Knowledge sharing and methods of communication

in high technology firms.

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Abstract

The article focuses on knowledge management, -sharing and -communication in a technical engineering environment. The case is opening a number of fundamental problems of knowledge sharing and knowledge management within a highly technical research field, and opens up discussion of embedded paradoxes of management and knowledge sharing and questioning management theory and the dilemmas of creating an efficient division of labour. Communication by a specific kind of knowledge workers, engineers working in R&D with a high focus on technological research, provides an extreme case of knowledge management and conditions for managing under many dilemmas of economic management rules such as the profit centres and need for experts in the direct customer contact as well. The issues of power become split into the knowledge power as an expert, and the manager's power as a department or a project manager.

Keywords:

Knowledge sharing, project management, communication, knowledge workers, networking

1. Introduction

The article focuses on knowledge management, -sharing and -communication in a technical engineering environment. The case is an R&D engineering company working in the energy sector. The firm is working with a multitude of technologies and technology management in energy, marine sector, off-shore installations and new materials, and the employees are nearly all engineers.

The firm ENGINEER was established as a parastatal organisation with public functions of quality control, but is moving in the direction of being much more like a private firm, and is buying up a number of firms to supplement their portfolio. The single units are profit centres, where they have to generate commercial contracts (Buono & Bowditch 1989). From being a firm mainly based on research and public contracts, they are all involved in generating new assignments and projects at many levels of the organisation. They may be using the resources from other units to participate in the solutions. The basic idea is that they can dispose of resources from other departments, and are involved in clearing work and assignments between departments on an hourly basis. The applications of resources from other units or departments need a good knowledge sharing and insight in their work and methods as if they are part of the same community of practice. A number of large projects work across boundaries, but a large number of projects are still small and one-man projects.

There are several processes of change in the organisation: 1) by acquisitions of new firms to function as new departments, and 2) from research in a broader sense to more and more emphasis on entrepreneurship and individual project generation, which is changing the roles at all levels, from department managers to project managers and to the individual engineers. The management of the single profit centres and collaborating across departments is another challenge in the complex management of high tech. On the basis of a number of observations; questions are raised on how to understand different processes and barriers for knowledge sharing and for management and leadership in such knowledge intensive firms.

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2. Knowledge and experts.

Skills and specific needed competence in many knowledge firms are hard to define in terms of educational competence, as with consultancy and IT-programmers, experienced-based learning play an important role. The autonomy of knowledge workers makes it difficult for managers to define what is relevant, interesting and necessary, and it is hard to control and judge for people who are outside the narrow specialisation or community of practice. The skills may be quite difficult to evaluate, and if work is of an intellectual nature, the knowledge intensive firms could be seen as systems of persuasion (Alvesson 2001), where knowledge workers have to create legitimacy on their skills and competence both through their practice of solving tasks, and by persuasion of other related experts. The role of persuasion is important as the signals to experts within the same field are easy to communicate, what is the difference that makes a difference to interpret what is expertise. Complementary fields of expertise could be more difficult to interpret as the signs are difficult to evaluate. The differences in the either customer based or technical organisation do not make the interpretation across a loosely coupled system easy. The perspective here is focussing the knowledge sharing platforms of communication or is close to the perception of creating a system of organisational knowledge, defined as: "The capability of members of an organization to draw distinctions in process of carrying out their work by enacting sets of generalizations" (Tsoukas & Vladimirou 2001, p.973). The effort of generalizations is tied to the competence to handle problems with a specific field of knowledge.

In such an organisation the complexity is created by the need to create organisational knowledge within the departments, and possibilities to make bridges to share knowledge across complementary knowledge and geographical separated units.

The development of new materials and a high level of quality control in the energy sector imply as an example that the former section on welding control has grown from the testing to a much wider understanding of quality control and testing forms both in the laboratory and in the enterprises. Recruitment of young people for these complex processes is nearly impossible, as expertise from science, different material-technologies, and from experience have to be mobilised. They have to train their own experts, which take a long time, and it is difficult to establish. The difficulty is both on the part of the expert and on the young engineer, who has to accept to be in a junior trainee position for a pretty long time.

