Some Critical Remarks in Favour of IT-Based Knowledge Management

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Abstract: We shall discuss the state of the art in contemporary knowledge management with respect to processes, tools, people, and the role and potential impact of information technology. In particular, we shall stress the importance of intellect and culture hereby.

Keywords: knowledge management, information technology, software tools, culture, intellectual capital, change;

1. Introduction

What is the impact of information technology on knowledge management in industry? Which type of change has been fostered by information technology? Unfortunately, we cannot refer to history. There is little scientifically established history of knowledge management in business. After all, who cares about history when we are talking about change![1] We are not going to close this gap in this article, but we shall refine our discussion to some of the most prominent, current problems with knowledge management based on information technology, and we shall try to derive requirements for a true leveraging of contemporary information technology in knowledge business.

1.1 A Scientific View

Knowledge has been a research topic in economics for forty years[2], but little convergence of scientific opinions has been achieved so far. In contemporary discussions, a diffuse spectrum of meanings is associated with all knowledge compounds, the most prominent of which being knowledge management, which has become a business hype in the last few years. For example, there is a quite popular debate on the distinguishing difference between knowledge management and information management. Some say that there is no difference at all, others present knowledge as Deus ex machina for information management. In its essence such discussions do not contribute a lot to the goal of understanding how knowledge could or should be managed in organisations.

Usually, the term knowledge addresses some kind of understanding how to achieve solutions in a particular problem scenario based on available information. According to that understanding of the term "knowledge", it tells us how to generate useable information from available data, and this includes the ability to collect and/or process the appropriate data at the appropriate time, and the ability to implement a solution or to achieve a basic understanding of a particular problem context. In the following we shall stick to that basic, common sense understanding of "knowledge". Consequently, the management of knowledge deals with the problem to provide people with knowledge necessary to solve their(sic!) problems, or rather, with the problem to support them in acquiring the necessary knowledge by themselves. Speaking in abstract terms, knowledge management then deals with archiving, retrieving, and re-interpreting information to be used by others, or provided by others, respectively. This being said, we would like to stress that implementations of these management tasks make take very different forms, starting with the forming of non-written cultural traditions and ending up with emerging, artificially intelligent, digital systems. Thus, the enumerated management

[1] The few available studies on knowledge management before the invasion of information technology are mostly neglected in the debate, although it might to be worthwhile to compare the management of knowledge workers in the 19th century with contemporary practice.

[2] Around 1960, Fritz Machlup coined the term knowledge industry, and Peter Drucker introduced the term knowledge worker.

tasks could be subsumed as the one and main task to support the sharing of knowledge, which clearly includes its persistent storage in a reusable form. Thereby, the embodiment of knowledge can be anything from a common behavioural attitude characteristic of a particular culture to a digital representation, while by its - i.e. our - very definition the only form of materialization of knowledge is problem solving. Everyday experience tells us that knowledge sharing and transfer works best when some form of materialization is involved, such as exercises.

The dramatic arts provide an instructive alternative example for materialized knowledge transfer, as well as for the delicate relationship between the representation or the embodiment of knowledge, the transfer of knowledge, and the cultural tradition of knowledge acquisition. The origin of the dramatic arts is story-telling, which was formalized to performances of tragedies or comedies by the Greek, i.e. rules were invented defining the structural pattern of the story, the form of presentation and the setting for the presentation. Theatre was then believed, and it still is, to create emotional effects on the mind - which has been thoroughly discussed by lots of different philosophers, ranging from Socrates to David Mamet. However, it was equally important as a knowledge transfer artefact, as it offered cultural knowledge, embodied by natural language text, but requiring the materialization in a play in the presence of an audience. The two crucial ideas were that the performed story is one about problem solving, and that social meaning is associated to text by the natural trick that text is spoken by characters with a particular social role. Thus, theory and application were naturally combined during the performance. As people in the audience projected the actions on stage to their own life situation, they exercise in thought. Although contemporary theatre is of little importance for the tradition of cultural knowledge, it still tells a lot about the essentials of knowledge management. It effectively deals in parallel with theory and practice and it emphasizes the importance of structure, the social aspect, and the role of emotion. It is the interplay of all these factors which once was the success factor for the dramatic arts.

