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Leveraging Knowledge Management activities in everyday practice

Dr. Dick Stenmark
Göteborg University
Department of Informatics
P.O.Box 620
S-40530 Göteborg, Sweden
Phone: +46 31 7735566
Email: stenmark@informatik.gu.se

1. Introduction

Ever since man first shared the knowledge of how to make fire with his fellow human beings, the managing of knowledge has been employed by masters training their apprentices and by parents teaching their children. Managing knowledge is hence no new phenomenon. In recent years, however, the *importance* of knowledge in business and industry has risen dramatically, and shifted from being one resource amongst many to becoming *the primary* resource. Being able to effectively manage this resource has thus received the attention of many chief executives and Knowledge Management (KM) as a concept has become a vividly debated topic.

Although knowing is a profoundly human ability, and acknowledging that an organisation's ability to apply its knowledge depends heavily on social factors, many commentators have argued that information technology (IT) can have a positive influence on an organisation's KM processes. Attempts have been made to design and apply many sorts of IT artefacts for creating, storing, transferring, and applying knowledge, and software vendors offer a multitude of knowledge management systems (KMS). Practical results from KMS research, however, suggest that these systems often fail when implemented in the everyday practice of modern organisations. One possible explanation for the under-utilisation that I have come across in my research is the imbalance between the additional workload required by the organisational members and accuracy and timeliness of the content needed for the KMS to be attractive (see Lindgren and Stenmark, 2002). This imbalance leads to a maintenance problem, which in turn results in systems that are of little use for the organisations. Although KM systems maintenance has been acknowledged as an important research issue, it remains a serious practical problem for organisations and there is little advice to find in the literature. However, as indicated in my recent research, there are ways forward (see Stenmark & Lindgren, 2004).

It is widely recognised that contributions from *all* organisational members are an important prerequisite for successful KM systems (see e.g., Hahn and Subramani, 2000). Concurring with this, I argue that KM systems must be designed so that the technology itself actively affords user participation. Drawing upon experiences from my work with three KM systems implementations at Volvo in Sweden and lessons learned from the field of Computer Supported Collaborative Work (CSCW) in the 1980's, I shall present general design principles describing how KM systems can be integrated with everyday work to leverage user practices. The objective is to demonstrate how KM systems can be designed to better support knowledge application in organisational knowledge work processes and at the same time avoiding the maintenance problem mentioned above.

2. Knowledge epistemology

Ever since the ancient Greek period, philosophers have discussed the nature of knowledge. As previously mentioned, we have in recent years witnessed a booming interest in knowledge also from disciplines other than philosophy; organisation theorists, information system developers, and economists have all been swept away by the knowledge management avalanche. It seems, though, that the interest is particularly strong within the IS/IT community, where new opportunities to develop computer systems are welcomed. A plausible question to ask then is how knowledge relates to information technology (IT). Can IT at all be used to handle knowledge, and if so, what sort of knowledge? What sorts of knowledge are there? What is knowledge?

It seems we have little choice but to return to these eternal questions, but belonging to the IS/IT community, we should not approach knowledge from a philosophical perspective. As I have argued elsewhere (see Stenmark, 2002), we need not arrive at some universal truth of what knowledge really is but instead on a pragmatic understanding of how to manage organisational knowledge. The epistemological debate is dominated by two distinct schools; those who see knowledge as object and those who see knowledge as an intrinsically human feature. Inspired by Swan et al. (1999), I shall call these the *Commodity view* and the *Community view*.

The Commodity view of knowledge as an absolute and universal truth has since long been the dominating view within science. Rooted in the positivism of the mid-19th century, the commodity view is still especially strong in the natural sciences. Disciples of this tradition understand knowledge as an artefact that can be handled in discrete units and that people may possess. Knowledge can be separated from the knower and made explicit. The community view also has a long history but is in its modern form rooted in the critique of the established quantitative approach to science that emerged primarily amongst social scientists during the 1960's. Supporters of this view argue that knowledge can never be separated from the knower and should be understood as socially constructed. According to this tradition, knowledge is tacit and can only be defined in practice, in the activities of and interactions between individuals.

Regardless of how you understand knowledge, the maintenance problem for KM systems still applies, as we shall see from the following Volvo case study. (For a more thorough description of the case, see Stenmark & Lindgren (2004) or Lindgren *et al*. (2002)).

