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A CASE STUDY OF IDEA WORK IN THE EARLY PHASES OF PRODUCT DEVELOPMENT

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ABSTRACT
Focus in this paper is on the early innovation activities, in particular idea work. Based on a case study from industrial practice on the development of a new circulator (the Alpha Pro circulator) we aim at getting a better understanding of the work with ideas in the early phases of product development. Based on our case we will point out four central findings: 1) Early idea work is a complex process and interlinked with many other activities both inside and outside the organization. 2) Ideas evolve, combine and change over time. 3) Idea work involves a wide range of actors. 4) Carrying ideas through demands continuous mobilization of support among a range of actors.
We suggest that the actors involved in idea work and their interaction such as negotiating different understandings of what constitutes a qualified idea as well as the continuous mobilization of support to their ideas among a range of actors should be key elements when we want to understand early idea work.

Keywords: Idea work, front-end innovation, interaction, political process, case study

1 INTRODUCTION
In the last decade, an increasing focus has been turned towards companies' ability to innovate. This focus has lead to an increasing interest among companies and researchers to get a better understanding of the conditions for innovation and to develop approaches and tools to manage the innovation process and support the actors involved. In particular, the very early innovation activities, often labeled 'front-end' innovation, are of interest, because they are recognized as being critical to the whole innovation process and considered as one of the greatest opportunities for improvement [1], [2], [3]. In practice, we have observed an increased interest in understanding the early innovation activities through our collaboration with industry at different occasions such as student and PhD projects, networking groups and workshops with participants from industry and academia. This paper will focus on the early innovation activities, in particular work with ideas in the early phases.
Ideas are the core of product development and engineering design activities [4]. Rubenstein [1] states: *"It seems trite, but it is the true that ideas are the technical lifeblood of the firm, whatever their sources. Without a steady stream of high potential ideas, its technical efforts in R&D, engineering, product development, manufacturing methods, market development, and customer and factory service can fall far short of needs and expectations"*. Ideas are indeed important and they come from a variety of sources: Organizational functions and diverse knowledge domains both inside and outside the company. What really is of interest, when we want to know more about the conditions for idea work is how ideas emerge and develop.
Through a case study about an energy labeled circulation pump, we will offer an understanding of idea work. I.e. how ideas get going and gain momentum in an organization. Furthermore, emphasis will be placed on the fact that work with ideas is an intricate affair involving complex interaction between many different organizational functions, knowledge domains and actors with differing perspectives on design and innovation.
We have structured the paper as follows. Section 2 introduces our research method and research questions. In section 3, we present state-of-the-art literature dealing with different aspects and understandings of idea work. In section 4, we present our case: The development story about the energy labeled Alpha Pro circulation pump. In section 5, we propose an extended understanding of idea work and in section 6, we finally conclude.

2 METHODOLOGY

In this section, we will present our research method, the case company and our research questions.

2.1 Research method

The empirical findings in this paper are based on a single case study [5] conducted in Grundfos, a global enterprise, developing and manufacturing a wide range of pumps for domestic and industry purposes. For the case study, a completed product development project was chosen with help from Grundfos. The development project and its result, the Alpha Pro pump, are by Grundfos viewed as one of the biggest successes in recent time. The case was chosen, due to Grundfos' interest in gaining insights for use in future innovation practices. The case can be characterized as being a unique case study [5], since it does not represent a typical development project at Grundfos. Most of the empirical data has been collected through interviews conducted by the first author. Twelve respondents were interviewed. The respondents were involved in either the particular idea work and development of the Alpha Pro pump, or had special knowledge about it and the organization's previous history. The respondents were in organizational positions such as R&D, project managers, Marketing, Chairman of the board, and politicians. Two respondents were interviewed twice, which sums the total number of interviews up to 14. Each interview lasted from half an hour to one hour and was audio recorded and then transcribed. The interview format was semi-structured which allowed the respondents to describe what they felt was important. Focus was on tracing the history of the idea work and development of the Alpha Pro pump. Additional to the interviews internal written documentation (only very little still exist), EU and industry reports, public newspaper articles and several websites has been used to gather information about the case.

2.2 The case company

With an annual production of more than 16 million pump units, Grundfos is the world's leading pump manufacturer. In 2008, the Grundfos group employed almost 18,000 employees and had a turnover of € 2.5 billion and a profit before tax of € 128 million. However, as well as Grundfos is a global enterprise it is also a Danish family company with its history, culture and traditions. It was founded in 1945 and is today owned by a family foundation, which was established as a self-governing institution in 1975.

2.3 Research questions

The aim of this paper is to examine how idea work is going on in the early phases of product development through an in-depth case study. It focuses on the complex interaction between many different institutions, organizational functions and actors with differing perspectives on design and innovation. We have posed the following questions to guide our analysis: What qualifies an idea? How do ideas get going and gain momentum in an organization? In addition, what kinds of actors are involved in the idea work? Through the answers to these questions, we will find indications for how idea work can be improved and stimulated in an organizational setting.