The above mentioned "sharing-task" is a wide land, though, and old forms of knowledge tradition play a pretty minor role there. On the one extreme hand, scientists define knowledge as formal data only, while on the other extreme hand, other scientists describe knowledge as something, which comes from reflected experience, or as a shared property of communities, respectively. While these characterizations have provided a tremendous, creative impact for the dialectic debate in science - and while the ties between knowledge and reflected, social experience are one of the very first things that should be taught in a course for practitioners - both approaches lead to some rather peculiar philosophical implications. The "formal" approach stems from the experience collected in the three thousand years of mathematics, but it ignores the importance of human factors. The "human-factors" approach suggests consequences, which are eventually not very far from shaman theories, when it is compared with experiences in natural sciences. Neither are human factors of little importance in formal sciences, nor is every knowledge necessarily based on experience or on social interaction with a particular (knowledge) society. We are able to solve problems in situations, which we have never faced before. We are able to apply ideas in a new context. We are even able to develop new ideas on our own, and apparently out of no corresponding experience whatsoever. Nevertheless, most of our thoughts are driven by some experience, possibly in different problem domains, and the successful development of new ideas, or the application of old ideas in a new problem domain, respectively, requires some social validation. For example, most famous artists are known for discussing their products with persons of their personal trust before presenting them to the public, and some of the spectacular e-business flops in the last years clearly resulted from the absence of appropriate social validation of the original plans. In fact, the latter examples point to a major risk of knowledge management, which relies to much on community factors, as what has been said about power centuries ago,

equally applies to communities: All communities corrupt (and absolute, i.e. closed, communities corrupt absolutely).

We may conclude that knowledge management activities should start from a truly holistic perspective of man, which takes into account all her social, all her cognitive, and all her emotional capabilities. Information technology should provide us with tools and processes to make optimal use of human capabilities.

1.2 A Practical View

Our post-modern reality does not admit clear-cut boundaries between problem domains, and the restriction of the discussion to a particular area does not provide us with sandboxes either, which can be built from "the" natural one-and-only right definition of what knowledge is all about. We may only develop perspectives at knowledge management problems and we have to accept the intrinsic contradictions in every bunch of perspectives, which is broad enough to apply to a complex scenario. Successful knowledge management requires either good luck - e.g. the appropriate knowledge guru as an advisor for a particular scenario, whose selection is a lottery - or a sound understanding of all the major perspectives on knowledge management. Contemporary change in business may turn excellent knowledge strategies into obsolete ones within a few years, and the other way round. Once successful tools may fail, and on the contrary, tools which failed to gain a broad acceptance from users may suddenly start gaining popularity with exponential-like speed, for very different reasons, whose initiation is hard (if not impossible) to predict.

We may conclude that knowledge management requires a broad background in alternative approaches and a high flexibility and sensitivity to changes in the attitudes and behaviour of users. In the following, we shall discuss the importance of cultural issues for knowledge management in practice. Understanding the interplay between information technology and digital knowledge tools on the one hand, and the communication and knowledge acquisition culture on the other hand is a prerequisite for success. This requires investigation by experiments with new tools, a permanent observation of how make use of available technology, and lots of analytic discussions with users, how they perceive the knowledge development processes.

2. The Potential and the Side-Effects

Information technology may improve the communication, it may improve the access to information, and it may increase the transparency in the system. Knowledge management may benefit from all three, but there are usually side-effects which may turn out to be serious drawbacks for knowledge management. For example, in many leading companies, Intra-Webs have been installed for information management and knowledge management, which has often changed communication paradigms: While before directives and guidelines were delivered to employees by the internal mailing system, and later by e-mail, afterwards in many companies they were simply published on the internal Web and employees had to find about their existence. This may cause significant problems, as people do not find out about the existence of directions. If, in addition, no garbage collection for directions is organised, people may identify old directions as currently valid, although they have been overwritten by new ones. Indeed, in such (existing) scenarios, both old and new versions may exist at different addresses, requiring that the employee checks whether a direction is still valid. The situation is usually worse for knowledge contents on the Intra-Webs, which are not subject to administration rules.

