Management of Explicit and Implicit Knowledge in Consulting Companies

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Abstract

Knowledge management is very important in the consulting business. On the one hand knowledge is the crucial factor of production that differentiates consulting companies from their competitors. On the other hand knowledge management is a consulting service that can be sold to other companies.
The changes that have to be established during the introduction of knowledge management in mid-size consulting companies are presented. They comprise changes in organization, roles, processes and information technology. The main focus is set on information technology introducing an approach to support the process of capturing and transferring implicit knowledge with intelligent software agents.

Motivation

There is no other branch today where knowledge management is as important as it is in the consulting branch. Knowledge is the crucial resource that gives consulting companies a competitive advantage over their competitors (cf. (Berry and Oakley 1993)). The knowledge about the required changes in processes, roles, organization, culture and information technology that is acquired while establishing internal knowledge management, can be sold to other enterprises as a consulting service. As a result, consulting companies do not only improve their internal courses of business through knowledge management but also list a provable return on investment.

The approach presented in this paper is based on experiences that were made during the implementation and integration of knowledge management into Siemens Business Services Management Consulting (SBS MC). SBS MC is a relatively young consulting company which employs about 170[1] consultants. For the above-mentioned reasons a successful knowledge management had to be established.

[1] As of October 99

Objectives

There were two objectives that led to the strategy presented in this paper.

The first objective was to manage the targeted strong growth of the next years and to integrate knowledge management from the beginning into the organization, the roles and the processes at SBS MC. The integration of knowledge management into companies – especially large consulting companies – has been widely discussed (cf. e.g. (Davenport 1997), (Manasco 1996), (Seemann 1997)). Nevertheless we think that our strategy is adding contribution to the integration of knowledge management concerning organization, roles and processes into medium and small-scale enterprises. The experience made at SBS MC has e.g. shown that it is not necessary to employ lots of full-time knowledge editors, knowledge analysts or knowledge navigators (cf. (Amidon and Skyrme 1997)) in order to set up a successful knowledge management.

The second objective was to automate the process of capturing implicit knowledge with information technology. This objective was motivated by the fact that many information and communication technology approaches to knowledge management focus on the management of explicit knowledge rather than the management of implicit knowledge[2]. According to Amidon and Skyrme (Amidon and Skyrme 1997) knowledge management technologies are mainly repository technologies (e. g. document databases or text databases), knowledge discovery technologies (e. g. OLAP), knowledge gathering technologies for retrieval and collaboration technologies like discussion forums or group decision support systems. All these technologies work and rely on existing data that is encoded in a machine-readable manner. This is a significant difference to our technological approach where it is a main task of intelligent software agents to *fill* a repository automatically with knowledge that is gained through automated observation of users. Thus the main target of our technological approach is to support the

[2] According to (Nonaka 1991) 'explicit' knowledge is formal and systematic and can thus be easily captured, whereas 'implicit' or 'tacit' knowledge is hard to formalize and to transfer to others.

automation of the process of capturing implicit knowledge with intelligent software agents and thus making it available to other employees or partners. Therefore we think that our approach contributes to the automation of the *articulation* of knowledge, i. e. the transformation of implicit knowledge to explicit knowledge (cf. (Nonaka 91)).

Knowledge Organization and Roles

This section discusses knowledge management by focusing on knowledge organization and knowledge roles. Knowledge organization deals with the topic of so-called "Communities of Practice" that support the exchange of knowledge among the employees of an organization. Knowledge roles are those roles that were introduced at SBS MC to support the work in the "Communities of Practice".

Knowledge Organization

The first step in implementing knowledge management is to find a way to set up the internal organization to support the exchange of knowledge.

A great barrier for knowledge management are organizational structures that promote “silo” thinking, in which locations and functions focus on maximizing their own accomplishments and rewards, hoarding information and thereby sub-optimizing the total organization. These barriers are enforced by the lack of contact, relationships, and common perspectives among people who don’t work side-by-side. (O’Dell and Grayson 1997)

This goal can be achieved by supporting informal networks between the employees in so-called ‘Communities of Practice’ (‘practices’). Informal communities exist in every organization because membership in those communities is based on participation in discussions and mutual learning about certain fields of interest. (Brown and Duguid 1991)

According to (Wenger 1998) Communities of Practice define themselves along three dimensions:

- A certain topic that all practice members discuss and are interested in and that defines their field of interest.
- Mutual engagement and binding to a social entity.
- A shared repertoire of knowledge about the topic of interest that all practice members have developed together.