3 THREE DIFFERENT PERSPECTIVES ON IDEA WORK

Ideas have been the subject of great attention in many research fields. In this paper a part of the existing literature on ideas has been reviewed, first to identify what understandings have already been proposed and second to identify where we can contribute. Overall, we have identified (what we have divided into) three different perspectives on ideas, which can be considered relevant with respect to product development and innovation.

In the literature, work with ideas is commonly referred to as ideation, a blend of two words, idea and generation. In this paper we have chosen to call the work with ideas; 'idea work' or 'work with ideas' instead of 'ideation', because we believe the term ideation to be too narrow. The work with ideas is more than just the task of generating them. To recognize ideas, support them and develop them is just as important and therefore we need a term, which acknowledges that.

In the following, we will present the three different perspectives on idea work, identified in literature: Aspects of creativity research, Sources of ideas and Process models.

3.1 Perspective 1: Aspects of creativity research

The search for literature on ideas quickly leads to the field of creativity research, because forming ideas is widely regarded as being synonymous with being creative. According to Vernon [6] creativity means: *"A person's capacity to produce new or original ideas, insights, restructurings, inventions, or artistic objects, which are accepted by experts as being of scientific, aesthetic, social, or technological value"*. Psychologists have done most creativity research and it is therefore in many ways interlinked with psychological research. Ryhammer & Brolin [7] have written a review article about creativity and have identified four main lines of development: 1) "The personality approach", here the purpose is to study the characteristics of the creative person. 2) "The cognitive approach", here creativity is studied as an aspect of intelligence, as a mainly unconscious process, as problem solving capacity, and as an associative process. 3) "Stimulation of creativity", the idea that creativity can and should be influenced. In this context, creativity often equates to a person's ability to generate ideas of originality and use of different problem solving abilities. 4) "The social-psychological & systems thinking approach" views social/environmental factors as having greater importance than earlier on, which means that creativity is regarded as existing within the larger system of social networks, problem domains and field of activity. Based upon Ryhammer & Brolin's [7] review, it is possible to identify two main angles on idea work. The first angle views idea work mainly as an individual activity in terms of what goes on in the mind of the creative person. The second angle also takes social/environmental factors and surroundings into account and perceives idea work more as being a social process.

If we want to get an in-depth understanding of how idea work is going on in regards to product development in an organizational setting, it is not enough only to give attention to the individual mind. Product development involves different actors from different organizational settings, so to understand how idea work is going on it is also very important to give attention to the interaction between the different actors involved.

Idea generation techniques

The third line of creativity research claims that creativity can be stimulated [7]. This means that a person's ability to generate ideas and problem solving powers can be influenced, and thus a variety of idea generation techniques and problem solving methods have been developed over the past six decades. Geschka [8] has identified about 50 different idea generation techniques. These techniques, "*can be classified from two different viewpoints: First according to the working principle used: Ideas can be generated by stimulating the intuition of the persons involved or by systematically attacking the problem. Second according to the idea triggering principle: Ideas result from a variation and further development of other ideas and concepts or from the confrontation with impressions unconnected with the problem in hand*". Brainstorming (in all its different designs) first proposed by Osborn [9], Stimulation Word Analysis, and Picture Confrontation are all examples of intuitive methods. Morphological Analysis developed by Zwicky [10] and TRIZ (Theory of Inventive Problem Solving) developed by Altshuller [11], are examples of structured idea generating techniques.

As mentioned in the introduction to this section there is much more to idea work than just generating ideas. Thus, when we want to understand how idea work is going on in an organizational setting, it is not sufficient to study applications of idea generation techniques. Furthermore, early innovation activities are often characterized by great uncertainty, which means it is rare that user needs, business opportunities, and product concepts etc. are very clear. Geschka [9] states that for a successful application of an idea generation technique an exact formulation of the problem is needed. However, if there is great uncertainty in the early innovation activities it is questionable if such an exact problem formulation can be produced at all.

3.2 Perspective 2: Sources of ideas

Ideas arrive from a variety of sources often depending on the management philosophy, the history, capabilities, and resources in a company [12]. A substantial part of the literature regarding ideas in relation to product development and innovation is concerned with the sources of ideas for new or improved products. The main part of this literature is based on empirical studies executed in different industries and business scales [12], [13], [14], [15]. In the literature, the sources of ideas fall into two categories, internal sources and external sources. With little variation in the different empirical studies, internal sources mainly comprise different organizational functions such as Sales & Marketing, R&D,

Management and Operations, whereas external sources mainly comprise: Customers/users, suppliers, competitors, government regulations and universities.
Like the 'Idea generation techniques', 'Sources of ideas' primarily also only relates to one aspect of the work with ideas i.e. the idea generation process. Of course, being aware of all the sources of ideas can make organizations more alert to where to search for ideas, but when we want a better understanding of idea work, the sources of ideas are not enough. It only indicates where ideas are generated, not what facilitates ideas to be conceived and developed. As White & Yazdani [16] state: *"the research on the sources of ideas is not comprehensive in analyzing the phenomenon of idea generation. It focuses on categorizing social groups but fails to show many of the processes by which the idea was conceived"*.