3. Traditional Knowledge Management systems

Volvo Information Technology (Volvo IT) is a Swedish IT service providing company within the Volvo Group, with its headquarters in Göteborg, Sweden. In 2001, Volvo IT was in the process of introducing and establishing more explicitly formulated KM routines (including IT support). Though being an IT company, the legacy from the manufacturing industry was evident and Volvo IT was primarily organised to meet the business requirements from its customers, which at the time mostly meant the other corporate companies. Furthermore, like many other large and dispersed organizations, Volvo IT had recognized the major problem regarding knowing who knows what. Accordingly, large investments were being made in both organizational arrangements and IT for supporting competence management. Moreover, Volvo IT planned to start offering their services also on the open market, which meant approaching customers outside the Volvo Group and thereby having to compete with external IT service providers. In such a situation, a KM tool such as a competence system became even more prioritized in order to take control over the internal competence management.

One activity meant to strengthen Volvo IT's competence management capabilities was the TP/HR project. This project had two main objectives: Firstly, to identify a competence structure for Volvo IT that could serve as a foundation for the mapping of employees' competencies. Secondly, to implement the identified competence structure in the TP/HR system and to define a maintenance organization that on a regular basis would keep the TP/HR's structure updated and relevant. Although the first part turned out to be more complicated than Volvo IT had anticipated and in itself worth further research, we shall here focus on the process of maintaining the system.

TP/HR was a commercial off-the-shelf module-based client/server system running on a Windows NT platform, TP/HR served as an interface between the user and an Oracle database server. The TP/HR system was implemented through a top down strategy where the competence structure was defined by management alone. Volvo IT's organizational structure can be described as hierarchical and this was reflected in TP/HR's closed system structure. While managers were authorized to see competence information about all their subordinates, employees in other positions could only see their own competence descriptions. Competencies were divided into a complicated set of functional and technical skill categories, which in turn had numerous sub-categories. This was the result of a lengthy effort to implement a competence structure that was common to and accepted by the entire organization. To produce such a map, however, turned out to be a non-trivial task and required much more work and consideration than the project team had anticipated. This is referred to as the Competence mapping challenge (see Lindgren and Henfridsson, 2002).

One contributing cause for the above difficulties was the pace with which old competencies changed and new emerged. Apart from alterations in the variety of competence within the organization that affected the structure itself, competencies and interests changed on an individual level as well. In order to cope with this evolution, Volvo IT established a maintenance organization for this purpose, but keeping the competence structure and the competence data up to date remained a burdensome task. In

fact, the map always tended to be out-of-phase with reality. This situation the literature describe as Competence evolution challenge (see Lindgren and Henfridsson, 2002).

A KM system is never better than its content and this content has to be provided by someone. TP/HR was primarily designed to support management in activities such as recruiting, resource planning, and project steering. However, the individual employees who were presumed to regularly provide accurate information about their competencies did not get anything in return and hence had no incentive for adding quality data. Without reliable data, the system became useless and Lindgren and Henfridsson call this the Competence input challenge.

In addition, organizational position determined how an employee could use the TP/HR system. Managers were authorized to see every subordinate's competence description, while organizational members in other positions could only see their own descriptions. Consequently, these employees could not use TP/HR in order to find people with a specific competence. They could only see their own data, which they themselves had fed the system. Needless to say, this information was of little value to them and did not help them carry out their everyday tasks. The system therefore became an isolated stand-alone application with no business impact. This is known as the Competence isolation challenge (see Lindgren and Henfridsson, 2002).

4. Rethinking KM systems

Having seen the challenges and difficulties a traditional repository-based KM system faces, we shall now look at an alternative approach. The Volvo intranet is a world-wide corporate net common to all companies within the Volvo Group. At the time of our study it consisted of little more than 700 web servers and approximately 750,000 web pages. The intranet was characterized by a bottom-up approach and Volvo IT's web-publishing policy allowed employees to publish whatever they considered worthwhile, which resulted in many semi- or unofficial web servers. Despite this seemingly uncontrolled situation, the contents of these servers were first and foremost work-related and business-oriented.

The Volvo employees spent much time searching the intranet for information, often just to check whether their favourite page had been updated and often without finding what they were looking for. To help the employees deal with information overload, we implemented Volvo Information Portal (VIP) – an agent-based recommendation system – to provide an awareness of new and relevant intranet information. The assumption was that VIP would be able to provide employees with more targeted information for a low user effort. A recommender system may be seen as performing personalised information delivery, i.e., such a system typically anticipates (based on e.g., the user's previous actions, other users' previous actions, or some mathematical similarities) what information a user is likely to be interested in and recommends such documents. User preferences are store in an interest profile.

VIP could perform three major functions. Firstly, based on a user's profile VIP would return intranet documents that would be of interest to the user. This was the employees'

primary reason for using the tool. Secondly, VIP would allow the user to find other employees with similar interests (i.e., with similar profiles) by invoking the "Community Matching" feature. Thirdly, VIP supported a "Search for Competence" feature, where users were able to find not just people similar to themselves but people with any arbitrary skill. This feature enabled the VIP users to enter a natural-language text describing a specific topic. VIP would then list all users with matching agents, i.e., all users who had agents actively searching for information related to the specified field.

