

Challenge of Knowledge Management: From Theory to Practice

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Abstract: Knowledge in today's business has imposed itself as one of key factors that are defining success. As a result of that many companies, especially global ones, introduce knowledge management into their business processes to achieve optimal exploitation of knowledge. First part of this article addresses theory of knowledge management. That part describes key terms and relations between them, defines knowledge related problems in companies, as well as benefits of knowledge management. Beside that, it indicates importance of knowledge management strategy that is crucial for success and shortly describes fundamental types of technological implementation of knowledge management systems. In second part the article presents a case study of knowledge management implementation in global pharmaceutical company PLIVA. Within that part concrete experiences are described, from analysis and planning to implementation and its consequences.

Key-Words: knowledge management, system implementation

1 Introduction

In the field of information technology terms "data" and "information", and even "knowledge", are often used interchangeably as if they were synonyms. Between above-mentioned terms there are clear distinctions and their relations can be described by hierarchy pyramid model [12].

At the bottom of pyramid there are data, which constitute pyramid's base. Data can be defined as simple facts and observations of states of the world around us. Above data there is information, which is basically data with relevance and purpose. In other words, they have been placed within a context. At the third level of the pyramid there is knowledge. It is defined as valuable information with meaning. Above knowledge there is only one level and that is wisdom - knowledge with insight.

Generally speaking, any knowledge can be classified into one of the two main categories [9]. The first category is explicit knowledge, which is also referred to as formal knowledge. By its definition, explicit knowledge can be articulated into formal systemic language and thanks to that it is easily transmitted between individuals. At the other hand, there is category of tacit knowledge that exists only in people's heads. That kind of knowledge is personal, deeply rooted in experience and involves personal belief, perspective, and values. It is context-specific, hard to formalize and therefore hard to communicate.

2 Role of Knowledge in Business

Economists and business analysts have identified knowledge as the ultimate competitive advantage for modern company [12]. From that derives conclusion that acquisition and distribution of knowledge in companies is one of important prerequisites for success on the market.

In traditional perception of the role of knowledge in business tacit knowledge is often emphasized as key for success and creation of new values [2]. Reason for that view is the fact that explicit knowledge (e.g. market research results, business plans, patents etc.) is useful only in combination with individual's tacit knowledge, for which some assessments say that constitutes up to 80% of all knowledge in company [10].

There are six types of tacit knowledge [6]:

- **know-how:** knowledge that defines procedures needed for successful accomplishment of tasks
- **know-who:** knowledge that allows individuals faced with a specific problem to contact the right person in a search for solution
- **know-why:** knowledge which explains why is something done i.e. what is desirable objective
- **know-when:** knowledge that defines when to do something, and when not to
- **know-where:** knowledge which allows people to find what they need
- **know-that:** instinctive knowledge that defines correct course of action, closest to earlier mentioned wisdom

Due to difficulties in transfer of tacit knowledge, it is most frequently transferred by direct interaction between individuals [11]. That kind of transfer is very limiting,

especially in big companies with large number of employees. There is a theory "30-Meter Rule" in favor of that thesis. It was developed at Massachusetts Institute of Technology and it says that frequency of interaction between two employees working more than 30 meters apart is nearly zero [3].

Result of state in which knowledge is isolated in people's heads is situation in which companies "don't know that they know". In other words, they are not fully aware of their capabilities. Solution for this problem can be found in a process of knowledge management (KM). There is no general and accurate definition for knowledge management but it can be described as business process through which companies generate value from their intellectual and knowledge-based assets. Generating values includes knowledge sharing and collaboration between employees, departments and companies, all towards achieving best possible business practice and improvement of employee's performance. It is very important to perceive that definition of K doesn't mention anything about technology. Knowledge management is most often facilitated by technology, but technology by itself is not knowledge management.

3 Importance of KM Strategy

Many knowledge management projects ended unsuccessfully because of equalization of knowledge management process and technology. Purchase or development of IT system for knowledge management, without clear vision what is the final aim and how it will be accomplished, ends as expensive failure on regular basis [4].

It is also important to keep in mind that knowledge management project has no formal conclusion. When given objectives are achieved, it is necessary to focus on preservation of accomplished benefits. Circumstances in companies are constantly changing and therefore benefits could become lost. Beside that, it is important to continue with identification of further opportunities for improvement of knowledge management process. Framework of knowledge management strategy is based on five golden rules [6]:

1. Aims and benefits of KM project must be clearly and unambiguously defined

In the beginning of a project, it is necessary to take a snapshot of initial state, define desirable aims and appropriate approach to realize it. Great deal of caution is needed here to avoid defining aims that are impossible to achieve.