3.3 Perspective 3: Process models

The literature concerning innovation and product development models (models that propose a certain relation between development activities) also encompasses different aspects of ideas and idea work. Many of these models begin with a stage where finding or discovering the idea, user need or business opportunity is essential. As Cooper [17] states: *"Ideas are the feedstock or trigger to the new product process, and they make or break the process"*. His Stage-Gate model opens with the 'discovery' stage including technical research, uncovering of unarticulated needs, and identification of opportunities. Ulrich & Eppinger [18] have also proposed a model for the development process but they are not as explicit about the term idea as Cooper is. Instead, they use the terms planning and concept development in reference to the early phases where user needs, business opportunities and technological possibilities are explored. Ulrich & Eppinger refer to these early stages as the front-end process. Koen et al. [2] criticize the conventional new product development process models for only representing the front-end as one single ideation step. Therefore they have proposed the New Concept Development model which is illustrated as a wheel where five iterative activities (opportunity identification, opportunity analysis, idea generation and enrichment, idea selection and concept definition) is placed around a driving "engine" (leadership, culture and business strategy) which forms the foundation for the five activities.
With the process models, we get a step closer to getting an understanding of idea work, because they take more than just the process of generating the idea into account, they also link it to some of the following activities (developing ideas etc.) which is just as important. However, one critique remains though: The process models are prescriptions for how to carry through the product development process but they do not tell us about how idea work actually is going on in an organizational setting. If we truly want to understand idea work, we need look inside and include the actors who engage in the idea work and analyze their interaction.

3.4 Towards a new perspective

We have studied state-of-the-art literature on ideas and idea work, and summed it up in three perspectives just presented above. Each of these perspectives explain only fragments of what we call idea work, however to gain a more comprehensive understanding, focus in this paper will be broadened to include both interactions between key actors and how the idea is formed. Here the STS approach (Science and Technology Studies) [19], [20], [21], and the Political Process approach [22], [23], can be at help. In the STS approach, two theories will be used in our analysis; SCOT (Social Construction of Technology) [19] and ANT (Actor-Network-Theory) [20], [21]. Central in SCOT is that technology cannot be detached from the social aspects when analyzed. This means that the social; actors' interaction and negotiation, shape the technology and likewise. In the shaping of technology, many different social groups are involved and they attribute different meaning to the technology over time as well as they shape it differently. This means that it is essential to consider the actors when analyzing idea work because they associate different meaning to ideas over time and shape them differently depending on their different background, education, social relations etc.
In an Actor-Network perspective, humans, society, nature, technology, facts, artefacts etc. are perceived as networks consisting of connections between heterogeneous actors, human as non-human. An actor or object is nothing in it self, but only through its relation to other actors or objects in a network. A central concept in ANT is the process of translation. Translation is a process by which an actor gains strength by associating with other actors, trying to establish or stabilize a network. With

regard to idea work the work with ideas can be understood as network building processes where actors enrol other actors in the network and the work with ideas.
In the Political Process approach an organization is viewed as a coalition of interests and as loosely coupled systems working under a common organizational framework. Actors are depending on their reading of the political situation in management and among employees/colleagues. In relation to idea work this means that actors will have to manoeuvre and negotiate their ideas to ensure support, resources and autonomy. In the following chapter, we will present our case and afterwards we will discuss it from an STS and Political Process approach perspective.

4 CASE STUDY: THE ALPHA PRO PUMP

In March 2005, Grundfos proudly presented the first energy labeled circulation pump ever on the ISH fair in Frankfurt (Internationale Fachmesse für Sanitär und Heizung). The development of the Alpha Pro pump had only taken 15 months, but before Grundfos reached a clear concept for the pump and could start the development project, several years of idea work had been going on both inside and outside the organization. The Alpha Pro pump is a small circulation pump, installed to circulate hot or cold water in heating systems, utility water systems and cooling- and air condition systems in one and two family houses. Grundfos have made circulation pumps since 1959.