Unlike the TP/HR system, VIP did not require explicit profiles of employees' job descriptions, CVs, competencies, or expertise. All that was necessary was for the user to create an agent and train this to return relevant and interesting information on a certain topic. To label the matching mechanism "Search for Competence" was a deliberate provocation to test the assumption that people interested in a certain topic also would have (or at least would eventually gain) knowledge on that topic. When the employees realised that no competence database was involved, an internal debate whether or not this assumption was true started. As is explained elsewhere (see Lindgren & Stenmark, 2002), the employees could be divided into three different groups; those who fully agreed that interests and competence were related, those who partly agreed, and those who disagreed. Nevertheless, a significant finding was that all employees found the implicit "profiles" made up by the agents to be more trustworthy than the explicit competence profiles in TP/HR, and this convinced Volvo to incorporate the concept of interests in their competence development schema.

Based on the experiences and lessons learned during the Volvo experiments, I argue that electronic traces of everyday activities such as search engine usage, sending and receiving email, printing, bookmarking, and writing documents can and should be leveraged to create trustworthy knowledge management systems. In the next section I describe some fundamental design principles.

5. Design principles leveraging user practices

Although KM systems differ in significant ways from Computer Supported Cooperative Work (CSCW) or groupware applications, I believe there are strong similarities between the problems faced by KMS today and the difficulties observed when introducing groupware applications in the eighties, i.e., the systems remain unused in practice despite good theoretical reasons why they should work. Grudin's influential work within the CSCW field has shed light on exactly these problems (see Grudin, 1987; 1994) and elaborating on his early observations, he presents eight challenges for developers of CSCW applications that I argue are applicable also to KM systems. These challenges are summarised in table 1. Drawing upon these eight challenges for developers of groupware applications, we shall here analyse experiences from our research effort at Volvo IT. This analysis is intended to generate general design principles describing how KM systems can be integrated with everyday work to leverage user practices.

Table 1. Eight Challenges for KM system developers (derived from Grudin 1994).

1. Disparity in work and benefit
Applications expected to provide a collective benefit still means that some people will have to adjust more than others, and CSCW applications therefore often require additional work from individuals who do not directly benefit from the application. The TP/HR system was also based on these principles in that employees were supposed to create and maintain their own competence database entries without even being able to use the system. Consequently, when KM systems depend on making knowledge, competencies, or experiences explicit by requiring the organisational members to verbalise, rank, or document their skills, it is clearly for the benefit of the collective and not for the individual. Thus, the extra effort needed from the person interacting with the KM system, does not result in any perceived value and the interest in the KM system can be expected to decline quickly.
2. Critical mass and prisoner's dilemma
A groupware application requires a high percentage of all group members to interact with it in order to be truly useful and one or two defections may be enough to thwart an otherwise successful deployment. With only a limited number of test users in the VIP study, there was a significant risk that individual users would create agents for which there were no matches. The community feature would in such cases result in zero hits and therefore generate no additional value. However, since the primary incentive for signing up with the applications was not to find community members but to receive targeted information, the lack of community members may not have had a negative impact on the overall use.
3. Disruption of social processes
Group activities are highly dependant on implicit social, motivational, economic, and political factors that change over time. If developers of (groupware) applications do not understand these factors, their tools may inscribe behaviour that is at odds with the subtle social dynamics of the organisation and thus hinder acceptance. Since knowledge is an increasingly valuable resource in today's organisations, one can expect group members to be reluctant to make explicit their knowledge and allow it to be captured by some KM system for the good of the collective. TP/HR was a top-down system, designed for managers and from a management perspective. It is quite obvious that social factors with high influence on grass-root level were not considered. When interrupting social processes by forcing employees to make explicit their knowledge, KM systems tend to fail.

4. Exception handling

When applications are designed based on official office work handbooks and other readily available work specifications, the resulting tools may end up supporting the way things are *supposed* to work rather than the way they do work. The industrial organisation of the 20th century has been preoccupied with structures and standards, and this for good reasons. However, the breakdown of bureaucracy occurs when exceptions start to outnumber the routine. As we saw in the previous section, TP/HR was implemented on the basis of formal work manuals and corporate strategy policies. Many of the competencies needed in and work situations encountered during an ordinary office day were not covered by the system. To support and facilitate knowledge application, which is closely related to individual work practice, approaches other than static data bases are required.