Identification of aims will result in some particular benefits for the company. We can categorize these benefits according to following categories:

- knowledge and information availability,

- development of personal competencies,
- internal business processes improvement,
- customer satisfaction increase,
- revenue increase in addition to controlled costs.

2. Employee's behavior must change for the long term

People are essential in helping deliver successful knowledge management process. Absence of their contribution will block necessary changes and put whole project on a standstill. It is a fact that people alter their habits very hard, the most common arguments against changing behavior are:

- **Personal gain:** Why should I share what I know if someone else gets the credit?
- **Time is money:** My performance is measured on financial results, not on the base of knowledge that I share.
- **Knowledge is power:** If I share what I know, that will reduce my position or make me redundant.

3. Without quality leader there will be no success

Knowledge management project leader has a key role in whole process. Besides addressing usual tasks, which are part of any large project, knowledge management project leader has to focus on employees to achieve change of behavior described in the previous paragraph. There are three areas of activity that are linked to employees:

- **Company leadership:** Project leader has to convince people on leading positions in company of importance of benefits brought by knowledge management. Based on that, he or she has to obtain their active support. That is extremely important because personal involvement of company leadership is the signpost that will follow a great majority of employees.
- **Knowledge brokers:** There are individuals who dispose of great deal of tacit knowledge, especially know-who type. Usually they possess large enthusiasm about the idea of knowledge sharing so they often get the role of project coordinator in particular company departments. Knowledge brokers are main drivers of knowledge management in the middle and lower company layers and they act as extension of knowledge management project leader.
- **Other employees:** The main task for a knowledge management project leader in this area is to create feeling of significance for every employee, no matter where is his or her position in the company hierarchy. Besides that, it is desirable to create the feeling of belonging to a community, to bring in some kind of excitement and challenge.

Stimulations in form of awards for most active employees can also have very positive impact.

4. Changes in business processes lead to improved performance

Performance is a consequence of existing business processes so it is logical to consider possible changes that could lead to performance improvement. It is necessary to analyze current business processes and ask yourself whether it can be done quicker, better or cheaper.

Determined demands for changes can be in range from small corrections to radical alterations. Practice shows that tradition is the greatest enemy to changes ("we have always done things this way"), no matter how logical or justified they are. Therefore, it is necessary to have firm support from the company leadership for any major change in business processes.

5. Organizational learning leads to organizational success

A company can succeed and advance on the market only if it has ability to learn from business environment. Information from case studies is especially valuable, so its creation should be encouraged.

Good case study is not difficult to constitute. It is enough to define the problem, explain how it was solved and clearly indicate the result. By usage of case studies employees can help each other to avoid repeating same mistakes (everyone learns on mistakes of just one individual) or solving already solved problems (in large companies a same problem is very often solved few times by different employees because of lack of appropriate communication).

4 Technological Implementation

The role of technology in knowledge management process is to allow delivery of the right information to the right person at the right time [5]. Information system that should help to create collaborative environment for employees needs following features [6]:

- secure storage for both structured and unstructured information in a variety of forms,
- easy access to data and information,
- easy publishing of own information and getting information from other people,
- searching, filtering and ranking information,
- "intelligent" help to employees to exploit available data, information and knowledge.

There is a lot of different solutions for knowledge management implementation. Choice of solution depends on particular needs for knowledge management in company. Some of the most often solutions are:

- document management,

- data warehouse,
- groupware,
- Intranet web portal.

Document management system usually has full support for handling the documents (version control, access control, document sharing, support for meta-data, full body search etc.) but that is also the only thing that it offers. Main disadvantage of the document management system is its inability to properly manage information that cannot be structured in form of documents.

In that sense, the data warehouse offers much more possibilities, it can integrate data in different formats from many different sources. Besides that, data warehouse allows users to include conceptual level of meta-data for describing and evaluating the meaning and quality of data. Limitation of data warehouse is its inadequate support for collaboration, communication and coordination between employees.

Exactly those functionalities are main features of groupware software. Time planning, notice board, application sharing, conferencing system and instant messaging are just some of available capabilities. On the other hand, difficulties are in storing and managing of information, what is very limited in groupware.

An information system with consolidation capability of all features mentioned above is the web portal, which at the same time assumes the role of the company's intranet. That is a much outspread way of technological implementation of information system for knowledge management support. There are a few good reasons for that.

5 Corporate KM Project in PLIVA

Pharmaceutical industry is very knowledge-dependant industry. For pharmaceutical companies acquisition of knowledge, as well as knowledge reuse, is the key element that determines success. On that grounds pharmaceutical companies, the global ones in particular, express great interest in knowledge management. Implementation of knowledge management in pharmaceutical companies presents big challenge due to usually conservative business culture (high confidentiality of data) that prevails in them.