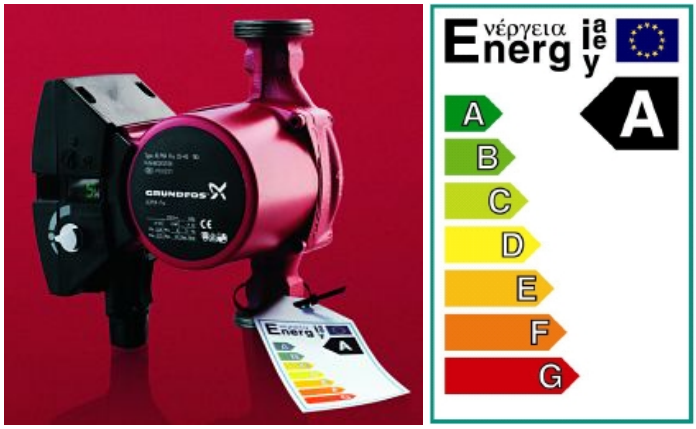

Figure 1. The Alpha Pro pump and the energy label

What was 'new to the world' and special about the Alpha Pro pump, was its low energy consumption and the fact that it was the first energy labeled circulator ever on the market. The Alpha Pro pump was labeled with an energy label in category "A", where "A" is the best and "G" is the worst. In March 2005 the concept of energy labeling was primarily known from other types of products like light bulbs and white goods. Figure 1 shows a picture of the Alpha Pro Pump and the energy label.

4.1 The case story

In the following, we will unfold the story about years of complex idea work, which lead not only to the development of a low energy consumption pump, but also facilitated a voluntarily energy labeling standard for circulation pumps in Europe.

The technological development

In the spring of 1985, 20 years before the Alpha Pro pump was presented at the ISH fair, an article from Fortune International [24] about smart power chips was passed around at Grundfos. *"…we were hungry for doing something that could, you can say, do the products of Grundfos trendsetting as you called it today. You didn't say that then, but anyway to do something special"*. (Electronic Engineer at Grundfos, (EE1)). The article stated that a new kind of semiconductor chip held the promise of being able to reduce energy consumption dramatically, by making AC motors 40% more efficient. The smart-power chip would allow AC motors to adjust the speed of the motor electronically, and hence the amount of electricity needed. *"…we went crazy. It was exactly what we had been waiting for"*. (EE1). The new technology would allow the frequency converter to be integrated with the motor and the pump, making the pump run twice as fast and reduces material costs. These arguments convinced the management to take interest in this new technology and formed a team, to investigate it further. In late 1986, Grundfos had established a team of 12 researchers. The team consisted of people mainly

recruited from outside Grundfos due to the lack of the required in-house competencies in developing the new technology. The team used all their time working on integrating the frequency converter. The plan was to have the technology ready after three years, but many challenges appeared. *"We had to learn to fit them on, we had to learn how to solder and weld with gold threads, copper treads and we needed clean room facilities"… "It showed a lot of difficulties and the modules burned off in a row and it cost a Volkswagen every time. But at some point in time we succeeded"*. (EE1). The number of people involved in the project grew. In the meantime, Grundfos had also established an electronics factory. In 1991, the first products were launched, containing the newly integrated technology.
After the success with integrating power and controlling electronics in the pump, the Motor Department was looking for a new technology project. They wanted to find the "*future motor of Grundfos" (EE1)* and conducted a series of pre studies with different motor types, with help from different specialists and universities. At some point, it appeared that a permanent magnet motor could be a promising new motor technology and the decision was made to focus on achieving better efficiency in motors using the new technology. The efficiency improvement was achieved, since energy consumption proved to be lower than in the existing standard motor technologies. They called this technology project, The Energy Project and it was launched in 1993-94.

A new environmental understanding develops

Overlapping with the Energy Project, Grundfos co-developed a Life Cycle Assessments (LCA) tool called UMIP (Development of Environmental Industry Products), between 1991 and 1994. The LCA tool was developed with four other Danish companies, the Technical University of Denmark and The Environmental Government Agency. A Life Cycle Assessment is an assessment of a product's environmental impacts throughout its lifetime. With the UMIP project, Grundfos realized that disposal was not the only thing to be concerned about with respect to the environment. Using the LCA tool showed that a circulator's greatest impact on environment (98 % of the lifetime energy consumption) was due to is operating phase.