Attempts at knowledge sharing on highly technical issues, such as the use of new materials or new methods in quality testing of tubes for energy and chemical production, has been heavily dependent on coaching. Given that complex range of knowledge necessary for such issues was

largely based on experience and generally not well covered in university education, the success of knowledge sharing was influenced by the mutual communication and respect between the senior expert and the younger staff. In the department, for example, 'true' knowledge sharing and understanding only took place when the experienced coach and his younger staff created a supportive learning space and ability to collaborate on the project. The knowledge sharing system is vulnerable in an organization where the experts are demanded for both the complex solutions, but are also the resource for training other staff.

The issue of expertise is a special challenge in R&D sections. The specialists or experts "see" what could be defined as problems and what as symptoms. The experts "catch the concepts and diagnosis of the problems, on the basis of the first dialogues with the customer." The specialists have a very broad knowledge base, but also very deep, as to "see through a problem". The expertise is observable for the newly educated. They thought they were up-to-date and could manage, but realised they have to learn a lot, and cannot grasp the diagnosis on the basis of "intuition".

The "seeing" is a concept very close to one form of tacit knowledge of experts as described by Gourlay (2002) Collins (2001), and a "meaning" created in new fragments of information due to a deep insight. The problem is to communicate the meaning to young staff and to coach on this process as it leans on a very long knowledge experience, where experience and insight are used to recognise patterns for the creation of meaning.

Although knowledge transfer, as a concept, was attempted in many of these departments, the underlying processes of communication, such as creation of meaning and learning were very complex. In fact, the actual transfer of knowledge might be just as complex as the content of the personal knowledge held by the senior experts. It is always much easier to identify "the expert," the individual who can "see through" problems, than to specify the demanded skills to get this capacity.

The dilemma of customer relations is not only a problem for the technical experts, who do not want to do 'sales', but also a problem for the sales people, who have to be able to identify problems, and communicate with the technical staff and to be trained as sales personnel. It takes at least a year to educate a sales person to a knowledge field and how to communicate to customers, even if they all come from engineering and know the core issues of the firm. But they have to create legitimacy with both the technical engineers at the R&D in their own firm, and with the engineers in the customer firm, who often would prefer the "real expert". If sales people are too much marketing and

sales people, they may reach the right people, but will have problems of being one of their kind as technical engineers within their community of practice.

Sales and marketing are very important in a firm with more than 60 % of the turnover outside Denmark, and thus a very geographically spread and culturally distributed knowledge management. One of the barriers they have to work with is between the R&D and sales. Specialisation is important, but the coordination and mutual perspectives have to overcome the barriers, and it appears necessary to create a mutual kind of legitimacy, which is not evident.

Technical experts are demanded to be part of teams both at the level of a project solution, coaching junior staff and sales. In many ways it is different levels of expertise, but the main paradox is that a classical division of labour is extremely difficult. They describe the staff as "scientifically and theoretically strong, and with a practice". When idea generation and project development is in the contact with customers, the innovative skill has to be in contact with customers, but at the same time use time to develop the scientific knowledge. The most appreciated members of staff most easily create projects for themselves, but are also chased by other project managers to be involved with their expertise.

3. Organising

While a few large projects were undertaken by teams, the majority of projects were very small or just one-person projects, a type of technically-advanced consultancy, which moved the focus from research to commercial value. Responsibility for generating projects and invoiced hours was highly decentralized, to the point where it was seen as a responsibility for everyone. This meant, however, that the focus was placed on individual efforts and personal projects to fulfill profit demands rather than sharing knowledge and disseminating new ideas. Department managers are responsible for the budget and for the invoiced hours as well.