First knowledge management initiatives in PLIVA emerged in the late 90's. At that time there was no technological implementation of knowledge management and no global corporate knowledge management strategy. However, there were knowledge sharing activities in different forms, e.g. at weekly scientific presentations, by internal publications and magazines, through close collaboration of project teams etc. In the next few years expanding and internationalization of the company (approximately

7.500 employees on three continents) made those methods unsuitable for further knowledge sharing.

Because of that, in 2002 PLIVA officially launched a project of knowledge management implementation, under the sponsorship of Management Board chairman. Knowledge management was defined as efficiently connecting employees in possession of certain knowledge and employees in need for that exact knowledge, accompanied by knowledge recording for the purpose of easier learning process in the future. According to PLIVA's understanding, essential objective of knowledge management is to make thinking and learning abilities more effective at the company level, especially in comparison to competition. All of that is done to realize maximum possible competitive advantage at the market.

The first step taken in the project was creating of SWOT (Strengths, Weaknesses, Opportunities, Threats) matrix to recognize current strong and weak points of the company in that field (Table 1).

<p>Strengths</p> <ul style="list-style-type: none"> ▪ knowledge management initiatives appeared early ▪ KM project is appointed and supported by Management Board 	<p>Weaknesses</p> <ul style="list-style-type: none"> ▪ numerous local languages (people communicate easier in the local language) ▪ lack of global and integrated IT infrastructure
<p>Opportunities</p> <ul style="list-style-type: none"> ▪ dramatic improvement of effectiveness and efficiency accompanied by raising of competitive response ▪ integration of internal and external knowledge 	<p>Threats</p> <ul style="list-style-type: none"> ▪ cultural differences within the global company (different counties have different cultures) ▪ unrealistic expectations by the management

Table 1. SWOT analysis

Early knowledge management initiative and active Management Board support were recognized as strong points. On the other hand, numerous local languages, regardless to the fact that official corporate language is English, were identified as one of the main weaknesses. Besides that, some potential integration problems due to heterogeneous IT infrastructure were also recognized. After an initial analysis, the project was divided into three non-overlapping phases:

- global infrastructure development, realization of human and organizational fundamentals for knowledge management,

- recognition of knowledge areas that are critical for PLIVA's business and steering of knowledge management process towards it,
- internal knowledge integration with knowledge from business environment, accompanied by development of new strategic knowledge.

In the course of the first project phase, adequate IT infrastructure was developed to fulfill the conditions for knowledge management implementation. Also, PLIVA's employees that are experts for particular areas were recognized and recruited as knowledge brokers. Popularization of knowledge sharing between employees was realized by internal marketing and a rewarding system was established for the purpose of additional motivation. This phase is over and the project is currently entering into the second phase.

6 Knowledge Management System STRIX

After analyzing available commercial solutions for knowledge management, PLIVA concluded that those solutions had extremely unfavorable price-capability ratio. Concurrently, successful collaboration with Faculty of Electrical Engineering and Computing in Zagreb was in progress for the last two years. During that time, PLIVA's IT department was giving consultant support to Faculty's project of Content Management System (CMS) called FERWeb CMS. Current situation analysis had shown that the best cost effective and quality knowledge management solution could be realized by further development and adjustment of familiar FERWeb CMS. In that way an acquisition and customization of some new and unknown application was avoided.

Essential idea was to use FERWeb CMS as foundation for development and to realize, with appropriate upgrade, a knowledge management system in the form of a global corporate intranet. Accordingly, in a short time after decision about in-house development of the knowledge management system, PLIVA and Faculty of Electrical Engineering and Computing signed a contract for purchasing FERWeb CMS and its ownership rights. At the same time, PLIVA raised the level of IT expertise needed for project realization by recruiting three project engineers - programmers that were part of FERWeb development team during their undergraduate education at the Faculty of Electrical Engineering and Computing.

The project of knowledge management system development and implementation started at the beginning of May 2003. Two project teams were established: KM core team which had about 15 members from different PLIVA's departments who were conducting knowledge management strategy and the IT team which had 10 members who were developing the

system itself. All members of both teams were PLIVA's employees.

The main difference between content management system and knowledge management system is that knowledge management system has additional functionalities that allow advanced organization, presentation and retrieval of stored information. According to that, IT team started the transformation of FERWeb CMS into the desired knowledge management system. Members of the IT team were: the project manager, who also coordinated collaboration with KM core team, system architect who was at the same time the IT team leader and eight project engineers - programmers.