An idea is born: banning low efficient circulators

As a result of applying new technologies and conducting the UMIP project, Grundfos turned their attention on energy efficient pumps. Then a chance encounter caused Grundfos' CEO to meet a Danish EU parliamentarian in 1998, who told him about the recent implemented Ballast Directive in the EU. This directive banned low efficient starting switches in strip lights. According to the Ballast Directive and its energy classification, starting switches in energy category "H" and "G" was perceived as being low efficient, so manufactures of starting switches were required to out phase these products over a period. The Grundfos CEO spotted the potential to have low efficient circulation pumps banned as well. The CEO asked his Research Manager to find out what was required to do so. At first, his Research Manager did not exactly know what to do. Banning low efficient circulators was a political issue, not an engineering or technology based problem, which he and his team usually worked with. *"We are technicians and not politicians"* (Research Manager at Grundfos (RM1)). At another occasion, the Research Manager joined an independent working group composed of politicians and experts, at the Danish Board of Technology. Among others, a former Danish politician was invited. *"And then I thought: (…) that is a politician, he must know what to do'. So, that was what I thought… it was the first and only politician I've ever met and then I asked him: 'Can you help us with something?'"* (RM1). The Politician agreed to work as a consultant for Grundfos and help them, both to articulate the political message and to find the right persons and politicians to lobby. *"It was very much about thinking politics and formulating the goal in a way a politician could understand it"*. (RM1). At the same time, the Research Manager also involved the Senior Engineer who had previously worked with the development of the UMIP program and as a Grundfos representative in the Europump LCC working group. He was assigned to contact relevant politicians and run the lobbyism work in Denmark and the EU.

Mobilizing support to the idea in the EU

In 1998, many different activities began. First, the Senior Engineer contacted the Danish EU parliamentarian and some other Danish politicians. To begin with, Grundfos' political message was to make a legislation, which banned low efficient circulators. The Danish politicians predominately received the message positive, but legislation could not only be a Danish matter, but should be an EU

matter. This was far from simple and along the way Grundfos' political message changed, so instead of wishing low efficient circulators banned, they wished to establish an energy-labeling scheme. This faced various difficulties such as different requirements for heating in northern and southern Europe, and varying levels of technological development between the east and the west. Another problem at that time was that circulators were considered components in heating systems and not products on their own, and heating systems were a subject to national legislation and therefore it was not possible to legislate about it on EU level. Therefore, the next idea was to change the status of circulators from being components in heating systems to products and furthermore to make the EU interested in an energy-labeling scheme. The Senior Engineer participated in several conferences and networked to get the right contacts and to make people interested in Grundfos' course. At one point, the Senior Engineer concluded that one of the important actors was the Administrator with the European Commission, DG Energy and Transport, who was in charge of EU regulatory and voluntary programs for the rational use of energy in consumer equipment, buildings and industry. The first time the Senior Engineer gets a chance to present Grundfos' message, the Administrator did not believe Grundfos' calculations that there were 80 million circulators in EU. Nevertheless, a few days after the Senior Engineer had been rejected he got a call from the Administrator who had just investigated his own house and found four circulators. The Senior Engineer got a new chance to present for the committee.

Establishing the energy-labeling scheme

In 1998, Grundfos initiated the SAVE-II study with financial support from the EU and in collaboration with Oxford University and a consulting firm. This work was finished in 2001. Calculations showed that circulators are responsible for as much as 15 % of the electricity consumption in European households. At that time, the average energy efficiency of installed circulators corresponded to energy category "D" or "E". If all circulators were changed to "A"-labeled circulators, the electrical energy saving potential in EU's 25 countries would be 44 TWh per year, with a reduction of 17.6 million tons CO_2 per year [25]. The Danish EU parliamentarian suggested that an energy-labeling agreement had to be voluntary and that the first step should be to involve the industry association Europump (and thereby competitors). From then on, it was not only a Grundfos matter, but also a Europump matter. In 2001, a working group under Europump was established with representatives from Grundfos and four other European pump manufactures. The purpose was to develop a classification scheme for circulators, with respect to energy consumption. An energy efficiency index was calculated according to an annual energy profile. And a proposal for an EU energy label was designed. The "A" to "G" label for household lamps formed the basis for the design. The index for the label was calibrated so that most of the "non-controlled" circulators on the market at that time would get "D" or "E" label. The most energy efficient circulators on the market would get an "A" label, and the rest of the circulators would fall into other categories [26]. The classification project ended in February 2003. Figure 2 shows the timeline for the different activities in the Alpha Pro idea work. The year given in the timeline is the beginning year for the activity.

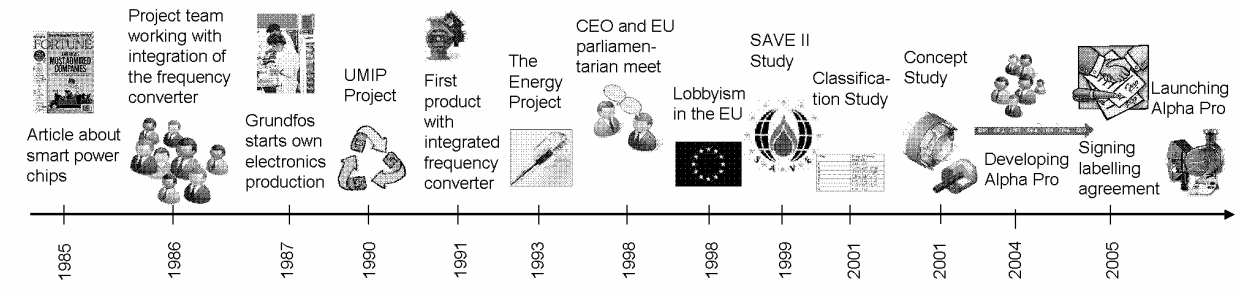

Figure 2: Timeline for different activities in the Alpha Pro idea work.