5. Unobtrusive accessibility

Even in groupware applications, the bulk of the work is carried out as individual tasks performed by individual group members, who mainly use groupware features to co-ordinate and communicate the result. Consequently, groupware features are typically used less frequently than many of the features supporting individual activities. The individual Volvo IT employees had no reason to enter the TP/HR system, except to update their profiles once in a while. In contrast, VIP rewarded the user by serving targeted information and monitoring the indicated field of interest on their behalf. Since information handling was something organisational members engaged in on a daily basis, information agents was a welcomed and relatively often used resource. The competence profiles derived from agent usage were therefore maintained both frequently and unobtrusively.

6. Difficulty of evaluation

Whereas interaction with single-user applications can be covered during an hour's observation, groupware interactions involve many different users and unfold over much longer periods of time. This makes evaluation of groupware applications more complex and less precise. The same is true for KM systems since knowledge is an intangible resource that often affects the organisation indirectly. Obviously, only three explicit competence profiles in TP/HR would have been a failure, but the existence of 30,000 profiles would not necessarily have indicated success. When evaluating IT systems in real organisational settings, it is very difficult to isolate the single factor contributing to the result and even more so when dealing with KM systems.

7. Failure of intuition

When software is constructed by the same people who are going to use it, intuition can be a reliable input to the design process. However, individual intuition is less likely to be able to predict the intricate demands on groupware tools that are to be used by a number of different users. A parallel from TP/HR is that mostly HR staff and managers (typical stake holders) were involved in the evaluation, whereas VIP was designed by a knowledge worker for other knowledge workers. An interesting observation is that managers on average were less impressed with the VIP approach than other employees. This indicates that there should probably not be one large KM system solving everything but many small applications handling more specific aspects of knowledge management.

8. Adoption processes

Due to the critical mass problem mentioned earlier, groupware applications require more careful introduction in the workplace than developers may appreciate, and hence, they must pay more attention to the adoption process than product developers have in the past. Although our VIP prototype was build around information seeking – a process familiar to most employees – the tool itself was new and unknown and obviously suffered from adoption problems. When KM systems depend on input from and interaction with many organisational members, the adoption process problems associated with CSCW tools apply, particularly so if the input needs to be explicit. This suggests that familiar applications used by many employees should be selected as hosts for the KM features to be added, e.g., email applications, word processors, web browsers or printer spooling systems.

6. Conclusions

A significant area of KM systems research is the development of systems with the potential to bridge the knowledge application gap in organisations. In this context, an important challenge is to develop design principles intended to keep KM systems alive – updated, current, maintained – by encouraging use. In addressing this challenge, this paper reports lessons learned from evaluating KM systems in a real organisational setting. The main contribution of this research is five general design principles describing how KM systems can be integrated with everyday work to leverage user practices:

- KM systems should not be introduced as explicit stand-alone applications that user intentionally must interact with in addition to their other job responsibilities. KM systems should instead be invoked when knowledge is applied in practice by exploiting spin-off from activities the organisational members already engage in. This indicates that there should probably not be one large KM system solving everything but many small applications handling more specific aspects of knowledge management.

- To be perceived as attractive KM systems should provide organisational members with a natural incentive not only to participate but to provide as updated and as accurate information as possible. The most plausible way for this to happen is to have the system reward the contributor with direct and tangible benefits.

- When KM systems depend on input from and interaction with many organisational members, familiar applications used by many employees should be selected as hosts for the KM features to be added, e.g., email applications, word processors, web browsers or printer spooling systems.

- KM systems must acknowledge and co-exist alongside existing social processes and organisational culture. Ignoring such issues and over-estimating the power of rational thinking is likely to lead to failure.

- Tomorrow's KM systems must be able to adapt to rapid changes in what sort of knowledge is being managed and to which field the knowledge is applied. KM systems based on rigid and well-defined structures are less likely to be able to do such adjustments and may therefore fail.

These design implications are not uncontroversial and it is noteworthy that management were more reluctant to embrace the VIP approach than were the ordinary employees. It seems the commodity view of knowledge was preferred amongst management whereas the community view was more appreciated amongst regular employees. A plausible explanation for this difference is that knowledge as commodity is much easier to manage whilst the community view makes more sense in everyday activities. When knowledge can be thought of as tangible and measurable objects it can easily be counted, sorted, stored and distributed according to management strategies. In contrast, when knowledge is emergent and constantly has to be re-negotiated and re-evaluated amongst the organisational members, it eludes the tools and systems used by executives.

The people involved in the everyday bread-and-butter operations of the organisation apply their knowledge in practice without having to make it explicit. They need to update their understanding of their tasks and their context in order to cope with the changing environment, and they do this not as separate activities but intertwined with their practice and in collaboration with their peers. They are not helped by a system that allows them count or sort their "knowledge objects".

Obviously, the question is not whether to use the one or the other but how to implement KM systems that successfully facilitate both perspectives and avoid the maintenance trap.

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