The organisation is a merger, after a number of subsidiaries are bought. Organising in a merger is complex and demands a specific strategy to overcome the barriers between the original firms or divisions. In one of the mergers, they tried to work on these inter-organisational relations by making focus groups with 2-3 from each of the firms around themes like services, markets, methods, products and competences. Only 3 of the many groups survived the first short period, the purpose was to break down some of the barriers and create personal knowledge of the competence in other departments. It functioned as a step in the direction of being able to mobilise

resources across departments, as an awareness of the competence that was available at the time of contracting customers. This is a deliberate strategy of bridging and networking to create personal knowledge in the form appraised by the engineers. Networking strategies are only an open window a short time, and does not appear to be a long time strategic perspective.

The effort of building up a matrix-organisation is not easy, as at the same time silos of profit centres at the personal as well as department level, profits have to be balanced. The complexity of handling many different strategies to mobilise both projects and resources become an entrepreneurial challenge for many researchers, and many more R&D employees are project managers to generate projects.

In a Scandinavian unit outside Denmark, they have generated a new market segment, where the technology of the mother company can be used, but with local project managers and contact persons. At the same time a process-technology of the daughter company could be used in other sectors and markets. The resources and skills in the daughter company are described as "a goldmine of good people", as they seem to fit very well into the profile in the organisation with complementary skills. The problem is to apply the resources and get the knowledge into play at an early stage of projects. The relational knowledge takes time to develop. It challenges not only managers to get access to inter-organisational resources and still develop their own profit centres. It is a dilemma in the whole organisation. The strategic portfolio at the top-management level is much more difficult to activate across communities of practice (Wenger 1998, Buono & Bowditch 1989), where the research and method insight is not as easy to communicate, as it has to be an insight already in the contact with the customers on defining projects.

Managing an organisation of researchers is like anarchy based project management of multidimensional artists in a very loosely organising perspective (Orton & Weick 1990, Brunsson 2002). Some of the complex dimensions are tied to customer relations, and the experts sell their ability to understand customer's problems better than the customers themselves. The customer dialogue is essential for grasping the main problems and to persuade the customer of the value of the expertise of the R&D firm. The "old experts", who can see through problems, are the best to do this. However they do not like to follow up and keep communication with the customer, as this is perceived as "sales activities" and below their status as experts.

In terms of knowledge sharing and expertise, this is a fundamental problem found with engineers and in IT. The real experts have to be present to understand the complexity and potential of an

R&D project with a customer, where innovation and R&D are developed with customers. But the relationship itself creates a barrier for the innovative experts. The have the best persuasive skills as experts, but the persuasion is less important for them, than the technology development. This is a dilemma and a challenge for department- as well as project managers.

In relation to management and knowledge sharing, the other dimension is the specialisation both according to market segment and to technology. In many ways the matrix is reflecting customer segments of expertise, such as the energy or marine sector, on the other there are technology specialisations relevant to use across customer segments, such as welding- or high pressure technologies, or test methods. The sector managers have to know were to find the relevant expertise to form teams for projects using experts from other teams, and assuming they are available. The same experts can then in certain periods be on different projects, where they have some projects they have mobilised and generated themselves, some are mobilised by their head of section and some other projects by other sections, where they get a kind of 'clearing fee'. This creates discussions of priority, as the sections as profit centres want to develop their own projects, rather than doing 'body-shopping' for other sections. It is a part of the negotiation whether the generation of projects has especially high fees for the section, or how the clearing of resources is evaluated, but for the time being the fee is the same for all work between sections.

In a knowledge management and networking perspective this is an interesting problem, as it resembles many other management problems in networks. The section managers have authority over their knowledge workers in their own section, and thus the work for other sections is a negotiation, and they have to be very motivated to do this. If such projects are given low priority, then the synergy at the corporate level is lacking.

4. Knowledge sharing: Meetings versus networking

Even within the same firms, the internal communication and methods for knowledge sharing both within and between departments differ widely. While some sections had department meetings once or twice a month to discuss projects or unfolding events, the actual knowledge sharing activities were very different, sometimes taking place within defined "meetings," but in others only occurring as part of the practical collaboration and interaction that takes place in a project.