We have conducted a case study[3] in a major company with similar problems. There, employees complained a lot that they would spend too much time with searching, and that inter-department co-operation would often face the problem, that information was not delivered, but only referred to, using a wrong address or an incomplete link sequence description. While this was obviously true, the analysis of log-files of the search engine revealed that most employees were not very skilled in using the search engine, and they usually gave up quickly. Our case study did not prove that the impact of the usage of Web-technology for information and knowledge management was negative or negligible – indeed there was clear evidence of its benefits - but it showed that the results of the usage were unsatisfactory due to unmanaged cultural change of communication patterns. The reasons for partial failure ranged from the absence of a known management strategy over violations of the existing guidelines for publication to a rather poor performance of most consumers of the published contents. However, rather than addressing the structural problems created by the introduction of a new technology, the management decided to introduce XML-based content management (while the development of tools for consumers had been stopped before). It was believed that the new publishing technology would solve the problem that users did not find what they were looking for, and that strategic and organisational considerations were not necessary. Our case study was completed before the introduction of the new technology, but we have not heard any rumours yet, that the problems have disappeared.

Comparing the results of this case study with other practical experience, we may generalise from the above example that the impact of information technology on information and knowledge management depends on how well the emerging change of communication patterns is controlled. Both information technology and knowledge management are embedded into a cultural environment. Information technology has the power to change the cultural environment and it will usually do so whether this is intended or not. First of all, transparency in the system changes its nature. A lot more is visible, including access restrictions built up by internal departments of a company; a lot more is observable, including the searching for information as it reflected in log-files of Web-servers; and a lot becomes hard to find because of the larger amount of accessible information. The potentially reachable information increases by orders of magnitude, but at the same time part of the business critical information is effectively hidden in the information mess. The outcome may be a clearly improved networking between people or a lot of frustration, or a little bit of both, which depends on how the company is lead and how the technology fits with the corporate traditions. It is a primary task for knowledge managers, and it is a conditio sine qua non for the leveraging of software tools in knowledge management, to identify and control the change of communication patterns induced by the use of the various forms of Inter/Intranet communication and by the use knowledge tools from information technology.

3. Processes, Tools, and People

Talking about knowledge management means talking about processes, tools, AND people - or rather, it should mean. In practice, people mostly talk about content structures or about social activities, both of which are important, but even together, they only cover a minor part of the problems.

3.1 Processes

In most companies knowledge management processes are rather poor if they exist at all. *There is nearly no reporting, no controlling, and no accounting.* These management instruments are

[3] See Lueg 2000

considered inappropriate and impossible to implement. Wherever reporting is known to be done, it focuses on implicit effects on other business tasks. Whether these effects are indeed due to knowledge management or not is generally impossible to tell. Why on earth should market shares reflect knowledge management! They may equally reflect the personal relations of the CEO with the top-management of the major customers. Knowledge management is an important factor for customer relationship management[4] (CRM), but not all customer relationship management depends on knowledge management. Leading companies have spent a lot of expertise on the processes related to those effects which are usually used to mirror the success of knowledge management, but only few have designed dedicated knowledge management processes. One of the reasons for this ignorance is the common belief that knowledge is not measurable, although no arguments can be given, which would not equally apply against measurement in other areas, where it is common practice. Since knowledge building processes are mostly analysed by experts who dislike the idea of measurements, while those who prefer measurements do not want to bother with the delicacies of human communication and knowledge acquisition patterns, this situation is not likely to change in the next few years.

Most knowledge management is tacit or implicit knowledge management[5], and change towards explicit processes ought to start from this status quo. Frog leap approaches would be no good deals. People have developed their individual knowledge acquisition skills in dealing with these tacit and/or implicit processes, which should be respected and exploited by future change. Reporting may start with the assessment of existing implicit processes and affiliated skills, which will reveal some of the strengths and weaknesses of the knowledge culture of a company, and thus provide a basis for the design of knowledge management processes.