Communities of Practice can be found within business units, across business units and – in some cases – across companies. The organizational concept presented in this paper was implemented in a mid-size consulting company and focuses on practices within business units. Nevertheless it can be rolled-out across business unit and company borders.

Each consultant has to commit himself for membership in one Community of Practice. The commitment to this practice is supported by the fact that the leader of this practice is his superior. In addition to that he should participate in another practice he is interested in. The type of the practice he has to participate in depends on his level of seniority. Employees with little industry experience should concentrate on industry-independent, service offering-oriented practices where they can apply the expert knowledge they gained during their education. In those practices they can choose the industry they want to become experts in. The topics these practices gather around are to a certain extent industry-independent, but do also have industry-dependent aspects if e. g. the skills that a certain project needs are situated in the intersection of an industry-specific and a service offering-specific practice.

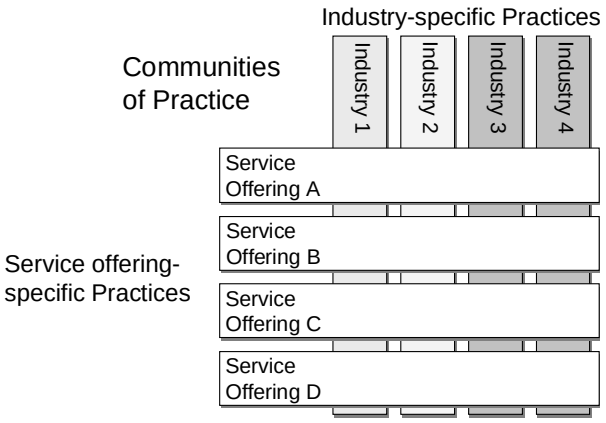

Figure 1: Organization Charts supporting Communities of Practice

Because of their greater experience in certain industries the senior employees commit themselves to industry-specific practices. While participating in his different practices, the consultant is part of a continuous exchange of project knowledge. By keeping an eye on practice diversity (that means project people from different practices) while assigning people to projects, one can guarantee an exchange of knowledge across the boundaries of individual practice groups. By doing so, a knowledge network is established that connects knowledge in the heads of many consultants from different practices.

Knowledge Roles

The preceding chapter showed how to set up a knowledge organization in a business unit in order to support and to integrate Communities of Practice and thus the establishment of knowledge networks. The following chapters describe the roles that are needed in the practices to ensure that they are internally well-organized.

Practice Leader. The practice leader is a subject matter expert and has a high reputation in the topic his practice focuses on. The reputation is based on his great functional expertise and his rich experiences he made in this field of knowledge. The practice leader is at the same time member of the practice and can play all other practice roles as well.

His major task is to drive the knowledge extraction process (cf. chapter 2.3.1). In addition to his leading role he has to perform several other roles within the practice,

e. g. driver & facilitator, promoter and quality manager.

Knowledge Broker. The major task of a knowledge broker is to translate the practice goals that were defined by the practice leader or by the practice members as an entity into action. He plays an important role in the knowledge extraction process where he identifies proactively possible knowledge assets[3]. In addition to that he is responsible for the contents of the practice's knowledge asset repository.

Technical Editor. The technical editor is responsible for the quality, consistency and design of the documentation under his control in conformance to corporate identity and style guidelines. He improves the clarity of material developed by other project team members. He is also used to develop knowledge assets based on models, prototypes, finished work products and comments from other project team members. Every Community of Practice should be supported by at least one technical editor.

Best Practice Team. The best practice team consists of subject matter experts, the practice leader and a technical editor. This team classifies the knowledge assets in terms of their value for the company, their expiration date, their degree of reusability and their level of maturity. The best practice team is a virtual team that can contain members from other practices as well in order to guarantee an objective rating and classification of the knowledge assets.