Developing and presenting the Alpha Pro circulator

In the meantime, Grundfos had started a concept study project, which aimed to refine some of the technologies to be used in an energy efficient circulator. In 2004, it was decided to develop a new energy efficient circulator, which could be labeled in energy category "A". The development project only took 15 months (normally they take approximately 30 months). Grundfos was aiming at having the product ready for the ISH fair in the spring of 2005. The scheme for a voluntarily label agreement

had been set, but no official approval of it had taken place. Since the classification project ended, not much had been done in the Europump working group. However, when Grundfos realized that it was possible to get a high efficiency circulator ready for the ISH fair, they started to push for the energy label agreement to become official. The Europump working group agreed that the energy label should be presented at the ISH fair in Frankfurt in 2005. The agreement was officially signed the day before the fair started. Grundfos was the only pump manufacturer, which had an "A" labeled circulator ready for the fair.

5 DISCUSSION

In the Alpha Pro case, it was not until very late in the innovation process that the idea or concept for the "A" labeled circulator was clear. Until that point, the idea or its different elements had developed in different contexts, both inside and outside of Grundfos, by actors with differing perspectives on what constitutes a "qualified" idea and different agendas and motivations for working on and promoting that particular idea or sets of ideas. In this section, based on examples from our case, we will offer an understanding of idea work where the actors involved in idea work and their interaction are our focal point. Based on our case we will point out four central findings that characterize early idea work: 1) Early idea work is a complex process and interlinked with many other activities both inside and outside the organization. 2) Ideas evolve, combine and change over time. 3) Idea work involves a wide range of actors. 4) Carrying ideas through demands continuous mobilization of support among a range of actors.

5.1 Early idea work is a complex process and interlinked with many other activities both inside and outside the organization

In most innovation and product development models, the initial phase comprises the early work with ideas, sometimes illustrated by a light bulb. Different models vary concerning how detailed the development of ideas are described. In some models, it is just taken for granted that an idea already exists. Furthermore, often the different stages; from idea generation to product launch, are illustrated with the same size of boxes in the model, not taking into account that the different activities can have different resource and time consumption. If we compare the process of working with ideas in the Alpha Pro case with the generic innovation and product development models, the initial work with ideas took significantly more time than the rest of the development process. See figure 3.

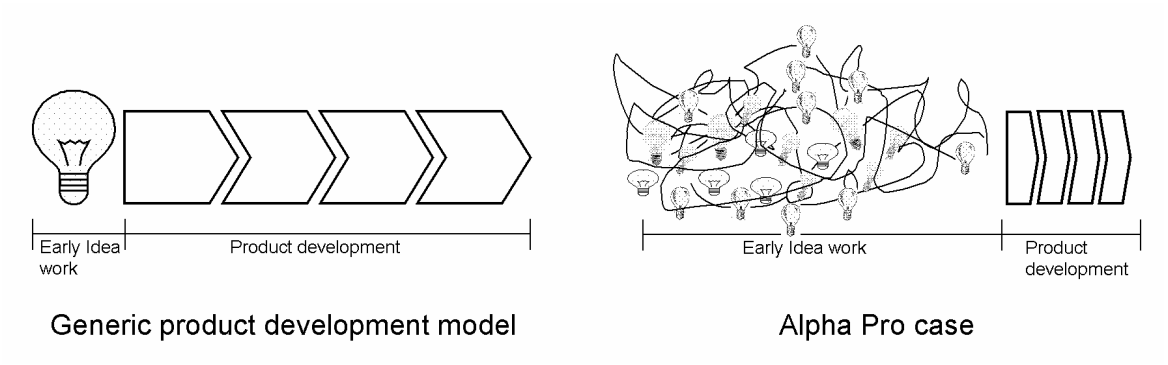

Figure 3. Comparison of early idea work in a generic product development model and in the Alpha Pro case

Of course, one could simply ask whether, it is relevant to perceive all the different Alpha Pro front-end activities as only one innovation process. And this is our first observation: all the different front-end activities like the smart power-chip project, the Energy project and the UMIP project etc. could also be seen as projects or processes in themselves. Nevertheless, along the way (viewed retrospectively) they have become a part of the front-end of the Alpha Pro innovation process, because the Alpha Pro pump is based on all these different insights and technologies. Therefore, idea work comprises much more than just to generate an idea. It is in many ways interlinked with many other activities both inside and outside the organization.