3.2 Tools

There are various types of tools supporting knowledge sharing processes. Their function is fivefold. They enable us to document and structure knowledge; they enable us to transfer structured or unstructured knowledge to a dedicated partner; they enable us to store and retrieve structured knowledge; they enable us to publish and retrieve semi- and unstructured knowledge, and they enable to observe the behaviour of users. This reads like an extended list of data management functions, and indeed it is. What distinguishes knowledge management tools from data management tools is that they deal with data plus semantics, not with data alone. The semantics may either be contracted, or they are assumed to be evident or self-explanatory. Providing data with self-explanatory semantics is strictly more than just providing self-describing contents or functions, as it requires that the self-description is semantically understood without a priori ontological[6] agreement In other words, data have to be delivered in such a way, that represented information is understood and can be used (more or less) straightforwardly. This concepts resembles the concept of *affordances*[7] as it is known from cognitive sciences.

Some of the available tools may work well as long as the agreement on the semantics is clear to all users involved in the knowledge sharing activities, but in general all of them fail, wherever such an agreement does not exist. In fact the degree of settlement of such an

[4] See Swift 2001, chapter 3
[5] Tacit knowledge management should not be confused with the management of tacit knowledge, which deals with undocumented knowledge in the heads of people, one of the hardest problems in knowledge management.
[6] An ontology is a specification of a conceptualization. See e.g. Gruber, 1993. Ontological agrreement means agreement on the formal ontology to be used.
[7] See Gibson 1979

agreement corresponds with the degree of potential success. Formal proof writing[8] is possible for computer programmes as long as no intuitive concepts are required. Content management works as long as descriptions of contents are naturally understood in the same way by their providers and by their consumers. Information exchange between different organisations works, whenever they understand each other's ontology. And so forth. It is the relation between established, formalizable, cultural knowledge and the complexity of the problem, which decides on the feasibility of computing solutions. Additionally, it should be noted that the problem of formalizing content is only one side of the magic medal. The other side is doing it in a way, which is understood by the potential consumers.

Some fifteen years ago, researchers believed that expert systems[9], i.e. systems providing rule-based contents, can be built to provide problem solving intelligence. Later many researchers realized that these systems work only for domains of low complexity, and that even all those algorithms and tools fail, which apply expert systems only implicitly. Nowadays, expert systems are becoming increasingly popular again, but they appear to be re-named (as knowledge management tools). Clearly, they will fail again wherever the complexity is too high. Moreover, some weak form of expert systems has become a promise for the future, namely ontology management systems. They usually define only a rudimentary set of rules, as their target is to enable users to share semantic understanding of data only. Obviously, they will be successful in more scenarios than expert systems, as they try to achieve less than those, but nevertheless, they will eventually face the same type of problems. The various XML-based representation standards will ease the dissemination, but they will not help to overcome the principal constraints for this type of artificial intelligence. This is marvellously illustrated with the following type of design problems: the design of a unifying or of an intermediary ontology system for scenarios, where there are lots of nearly identical ontology systems with essential differences in affiliated legal implications.

Let us consider international e-government, where the introduction of globally valid representation standards is not accepted by national governments: Dealing with the global cultural concept of marriage in Europe is highly complex[10], and it is even more complex if this is done for a world-wide scenario. Marriage involves at least one human being and at most finitely many, which may be of one of the two sexes, whereby an involvement of only one sex is only possible, when the number of involved people is one or two. Although most of us have a clear and rather concrete understanding of what marriage is, this is all what can be generally said about marriage. In order to develop a usable ontology, we have to split up the term into specialised forms, plus we have to develop rules, how these forms relate to each other. If we reduce our perspective to legal marriage, we can exclude that form of marriage where only one human being is involved, and we can further exclude those forms, where some involved are dead. If we restrict ourselves to legal forms of marriage in Europe, we may assume that exactly two humans being alive are involved. If we confine ourselves to Switzerland, we may even guarantee that the two humans will have opposite sex. However the price we have to pay for such precision is that the system is not usable in countries as close to Switzerland as the Netherlands.

The above example highlights the constraints to the processing of semantic meaning, and it provides a strong metaphor for the implications of cultural heterogeneity in Europe.