Knowledge Processes

This section deals with knowledge processes. Knowledge processes relate to the extraction of knowledge and the proper assignment of employees with the appropriate skills to projects.

Knowledge Extraction Process

In addition to management of implicit knowledge through the support and the establishment of knowledge networks, it is the task of the practices to convert implicit expert knowledge to explicit knowledge and to make it publicly available in a knowledge asset repository. The major benefit of this procedure is that knowledge is made independent of certain persons or existing knowledge networks. As a result, the following advantages can be demonstrated:

- The explicitly available knowledge is made persistent and independent of continued existence of the knowledge network so that a leaving employee does not mean the loss of know how and thus no loss of competitiveness.
- Training of new employees is facilitated by the explicit knowledge that is created in the practices since new employees do not have to rely on the knowledge transfer from their colleagues.
- Knowledge for future projects does not need to be reinvented.

Figure 2 shows the process that defines how knowledge assets are derived from the results that were achieved in the projects. It is called the *knowledge extraction process* (KEP). The starting point of the KEP is the consultants' daily project business, that supplies the project repository with documents and data, that are required for executing and documenting the projects. At the end of a project the project members participate in a project debriefing workshop where they - among other things - discuss and identify possible knowledge assets, e. g. case studies or checklists.

These possible knowledge assets are submitted to the knowledge extraction process with support from the practice's knowledge broker who helps the authors to provide the necessary meta data (e. g. about the author, the co-authors, the project it was developed in, the practice it belongs to).

The first person in this process is the leader of the practice who on his own or supported by other subject matter experts checks the content of the submitted document in terms of correctness and completeness. If the document does not conform to the required level of quality it is routed back to the author who has to improve its quality or to withdraw it from the KEP.

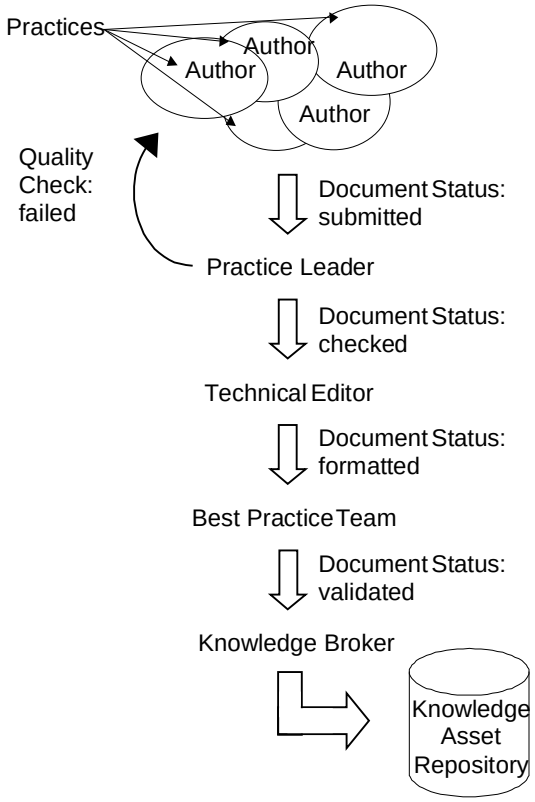

Figure 2: The Knowledge Extraction Process

The technical editor formats and designs the document

[3] A 'Knowledge Asset' is a document or a part of a document that contains valuable and reusable explicit knowledge that has been identified within the results of a project.

in conformance to corporate identity and style guidelines. The formatted and well-designed document is routed to the practice's best practice team which has to rate and classify it in terms of reusability, value for the company, innovation and degree of abstraction. The practice's knowledge broker transfers the rated and classified document to the knowledge asset repository. The primary difference between the knowledge asset repository and the project repository is the restricted access that guarantees that only the knowledge brokers are allowed to add documents to the repository or to modify and delete documents in the repository. Thus, a high level of quality and maturity of the tenors of the knowledge asset repository can be guaranteed.