The transformation lasted for the next 12 months. The main aim of that process was to keep FERWeb's simplicity and efficiency in information storage, along with development of functionalities that are characteristic for knowledge management system. During that entire period, IT team closely cooperated with KM core team that was constantly giving valuable feedback.

This was a task of large proportions since the development of needed functionalities demanded changing most of original source code in combination with expansion with new one. The number of lines of source code is no good indicator but it can give general impression about the scope of the work: original FERWeb CMS source code had about 20.000 lines of code and knowledge management system had about 120.000 lines of code after first 8 months. The completed knowledge management system was launched on January 1st, 2004. The final phase of development lasted for the next four months, simultaneously with the production phase.

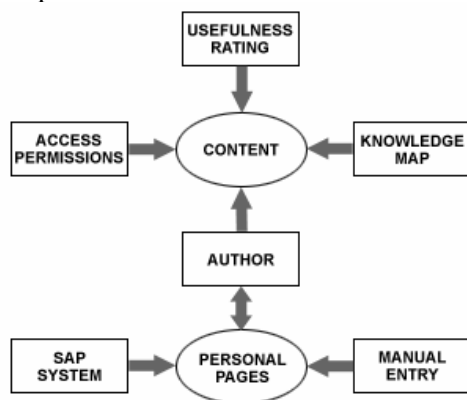


Fig. 1. The system STRIX

The final product, the knowledge management system in a form of web portal, was named STRIX. It is based on Open Source components: PHP script language and Smarty template engine, PostgreSQL database, Apache web server and Debian GNU/Linux operating system. It has a high level of data integration (Fig. 1) and

many functionalities, among which the most important are:

- **interconnection between employees through Blue pages** - These are the pages with different data about employees. A part of the data is automatically updated through synchronization with the SAP system (e.g. employee code, cost center, position in company, formal education, contact data etc.) while other data are manually updated by employees according to their aspirations (areas of interest, professional experience, involvement in particular projects, specialized education, seminars etc.). Besides that, the system records activities of each user in sense of content publishing (documents, news, frequently asked questions, discussions etc.). The main benefit of Blue pages is the ability to find employees with particular knowledge by searching the pages.
- **knowledge map** - Taxonomy of the terms that are relevant to PLIVA's business, are arranged as a hierarchical tree. The knowledge map supports use of synonyms, as well as defining different weights for different terms. During content publishing, one or more terms from knowledge map are linked to content in question. It is advisable to select terms that are deep as possible in taxonomy tree i.e. terms that cover small areas of interest. Knowledge map is very useful when it is necessary to find all content that belongs to some specific area. That is especially perceivable at terms for which there are synonyms that are not obvious. For example, Sumamed is a proprietary name for the drug that is manufactured in PLIVA. International non-proprietary (generic) name for the same drug is azithromycin. On the US market this drug is manufactured by Pfizer and drug's proprietary name there is Zithromax. During content publication, the author of the content links it with all three terms. At the same time, an author can define access permissions for user groups or particular users on that content. This activity will be recorded by the system on the author's Blue pages. The rest of employees will be able to find published content by searching knowledge map in combination with any of the three mentioned terms (Sumamed, azithromycin, Zithromax). The only condition is that their access rights must match access permissions defined on the content.
- **content usefulness rating** - Every employee can rate usefulness of particular content on a one-time basis. The range of rates is between 1 and 5, but there are contents for which that scale is too large (e.g. news). In that case employees can mark content as interesting one.
- **advanced search** - The search engine recognizes different word forms in English and Croatian

language. It is possible to perform a full-text search through documents that are written in some standard format (MS Office formats, PDF etc.). Search results can be grouped according to content type (e.g. news, documents, employees, FAQ, events in calendar etc.). It is also possible to search only some content types or to search content according to specified modification date range. Content usefulness rating affects on order of the search results, so content with higher rate is more on the top.

- **content subscriptions** - Knowledge management system users can subscribe to content change within a whole page (all changes), particular content type on a page (e.g. news changes) or a particular content entity (e.g. some specific document). When content changes, the system finds all users who have subscription criteria that fit to the change. These users get notified according to their user preferences (time period: immediately, daily, weekly and/or monthly and media: e-mail and/or intranet).
- **access permissions** - It is possible to define different access permissions per user groups or particular users. In that way, accessibility of particular content is controlled at the user level. Access permissions are propagated through the whole system so e.g. a search returns search results according to access permissions of the user who sent the search request. Besides that, access permissions allow establishing of content publication control: usually every user can suggest the content publication anywhere in the portal but suggested content will not become visible until it is allowed by responsible editors.