[8] Proof writing means creating a proof for a mathematical statement.
[9] Expert systems are rule-based recommendation or control systems, also addresses as old artificial intelligence – in contrast with new artificial intelligence which relies on the imitation of natural intelligence and biological mechanisms.
[10] See Oostveen 2001

Furthermore, it reveals the limits to community approaches in knowledge management. Knowledge sharing in international e-government has to bridge cultural differences, and learning on the side of civil servants is primarily done by dealing with exotic cases of foreigners who are not familiar with the local culture. Cases dealt with are usually unique for the local agency, and knowledge has to be shared either with remote offices of with different agencies. Such possibilities are hard to use with conventional communication technology, and knowledge sharing tools significantly ease the burden of accessing remote experience. Thus, international e-government is a showcase for both the capabilities and the shortcomings of information technology.

Looking at other definitions of human relationships or human behaviour[11], we may generalise the "marriage-problem" to state that in non-trivial intercultural settings ambitious semantic support systems are mostly drowned in their own complexity, even if the involved cultures are very similar. This already applies to larger SMEs[12]. The only chance for success is to rely on the human intellect as much as possible and to confine the information-technology-based support to some "intelligent" access support for available information. This is no argument against measurements though. Instead, the further development of tools should be guided by assessment of how people use existing tools.

3.3 People

Unfortunately, in practice human intellect is rarely the topic in knowledge management. There is a strong tendency to focus on the providers in knowledge management and to ignore the consumers. Technology is built for content providers and management plans are developed for providing the contents, while consumers are often ignored. As a result, many knowledge management systems are ignored or misused. Indeed problems of bootstrapping new tools in practice are similar to known problems for user acceptance of CSCW[13] tools. This type of ignorance may be observed in quite different communities, whose knowledge management ideologies are otherwise totally incompatible. Knowledge managers tend to talk either on content management or on the right behaviour, and this “or” is mostly an exclusive one. There are those who believe in putting knowledge into digital systems, and there are those who talk about sharing. Plus, there is the large community of those who perform private knowledge management and who do not understand at all the need for a corporate knowledge management. While the first two communities tend to ignore the problems of usage of information, many members of the third community focus on this problem and tend to ignore all other problems. You may find bunches of entire success reports on knowledge management projects in industry without one word about consumers and how they accepted and indeed used the system. And on the contrary, you may listen to amazing self-mirroring discussions in the knowledge sharing community, which talk about the right way to implement Knowledge management ignoring the social and organisational context, which often punishes people for knowledge sharing. If necessary change for real life implementation is considered at all, it is usually described only on a micro-level ignorant of its potential impact on the overall management structures. Thereby, it is implicitly assumed that better knowledge management would provide higher profits, although there is no evidence that this principle holds in general and by all means. An amazing observation can be made in many advanced communities of knowledge management experts: Although most of them are very aware of the importance of context management, some of somehow believe in its context-free realisation. This phenomenon seems to be related to the absolute belief in the benefits of

[11] Like family, parentship, honesty, politeness, dependability, etc.
[12] Small or medium size enterprises
[13] CSCW means computer supported co-operative work. Examples are tools for distributed software development.

knowledge management. Unfortunately, business life is more complicated and the individual business culture of a company or of a department has to be understood first, before effective knowledge management strategies can be developed.

We have to understand the individual working styles, the social interaction, the practice of collaboration, and the organisational and social incentive systems, in order to implement successful knowledge management. This in turn will lead to a change of the depicted aspects of the business environment, and indeed it may be used to somewhat nurture and control this change. However, there are no ready made solutions, and ideological approaches will only work where the ideology fits with business reality. In large companies employees have become flexible due to the regular experience of change, but still we are very far from universal cultural beliefs and social behaviour patterns. It makes little sense to proclaim the emerging of the ideal business and knowledge management culture, if the career of those will be damaged, who stick to it.

4. The Importance of Being Cultural

The various considerations and examples above suggest the following conclusion: The actual impact of information technology on knowledge processes depends on the cultural background. It reflects social tradition and individual education. Trivially, different users use software tools differently, and tools, which are helpful in one cultural and social setting, may decrease the intellectual capital of another company. Thus, there are no ready-made solutions for all. Moreover, the usage of tools changes our working patterns. This influences the social interaction and the business environment. We can thus employ tools and knowledge processes to shape this environment such as to improve its intellectual capital. However, this type of change requires more than plain business management: It requires leadership[14] and time.