But knowledge assets do not only differ in quality from the tenors of the project repository but differ also in quality compared to one another. After further reviews and a process of condensation and abstraction, knowledge assets can be declared as recommended practices, if the best practice team has the opinion, that the knowledge described therein should be applied to future projects. Those recommended practices can be elevated to an even higher level of quality by a methodology engineering team and can be classified as validated practices in the knowledge assets repository. If knowledge assets are incorporated into a company wide method database for project execution, they have achieved the highest degree of quality and abstraction.

Assignment and Skill Management Processes

In addition to the management of implicit knowledge via discussions and mutual learning about a certain topic in Communities of Practice and the management of explicit knowledge supported by the KEP, human resources management plays an important role in knowledge management in consulting companies. In order to provide the customer with best results, projects have to be staffed with consultants that have all required skills. In a small consulting company where everyone knows each other's skills, this process needs no professional support. But if the company expands to some hundred or more consultants, it will become impossible for project managers to know each consultant. As a result it will be more and more complicated to staff projects with the best suited persons in order to assign the appropriate and needed knowledge to a project. The processes that lead to a profound knowledge about the employees' skills are called skill management processes.

Consulting is a people's business and consulting companies only make profit when they sell a certain share (called *billability*) of the weekly working time of their employees to customers. It is important that the average time that each employee works in external projects is above this mark. In order to achieve this, assignment has to be set up in a professional way. Therefore the role of an assignment manager should be established whose task is to assign consultants to projects as good as possible in terms of their skills and their billability. The data the assignment manager needs to fulfil his task allow him to generate forecasts (e. g. the next six months) and to send a trigger signal to the recruitment manager if there is a gap between the required and the available human resources. In combination with IT-support for skills management, which enables the assignment manager to get projects executed by consultants that have the required skills, these knowledge management processes will lead to maximum customer satisfaction and employee contentment.

Knowledge Technology

This section deals with knowledge technology and introduces an approach for the automated capturing of implicit knowledge with intelligent software agents.

Motivation of the Technological Approach

Knowledge is not homogeneous. Figure 3 shows that there are many different types of knowledge that can be structured in three dimensions. (Warnecke, Gissler, and Stammwitz 1998)
One of these dimensions differentiates between the above-mentioned 'implicit' and 'explicit' knowledge.

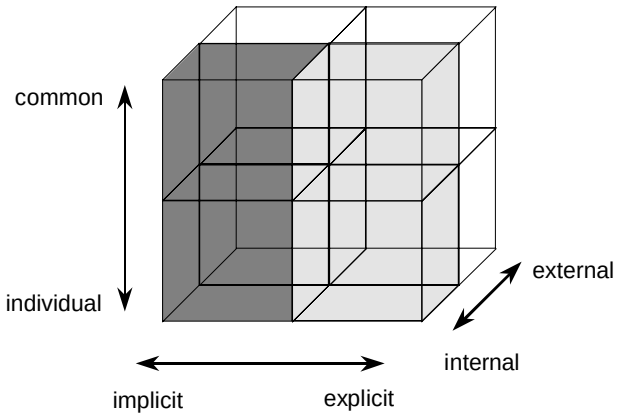

Figure 3: Dimensions of Knowledge

The other classifying attributes have the following meaning:

- Common knowledge is knowledge that is mutually shared within a certain social entity.
- Individual knowledge is knowledge that is owned by a single person and not shared with others.
- Internal knowledge is knowledge that is only accessible within a certain social entity.
- External knowledge is knowledge that is only accessible outside of a certain social entity.

Many IT-based approaches to knowledge management concentrate on the management of explicit knowledge that is captured in some kind of media, e. g. digital documents that contain knowledge assets. They provide support for storage, retrieval and versioning of the media the explicit knowledge is captured on, but they provide no support for

the *process* of capturing implicit knowledge and making it available to other employees or partners.

The experiences made at Siemens Business Services Management Consulting have shown that it is an unnatural behavior to think about one's own knowledge, write it down and process it in a way that makes it understandable and valuable for others. This behavior can be enforced and facilitated by processes like the KEP and by incentives but nevertheless it remains unnatural and arduous. The following approach covers both the management of explicit knowledge and IT-support for the process of capturing implicit knowledge with intelligent software agents (cf. (Maes 1994), (Edwards et al. 1997)). For an overview on the topic of software agents see (Brenner 1998), (Cheong 1996).