In one of the R&D departments, for example, the engineers working with complex technologies found that meetings were actually a barrier to effective communication. Although the different

groups did hold meetings, the section manager felt that they resulted in a relatively poor exchange of knowledge. He pointed out that, "meetings could be the occasion for knowledge sharing or knowledge communication, but the perception of meetings is very negative, as meetings do not work for engineers." As the section manager noted, "we need networking, not meetings," stressing the problems associated with anything that resembled "meeting rhetoric." As he continued, "the informal network carries the projects, and forms a skeleton of knowledge; the meetings do not provide that type of function." While the R&D department did have regular brainstorming sessions on technological developments, these discussions were limited to four to five people at a time. The section manager felt that they were able to "get more serious about ideas and find new concepts" that could serve as a foundation to the technology they were developing, and again avoiding "meeting rhetoric", which is signaling a very bad image.

5. Power, knowledge management and leadership.

Some of the problems of the self-management of experts, who want to be working with R&D only, is providing a challenge for project managers. In one of the departments, the department manager chooses to keep the old experts as responsible for technology and inputs to projects, but not as project managers. Project managers are selected outside this group and trained to handle complementary skills and the specification of the project management and deadlines. "The experts are not necessarily good project managers, as they get too engaged in the technological problems and interesting research problems. The experts are of much better use as experts on the technology, and being part of a team managed by a project manager, who is concerned with the scale and content of the project agreed upon in the contract."

The firm is doing their own training on project management to educate this role in a very research intensive organization.

The challenge of capturing organizational knowledge and sharing knowledge under entrepreneurial conditions raises questions about the role of power and leadership in dynamic, loosely-coupled networks. Most project management tools are tied to well-defined organizations and relatively linear processes (Mikkelsen & Riis, 1992), where the tasks to be divided are well defined. As illustrated in the cases in this chapter, however, when the level of complexity rises, the boundaries of the organizations are fluid, and projects involve simultaneous development efforts, a number of self-managed decision makers are involved in a complex set of reciprocal interactions (Jensen, Mønsted & Olsen, 2004).

The leadership powerbase in this type of entrepreneurial context is based on relationships, and, within this context, power can be thought of as constituted in interpersonal relations and tied to knowledge. Haugaard (1997, 2003), for example, has elaborated on the constitution of power, focusing on its dynamic changes based on Foucault (1980) and Barnes (1988). Haugaard's emphasis is placed on both the constraints of the social structure *and* the facilitation of the creation of power through social order. Within this context, "destructuring" agents are seen as a social function (Haugaard, 2003, p. 94), which raises an interesting perspective on the entrepreneurial constitution of power in relationships. Haugaard (2003, p. 92) continues his analysis of the power concept as closely tied to the "circles of validating knowledge," arguing that the leader is a leader, "not only because he believes so, but because the others constitute a validating ring of reference for that belief." The power concept is important, therefore, not as power to steer and control, but rather power as constituted by the social relations around and in communication with the person in power.

The cases in this chapter point to two key issues about and insights into knowledge creation and knowledge sharing, entrepreneurial leadership, and the types of power necessary to build a true leadership role:

- *Power and forms of power*. Power is generated and constructed in social relations, and leaders must attempt to persuade project participants inside and outside of their departments of their legitimate leadership role.

- *Management as persuasion, communication and negotiation*: Management and leadership are constituted in loosely-coupled organizations and networks, and managers have to find ways of knowing what is on the agenda of their own staff, in order to create the knowledge platform for external negotiations. *Negotiated management* of self-managed knowledge workers inside and outside the firm serves as a strong metaphor of the conditions for management in this environment.

These power-related issues have a number of implications for our thinking about knowledge sharing and communication. The idea of knowledge-based firms as systems of persuasion (Alvesson, 2001) leads to a perception of leadership as constituted power on the basis of negotiation. The interpretation could be a kind of *entrepreneurial leadership*, as the ability to persuade others that they can be considered leaders, and also managing and especially motivating

self-managed knowledge employees. It moves leadership and power discussions beyond organizational positions, focusing more fully on the relationships between self-managed professionals and network-based leadership.