It has been argued for long that information and knowledge bear their meaning and relevance only in the actual context of problem solving, which is characterized by the social setting. This suggests a return of situated design[15] for the development of knowledge management solutions. However, this alone does not suffice. Information technology for monitoring and pattern mining in event streams is needed to support the control of the knowledge management life cycle. Any interaction between a user and a tool creates one or various events, which may be monitored. Individual events sum up to event streams, which represent the user behaviour and observed event streams bear implicit knowledge about preferences of users, about the degree of acceptance of new tools, and about problems users have with the available tools. Data mining techniques may be applied to turn this implicit knowledge into explicit descriptions of preferences and problems. Thus, information technology provides us with meta-knowledge, that is knowledge on success or failure of knowledge management tools and processes. This is not the golden bullet for knowledge management, but it is a major asset for the management of intellectual capital. Monitoring and mining together with traditional interviewing techniques support the control knowledge processes on the level of tool usage. We should not use such control tools as a substitute for the understanding of the interplay between culture, community, and intellectual capital, but they provide us with very helpful information in order to achieve such an understanding.

There is no clear-cut separation between knowledge and intellect as they are inseparably intertwined. Therefore, there are natural limits to knowledge transfer, which cannot be

[14] I.e. leadership familiar with the potential and side-effects of contemporary information technology

[15] Situated design means, among others, user-centered design focussing on their skills, situated actions in the work environment, and on social interaction. See Greenbaum 1991.

overcome. The transfer itself must be socially and intellectually compatible, and, if successful, it may result in a transfer of intellect. This is not for free. In fact, it provides the primary challenge for the technical and the organisational implementation of knowledge management. Neither pure content management nor pure knowledge sharing will provide a solution, except for rather trivial cases. We have to go for intellect management, and this starts at home and in school. Thus, we may observe two classes of knowledge management problems. Knowledge management for knowledge workers in the sense of Peter Drucker, who are strongly affiliated with their own community and who want to follow the innovations in their field, and knowledge management in areas with a lot of cross-disciplinary innovation requiring intellectual participation of intellect workers. Successful companies need a balance of both groups and of their respective knowledge acquisition activities. Cultural diversity is both an asset and a risk, and it should be maintained both for knowledge groups and for the intellectual networking culture.

There is a long ToDo-list for research on knowledge management. We shall name only a few basic issues here:

- We have to understand the psychological, the social and the cultural dimensions of the use of information technology in tacit knowledge sharing activities - in their full diversity!
- We have to work on practically usable, effective, and efficient methods, tools, and processes for intellect sharing - in business environments!
- We have to develop flexible, context-sensitive strategies for the bootstrapping of knowledge sharing - sensitive to a particular scenario with a given, possibly heterogeneous, corporate culture!
- We have to find ways to implement reporting, controlling, and accounting of intellectual capital!

The two key questions are: How can we monitor the interplay between information technology and knowledge and intellect development processes in an actual business scenario and how can we exploit these observations for the steering of the processes and the control of the cultural change.

In January, the Swiss Knowledge Management Forum (SKMF) will be founded, after more than a year of preparatory workshops.[16] It will be a forum for knowledge exchange between practitioners in knowledge management. We hope that this will have some intellectual impact on knowledge management practice, and that some scientific research will be stimulated based on a co-operation between industry and academia. After all, we are very far from understanding the full potential of information technology for knowledge management. So far, information technology has not caused any fundamental changes in knowledge management. It allows for a global sharing of data, computing resources, and tools[17], and it leverages the sharing of knowledge inside organisations and across organisational boundaries, but we have not yet learned how to use all these great possibilities. Once we have learned that, a revolutionary change of our business environments will result. Traditional and inter-cultural social interaction and individual or co-operative navigation through digital knowledge spaces will be the two main skills of future intellect workers, whose life will be rather different from what we may imagine now.

[16] For more information see www.swisskmforum.ch.
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