Figure 3 shows at the right-hand side on the front of the cube the external, explicit types of knowledge that many approaches to knowledge management focus on. In contrast to that our approach supports the transformation of the implicit types of knowledge at the left-hand side on the front of the cube to the explicit types of knowledge.

A certain part of a person's implicit knowledge is encoded into its behavior (cf. (Nonaka and Takeuchi 1995)). The central idea is that an intelligent software observation agent observes users when they work on tasks in their everyday work and automatically captures this evident part of their implicit knowledge. Typical knowledge that can be captured in this way is knowledge about processes which shows up in the sequence of steps when solving a problem or performing a task. It is the job of an information broker agent to analyze the knowledge that can be detected by the observations and to make it available to the other employees of the company.

The system comprises five different parts that are all dependent on each other. The five parts are:

- a structuring scheme for knowledge assets,
- an intelligent repository for historical data and context information,
- a software observation agent who observes users,
- an information broker agent who analyses the observation agent's observations and autonomously provides users with the appropriate knowledge assets and
- an intranet-based workspace that transparently integrates the underlying technology.

Figure 4 shows the five parts and how they are related to each other.

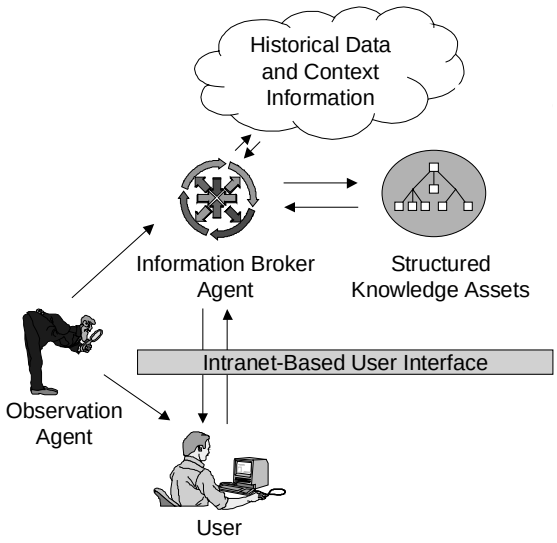

Figure 4: Interdependencies of the System Components

The user works in his intranet-based workspace on a task he has to fulfil, e. g., writing a proposal. Every single step he does that is related to fulfil this task is observed and stored by the observation agent. The information broker agent has access to historical observation data and context information, e. g., about pre-defined processes or recommended knowledge assets for certain steps in certain tasks. With this kind of background information it analyses the observation data and is able to decide which knowledge asset in the structured knowledge asset pool the user should use in his next step.

Structuring Scheme for Knowledge Assets

The multi-dimensional structuring scheme for knowledge assets is a vital pre-requisite for the other parts of the system and especially for the information broker agent. It has to decide which knowledge asset fits best to the needs

Structuring Dimension	Exemplary Attributes
Document Description	Author Title
Life Cycle	Publishing Date Expiration Date
Origin	Practice Related Projects Related Industries
Document Quality	KEP Status Level of Maturity
Related Processes	Project Acquisition Project Execution Marketing Human Resources Mgmt

Table 1: Dimensions of the Knowledge Asset Structuring Scheme

of the user in performing the next step of his task. Thus it is dependent on a complete set of meta data describing each single knowledge asset in the knowledge asset repository. Table 1 shows some dimensions of the structuring scheme and attributes within these dimensions.

User Observation with a Software Observation Agent

The observation agent is the system's major information provider. He has to observe the users during their work and to store the users' 'traces' in the repository for historical data and context information. Its intelligence focuses on determining which of the users actions are relevant for the solution of the task he is currently working on.

Repository for Historical Data and Context Information

The contents of the repository for historical data and context information comprise two parts. The first part contains context information. This information should be provided by subject matter experts in the company who know the processes and the best practices for certain tasks in their business. It is needed to decide which knowledge asset fits best to a certain task a user has to fulfil based on the process the task belongs to, the next step the user will have to do in this process and the structured meta data that is attached to the knowledge assets. The second part contains historical data that comprises of former observations that were made by the observation agent.