Hansen & Andreasen [27] suggests that a product idea can be described according to eight different dimensions; strategy, technology, product, task, goal specification, user/ customer, need and business.

The product idea may be a partial idea that successively develops into an idea with completeness and enough merit. This means that an idea not necessarily from the beginning encompasses all the eight dimensions, but only some of them. A product idea is perceived as complete when clarification in respect to all the eight different dimensions has been reached. Referring to Hansen & Andreasen, it is obvious, that most of the ideas presented in the Alpha Pro case are incomplete and refers to different partial aspects of what is expected to constitute a product. In Figure 4, the process of turning all the partial ideas into the Alpha Pro pump is illustrated. However, how can we understand the process of turning all these 'partialities' into a working and successful product? What is at stake here? Here we will turn to the interactive perspective on idea work. This perspective comes from the sociology of technology [19], [20], which offers several concepts and perspectives aimed at analyzing the interaction between the content of ideas and actors.

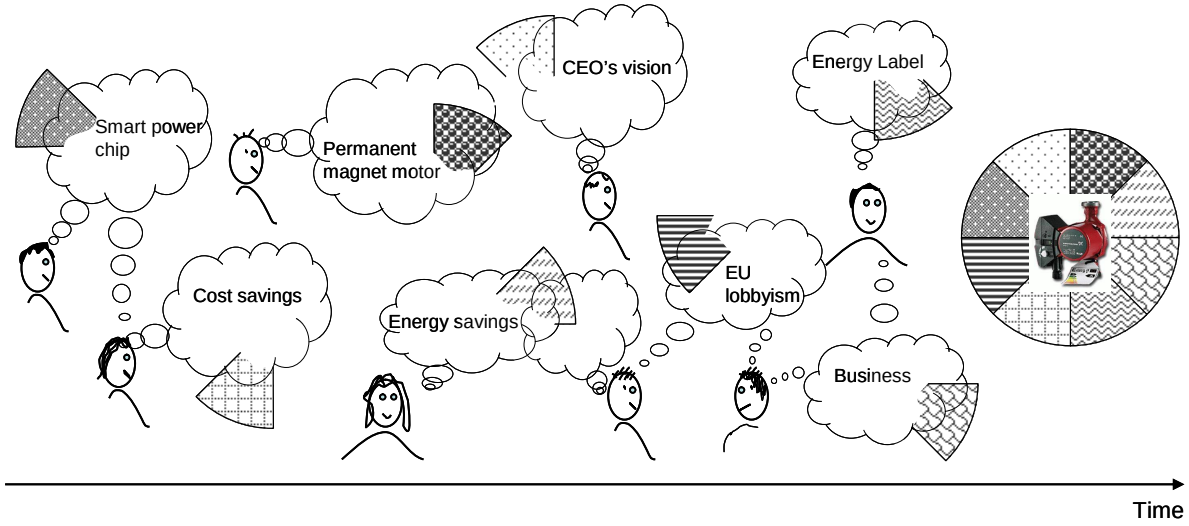

Figure 4. The process of turning all the partial ideas into a working and successful product

5.2 Ideas evolve, combine and change over time

The Social Construction of Technology [19] focuses on the changing associations of meaning related to ideas and artifacts over time. The point is here, that changes in the perception of what constitutes a product idea may unfold over time, depending on changing attentions from the unfolding array of actors engaged in the process. The changing perspectives on what constitutes a qualified idea can be traced together with the defining actors involved.

In our case, a group of researchers at Grundfos was eager to find an idea, which could make the products of Grundfos trendsetting in the middle of the 1980'ties. The inspiration to the idea was found in an article about smart-power chips. The statement: *"…we went crazy. It was exactly what we had been waiting for."*, points towards what these researchers perceive as a qualified idea. For these researchers, to make Grundfos' products trendsetting means to improve the products with respect to efficiency and the smart-power chips held the promise of that i.e. it could be possible to make the pump run twice as fast. But why do these researchers perceive the chip solution as a qualified idea? There are different analytical concepts (Technological Frames [19], Actor Worlds [20]), that offer explanations. People use different competences and frames of reference (interpretive schemes) to ideas because of their education, background experience, the activities and things that occupy their attention and social relations. In our case, this means that the researchers, many of them with a background as (electronic) engineers look for certain kinds of ideas (problems and solutions). In their view, the idea is qualified through the relation between the functionality of the power chip and expected increase in pump efficiency. Other qualifications apply to the other actor groups represented in the case i.e. the environmental people, politicians, interest groups etc. they all have different frames of reference, which make them able to recognize the value in certain perspectives.