Apart from technological support to the knowledge management process, STRIX has the role of integration platform for miscellaneous IT solutions in different departments. So far STRIX has been successfully integrated on data exchange level with SAP, Documentum and Microsoft Sharepoint systems.

About ten months after launch, PLIVA's knowledge management system STRIX has become freely accessible to the public in the form of a light version under conditions defined by GPL (General Public License). Free version of STRIX includes all main and general functionalities while advanced functionalities, specific for business processes, are protected by commercial license.

7 Derived Lessons

First signs of knowledge management benefits became visible after about six months when system accumulated sufficient amount of information. After critical mass of information has been entered into the

system, the system began to profile itself into the main media for communication and knowledge exchange within the company.

Thanks to diversity of functionalities, the knowledge management system STRIX managed to back up all six types of tacit knowledge:

- **know-how:** Complex proceedings and algorithms for accomplishment of tasks can be written as formal documents, which are then managed through the document manager. Simple procedures can be defined in the form of frequently asked questions or be provided during forum discussions.
- **know-who:** Fundamental source of information about employees' knowledge are the Blue pages; it is possible to find persons with particular knowledge or professional interest by searching it. Besides that, author is defined for most of accessible content inside the knowledge management system and that information can be used for additional contact between employees regarding further explanations.
- **know-why:** Motivation of employees greatly depends on their comprehension why they are doing something. Particular actions of management and wider context of company's operations (e.g. vision, mission, key values) are being explained by news, announcements and press releases. That type of content can have attachments (e.g. relevant documents), as well as forum discussions addressing the issues in question.
- **know-when:** Different time-dependend information is being published in an event calendar, as standalone entities or as part of particular news. Public events in calendar can be published at the Company level or some department level. The calendar also allows entries regarding private events.
- **know-where:** Ability of quick and simple information retrieval has been realized by means of advanced search engine and knowledge map, as well as through logical content categorization and intuitive navigation.
- **know-that:** Creation of virtual communities enables experience exchange that is vital for transmission of this tacit knowledge type. Virtual communities are being realized as separate intranet sub-pages, which are in dispose of all the system's functionalities (news, document management, FAQ, discussions etc.).

After a full year of operational status, a global research among PLIVA's employees was conducted for the purpose of determining the impact of implemented knowledge management system. Using grades in range from 1 to 5, employees rated importance of main intranet's features concerning their job and satisfaction with realized in relation to assumed importance (Table 2).

Feature	importance	satisfaction
accessibility	4.48	4.37
page loading speed	4.40	4.25
functionality	4.11	4.01
- Blue pages	4.38	4.26
- search	4.34	3.98
- content subscription	3.78	3.79
- ability to suggest content	3.87	3.82
- document sharing	4.19	4.19
TOTAL	4.33	4.21

Table 2. The impact of implemented KM system

Altogether, 927 employees took part in that research and they evaluated three features of the knowledge management system. The first evaluated feature was the system accessibility, which depends on system's stability during work and network infrastructure integrity. Next feature was the page-loading speed which directly depends on system's functional complexity. This factor can be affected by the source code and database optimization. The last feature evaluated by users was the overall functionality and that was realized through evaluation of five individual functionalities characteristic of the developed system.

Results showed that accessibility was the most significant feature, followed by page loading speed and overall functionality. According to user's satisfaction, ranking of the above-mentioned features was the same. Among functionalities, Blue pages were rated as the most significant, followed by search, document sharing, and ability to suggest content and content subscription. Ranking according to satisfaction was almost identical, except traded positions for search and document sharing. On the bases of that research, key components of the system that were most important for the users were recognized, as well as components which needed additional improvement. Relevant actions have been initiated in accordance with these discoveries.

8 Conclusion

Laws of modern market impose intellectual capital as the most valuable asset, which a company can own. Intellectual capital walks out of company every day in heads of employees, so it is necessary to adopt some kind of its preservation and later reuse. Because of that, PLIVA decided to implement a knowledge management system. That process wasn't cheap; it required great deal of effort, time and resources before benefits became visible. The main obstacles were individual issues of employees who often focus only on competition of their projects and because of the tight

schedule they don't have time to share knowledge and help other employees.

After initial adjustment period of six months, PLIVA's employees began to use the knowledge management system more and more. Main consequences were an increase in use of company's knowledge base, enabled interconnection and gained higher quality in collaboration between employees, which resulted in enhanced performance. Identification of experts for particular areas and affiliation of employees with similar interests were eased by usage of the knowledge management system, which also lead to faster problem solving. The knowledge management project was successful and that was confirmed through above-mentioned research, in which after only one year of its use, employees rated knowledge management system importance with high grade of 4.33 (86.6%).

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