Observation Analysis with an Information Broker Agent

The information broker agent is the central component of the system and has to fulfil the following tasks (see Figure 5):

- interpreting the context data in the context information repository,
- analyzing the historical data and the current observations and
- deciding – based on the results of the other two tasks - which knowledge assets the user needs to solve his problems and to fulfil his tasks.

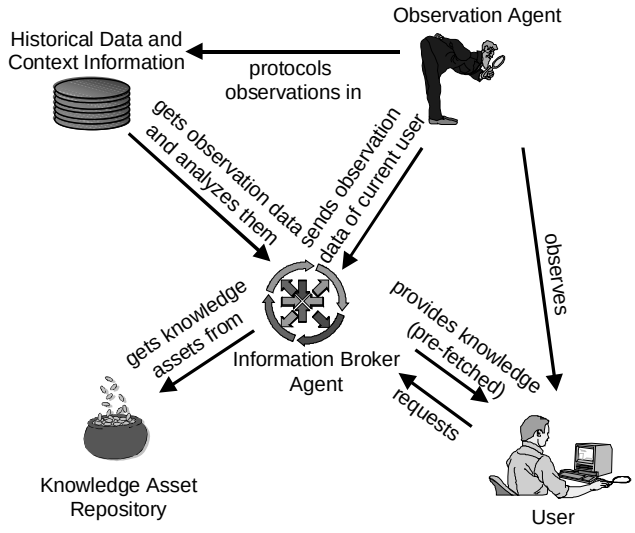

Figure 5: Central Role of the Information Broker Agent

The information broker agent has to decide which knowledge asset fits best to the needs of the user in the next step of the task the user is working on. That means that the information broker agent has to 'guess' which knowledge asset the user will need in his next step. In order to be able to make such decisions the information broker agent is conceived as a 'learning' agent that makes his decision based on the analysis of the historical data and the context information. If the steps of the user's current task have been pre-defined by a subject matter expert and this definition is contained in the context information repository the information broker agent will supply the knowledge assets referring to this definition. If there is no such definition of the current task the information broker will make his decision based on the statistical analysis of the historical data. That means that he will suggest the knowledge assets that the majority of the users used in the past in order to solve the task. It is evident that the information broker agent needs extensive information about the user's context from the context information repository in order to be able to find a decision that fits best to the needs of the user.

Integrated Intranet-Based Workspace

Intranet technology is one of the major enablers for the breakthrough of knowledge management in the recent years because it makes it possible to access enterprise-wide knowledge bases in a heterogeneous technical environment and to integrate them into a standardized user interface that is provided by internet browsers. It is not astonishing that the introduced approach is based on intranet technology as well. The user shall be supported by a workspace where he can create work products that – in the best case – consist of several adapted knowledge assets with some 'glue' in between.

Conclusions and Outlook

The outlined approach describes the changes in organization, roles and processes that are needed for the implementation and integration of knowledge management into a mid-size consulting company of about 170 employees. Important parts of this approach are the support for Communities of Practice as an inseparable part of the organization, the introduction of new knowledge roles that are responsible for the internal organization of the practices and certain knowledge processes – especially the knowledge extraction process – that make the management of implicit and explicit knowledge an integral part of the company's courses of business. Based on the experiences that were made an innovative technological approach is presented that supports the unnatural and arduous process of capturing implicit knowledge and making it available to other persons. The central idea of this technological approach is to capture the implicit knowledge that is encoded in the behavior of users working on certain tasks with intelligent software agents, analyzing these observations and therefore having the possibility to spread this knowledge to other users working on the same tasks.

This concept and its technical realization are in the early stages of development and deployment. A next important step will be to set up the knowledge asset repository structured by the structuring scheme. To enforce target platform independence as well as style and corporate identity guidelines for knowledge assets, the structuring scheme will be mapped to a Knowledge Asset Markup Language (KAML) which will be implemented in XML.

A critical success factor of the observation agent will be the ability to recognize the begin and the end of certain tasks and the context they are performed in.

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