In a later technology project in the beginning of the 1990'ties in the Motor Department, efficiency was again in focus when they wanted to find the *"future motor of Grundfos"* and initiated some pre studies on different motor technologies. However, something had changed since the last technology project. This time the perception of efficiency is different, where efficiency earlier on was a question of the

speed of the pump, now efficiency is energy efficiency. But what have changed in the meantime? One important change is the evolvement of a new mindset with respect to environmental awareness in Grundfos in the beginning of the 1990'ties. With the UMIP project, it became evident that a circulator's operating phase had the greatest impact on the environment. So from having understood environmental matters as mostly concerning disposal especially with respect to manufacturing processes (handling of chemicals, waste etc), the whole product life cycle is taken into account. The UMIP project sets energy savings on the agenda in Grundfos. This influences how the researchers perceive efficiency and what constitutes a qualified idea for them. Instead of talking about the pump's output i.e. capacity, they now talk about input i.e. energy consumption. The Energy project is a manifestation of this altered focus.

5.3 Idea work involves a wide range of actors

It is evident throughout the case that ideas develop through interaction between different actors. The idea about banning low effiecient circulators emerged after the meeting between Grundfos' CEO and the Danish EU parliamentarian. What had happened if those two have not met?

In an actor-network (ANT) perspective [22], the work with ideas and development of products can be understood as network building processes. Creation of networks and changes in relations between actors in networks are seen as the outcome of a translation process [22].

An important aspect of the interaction between the actors engaged in the idea work is their negotiation of understandings and frames of reference. Even though the interaction between the environmental people and the Motor Department is not so clear described in our case deschription, the UMIP results are very central for the Motor Department's new understanding of efficiency, as being a question of energy savings for the user. In this perspective, the UMIP project and the Energy project (including both humans and non-humans) can be understood as an actor-network. There has been a translation of the frame of reference (energy savings/consumption) of the participants in the UMIP project, to the researchers in the Motor Department into the Energy project.

5.4 Carrying ideas through demands continuous mobilization of support among a range of actors

When we want to understand how ideas get going and gain momentum in an organization, we can turn to the political process approach [23], [24]. This perspective can help us identifying the driving actors; how they focus on legitimate arguments in the organization and how they create new agendas, aiming at providing support from unexpected allies, in this case: external actors, the UMIP project, politicians, the EU, industry associations, and competitors. Successful idea work demands continuous mobilization of support among a range of actors. If the involved actors do not succeed in mobilizing the support to their ideas, the ideas face the risk of leading to nothing. In the Alpha Pro case, the support is mobilized across different actor groups repeatedly both inside and outside of Grundfos. In our case, the political processes are evident in the mobilization of support to the energy-labeling scheme. Not only in the political system (the EU) but also internally within Grundfos and with respect to the competitors in Europump. Here legitimate arguments are crucial. One example is when the Senior Engineer had the chance to present Grundfos' idea for the Administrator with the European Commission, DG Energy and Transport. Here the potential energy savings (CO_2 reduction) articulated as the number of households in the EU with one or more circulators is the compelling argument, even though the Administrator does not buy into it in the first round. Generally, energy savings (potential CO_2 reduction) are the focal point in many of the negotiations about the rationale for developing and implementing the energy-labeling scheme. One example of building momentum is the initiation of the SAVE-II study, not only due to the output of the project but especially because of the financial support from EU and the SAVE-II name on the report. This testified the EU engagement and commitment in the course. The SAVE-II report is used as a means in the further enrollment of actors i.e. Europump and the competitors.

6 CONCLUSION

In this paper, we have offered a new perspective on how to understand idea work, which involves actors and their interaction. As the Alpha Pro case shows, the innovation journey is a complex process of interaction and it would be unfair to all the many actors involved only to recognize the idea or product success as the achievement of one person. When we look at the development story of the

Alpha Pro pump, we can identify many different ideas that are at stake, originating from a variety of different actors and interest groups who negotiate their different frames of understanding and perspectives on what qualifies an idea. The case illustrates that ideas referring to only one dimension or one perspective of relevance may gain some 'currency' within a limited group of actors. This is however not enough to constitute a complete product idea in an industrial company. Ideas get going and gain momentum in an organization through network building and political processes. Legitimate arguments and the continued collection of contributions across a diversity of perspectives and domains are crucial in the negotiation of support to an idea. To improve and stimulate idea work it should be recognized that the involved actors enter the process from a diversity of perspectives on what constitutes a qualified idea according to their education, background experience and the activities that occupy their attention. Furthermore, awareness about the idea transformation processes and political processes whereby ideas gain momentum are key in improving and stimulating idea work.
In this paper, we have examined the development of a completed product. In the further research on idea work focus could be on what instruments companies deliberately stage to facilitate the early work with ideas. And from an academic viewpoint it could be discussed whether at all it makes sense to talk about 'early' idea work instead of 'continuous' idea work which our case indicates is going on.

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