Knowledge sharing is tied to both the individual and to the internal relations in the firm as the network and contacts to other experts is an important part of the organization's intellectual capacity. Thus, the talent of developers is not only an individual level phenomenon, but, as scientific and technological human capital, is dependent on the larger social context. As Bozeman, Dietz and Gaughan (2001, p. 724) suggest:

> Much of this capital, especially that aspect that is interpersonal and social, is embedded in social and professional networks, technological communities or knowledge value collectives… none of these discounts the more traditional aspects of individual scientist's talent… Our concept simply recognizes that in modern science being brilliant is only necessary, not sufficient.

Our view of knowledge management is increasingly being shaped by leadership roles and challenges and platforms of power, as communication and motivation becomes inevitable variables to understand how leadership is constructed in social spaces. Management is a social construction, and managers must create legitimacy and relevance in their communication with self-managed knowledge workers. The ability to persuade "followers" is necessary to create a power base, not only as a fundamental perspective in entrepreneurship but also more and more in knowledge-based firms. Entrepreneurship can be seen as chaos handling and the ability to create meaning in complex innovative settings that involve different types of expertise and customers. The opportunity and challenge involve balancing exploitation and exploration, pushing the organization's ability to both create and share new knowledge. As larger firms are increasingly fragmented into profit centers as part of a short-term economic rationale, they also increasingly import many of the problems faced by entrepreneurs in smaller, knowledge-intensive firms realizing the barriers to knowledge sharing, and the lack of concern for more complex communication and knowledge management. The subdivision in profit centers create a new demand for new project management strategies based on a more flexible communication, and the legitimization of knowledge management as a social construction of leadership.

Management in knowledge intensive firms is less a position than an action, stressing the ability to facilitate and create the context and motivations necessary to create knowledge- intensive products. The role is much more similar to the network manager who is only a manager through

the acceptance of his or her actions by the network partners (Mønsted, 2003). In this context, the position and control aspects of the manager's role are loosened considerably. Yukl (1989, p. 252) stresses the increasing need for more emphasis on shared leadership within leadership research. The profile of knowledge workers and their desire for autonomy creates a knowledge-sharing context, where leadership is tolerated – as long as the manager is credible both in actions and as a person, and does not set too many obstacles to the part of work that is interesting and fun. The platform for management has to be defined in this context, and the power base must be created rather than assigned through position. The power game is a dimension of management and leadership, but knowledge workers, who expect to be self-managed, do not accept positional power alone. To give "power," it has to be linked to personal power and credibility (see Haugaard, 1997, p. 31; Yukl, 1989, p.254).

6. Conclusion

The empirical case raises a number of issues about knowledge sharing and management of knowledge workers, which are questioning management theory and the dilemmas of creating an efficient division of labour. The cases are all very close to Ralph Stacey's perception of complexity (Stacey 2001), or that "plans never work, but then why and how do projects succeed anyway?"[1] The kind of communication by a specific kind of knowledge workers, engineers working in R&D with a high focus on technological research, provides an extreme case of knowledge management and conditions for managing under many dilemmas of economic management rules such as the profit centres. The issues of power become split into the knowledge power as an expert, and the manager's power as a department or a project manager. The mutual dependency is evident, and how to describe power is tied to the social construction of power in the inter-organisational processes of work.

In a management perspective, the need for the best experts in many different functions, and thus an extreme pressure on a small number of experts is difficult to create a basis for division of labour. It is a fundamental paradox, that expertise is needed not only in the internal functions, but also in the definition of problems with customers.

The other dilemma is the way of communication among the engineers. Engineers in the organization tend to refer to networks rather than meetings as ways of communicating. If knowledge sharing in meetings is faced with barriers, then other forms of communication in smaller

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[1] Presentation at the LOK conference in Kolding 2002

groups and at the white-board or computer screen has to be considered. The issue raised is whether the platform of communication is different for different scientific groups. Then the consequences for organizing and knowledge management has to respond to this.

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