration. The composition of both the research and industry partners has enabled Forrest to provide better understanding of the whole value chain within bioenergy, which enables the participants to assess the individual research projects implications in a wider context than before. Not only has the value from each project become higher, but at the same time, the number of projects that can be realised has increased as well. With the establishment of Forrest, various geographical separated research organizations within the similar research field have become better integrated, producing a more coherent and solid research community within bioenergy. The infrastructure on both locations has been vastly improved, which is perceived as promoting the feeling of mutual benefits. The Forrest management team promotes social integration between the different partners mainly through the arrangement of two yearly conferences for all persons involved in the research centre. At these gatherings the different actors is involved in discussion in several workshops, presentations, as well as informal discussion through dinners and other social activities.

5. Discussion

From the presentation of the empirical findings, we notice that the Forrest research centre plays an important role regarding exposing the industry partners to new knowledge. However, the partner companies' ability to integrate this knowledge is to some extent dependent on their previous experience with collaboration, and on potential activation trigger as the introduction of new regulation. In addition, successful knowledge integration is also dependent on social processes within Forrest; both through social integration as yearly conferences, but perhaps more importantly through daily work between the industry partners contact person and their corresponding research sponsor. A well function relationship with regular contact lowers the companies' barrier to contact researcher and initiate new and relevant research projects. The communication between the research environment and the

companies seems to be further improved if the industry partner's contact person is closer to the practice of research, either by working in R&D or having worked with research previously.

Looking back to the propositions made by Zahra and George [7], it seems reasonable to conclude that companies can increase their absorptive capacity by becoming an industry partner in a large scale research centre. In particular, this applies for their potential absorptive capacity, which benefits from access to new knowledge developed in the research centre. However, this expansion is dependent on the overlap in what the company already knows and is able to identify as relevant. Previous positive experience with collaboration with particular research communities will increase the likehood for an increase in potential absorptive capacity, and will probably also guide initiatives from activation triggers towards previous partners. However, a potential increase in the realized absorptive capacity is not as evident. First, the company is very dependent on the capabilities of their contact person in relation to the research centre. If this person is not functioning optimally, it will have a negative influence the company's ability to transform and exploit new knowledge derived within the research centre. Instead of acting like a facilitator for realized absorptive capacity, this person can instead act as a bottleneck. On the other hand, the social integration mechanisms in Forrest like the yearly conferences could probably reduce the gap between potential and realized absorptive capacity by increasing the efficiency factor (r). Social integration mechanisms lower the barriers to information sharing while increasing the efficiency of assimilation and transformation capabilities within the research centre. However, a major challenge for the partner companies is to involve enough employees in the overall research centre activities. If too few persons are involved, the potential increase in the realized absorptive capacity is lost because new knowledge from the research centre is not likely to be very well integrated in the company as a whole.

Considering our findings in an even broader theoretical view, it is possible to identify several areas for further research. However, we will restrict ourselves to mention just four aspects. First, it is clear that R&D collaborations present unique coordination challenges when it comes to the sharing or transfer of knowledge between organizations [15]. This implies a need to create a learning environment where learning occurs in both universities and the companies, and where learning is not only limited to the principals [16]. The challenge is thus to extend knowledge and to create a shared understanding in other parts of the organization. How companies work to integrate external research collaboration within their own organization needs to be addressed in further research. Second, another key aspect is the formation process of research collaboration, where Ring, et al. [20] argue for the importance of a strong awareness of partners converging business interest and a strong social relationship as determining factors of collaboration success. Third, another key aspect is to examine how to mitigate the companies' perceived barriers for collaboration with universities. Bruneel, et al. [21] claim that prior experience with collaborative research lowered firms' barriers of collaboration with universities, in which development of mutual trust was an important component. Common collaboration experience should also enable academics and industrial collaborators to converge in attitudes and learn to share common norms and reach a mutual understanding regarding the nature of the collaboration and research processes [21]. A fourth general aspect for further research is to look more into the university-industry collaboration processes, as the organisational dynamics of university-industry collaboration remain under-researched [17-19]. Fifth and last, more empirical research is needed to better understand how companies and research centres could contribute to increase the realized absorptive capacity, and not only the potential absorptive capacity.

6. Conclusion

There are benefits to be gained for companies involving themselves as industry partners in large-scale research centres as the Forrest, within the CEER scheme. Their potential absorptive capacity is increased by knowledge exposure, and hopefully new positive experience with collaboration over time. However, both this effect, and a potential increase in realized absorptive capacity is very dependent on the active involvement of the company and choosing the right persons to represent the company towards the research centre. By contacting the researchers on a regular, keeping up to date, taking initiative and proposing research projects, combined with some patience, participating industry partners should be better positioned to reap the benefits from their funding.

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