PRELUDES TO KNOWLEDGE*

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A knowledge society may be characterised as a society which economy, production and markets are organized on the basis of knowledge. Knowledge is thus the moving force behind economic development and is the property of him, who is its rightful owner and who knows how to utilise it. A great deal of professional and scientific literature therefore deals with the role that knowledge plays in an organisation. Knowledge influences and changes social and culture surroundings as well. Its implementation in social life can positively influence or even change the quality of life.

The monothematic issue of Scientia agriculturae Bohemica contains scientific articles, which deal with the study of knowledge in three different domains:

(1) Theoretical delimitation of the notion, implementation of metrics, understanding knowledge in various types of environment.

(2) Representation of knowledge, transfer of knowledge and implementation of knowledge in various environments with the help of a mathematical model and through the methodology of mathematical modelling systems.

(3) Sharing knowledge in companies and schools, and creation of a knowledge based curriculum.

The article introduces, describes and explains specific notions in the area of knowledge based engineering and an analysis of chosen problems is made with the aim of delivering to the reader scientific discussion of problems which may elucidate issues, which will be addressed in detail in the presented articles.

data; information; knowledge; metrics; measure; mathematical model; knowledge map; definition of knowledge; knowledge representation; knowledge transfer; Ba concept; product-centered approach; process-centered approach; expert system; knowledge elicitation; knowledge life cycle in company; knowledge life cycle in higher education

1. Introduction

In the contemporary knowledge economy most organizations depend for their value and competitiveness on the development, use and distribution of knowledge-based competences. Knowledge increasingly becomes the key strategic resource of the future development. Although transfer of knowledge within organizational structures can be realized through many different ways, these all have one common base: education and training. It is impossible to transfer and share knowledge among employees without having well developed and well functioning educational systems in organization.

A knowledge society is often considered as a knowledge economy and knowledge based enterprising where knowledge is an organizational asset. That is why most of the scientific literature deals with knowledge in organizations. But knowledge society concerns also population outside organizations where transfer and share of knowledge can substantially increase the quality of their private and social life. It is a challenge to develop new forms of further education, adult education, self education, networked people and educational institutions.

For universities it is the challenge of seeking fundamental insights how to help organizations and people to nurture, harvest and manage the immense potential of their knowledge, to help them to create new maps and measures and reinvent themselves in order to innovate and excel in the context of the knowledge society.

This special issue of the Scientia agriculturae Bohemica magazine offers the reader a series of specialised articles concerning both the process and product approaches in knowledge transfer and knowledge exploitation (a) in organizations and (b) among professionals involved in higher education. The authors are concerned with a wide spectrum of problems of contemporary knowledge management in companies as well as knowledge in tertial education which – in many cases – serve as environment for sharing knowledge among professionals and interested public.

This introductory paper involves the reader in generic problems discussed and solved in the presented articles, explains and deals with different approaches to knowledge phenomenon which depend on time, place and environment in which knowledge is applied for the benefit of humankind.

The articles may be divided into three groups according to their content:

1) Definition of knowledge and description of a knowledge life cycle. Here, more precise differentiation among categories "data, information, knowledge" helps the teachers and managers to better understand

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the revolutionary role of knowledge in the contemporary "knowledge society".

2) Mathematical models, system modelling and meta-modelling used in knowledge representation, knowledge storage and knowledge transfer. These techniques enable one to work with knowledge in a highly structured and precisely defined environment.
3) Knowledge sharing within an educational process in schools and companies: creation of a knowledge-based curriculum, work with texts and information sources, evaluation and assessment of knowledge education.

In the following paragraphs I do not intend to examine and describe the various aspects of knowledge mentioned in the presented articles, nor do I want to analyse the various perspectives taken by theorists in this field. My interest is not focused on *what knowledge is.* Rather I am concerned with *what knowledge can do.*

2. Problems with the definition – historical point of view

Knowledge is a category associated with human society for centuries and first of all it is studied in philosophy as one of its main branches concerning metaphysics, epistemology (or theory of knowledge), ethics, and logic. The theory of meaning and formal logics is now being regarded more as a part of mathematics, whereas epistemology remains the core subject discussed in different philosophical schools. Philosophy today is thus concerned with the common core of human knowledge and experience and also with the concepts, modes of argument, and foundations of other special subjects, so that there are, for example, philosophies of science, history, art (aesthetics), politics, and religion. All these disciplines are based on knowledge.

In Plato's dialogues the relation between knowledge (epistêmê) and skill (technê) is complex and surprising. In the Socratic dialogues characters frequently cite technê as a way of illustrating important points in their philosophical conversations. In dialogues we can clearly recognise the two aspects of knowledge: *activities* which are associated with the word *technê* and the system of *understanding, cognisance and insights believed as true* associated with the word *epistêmê.* Neither Plato nor other former as well as contemporary philosophers give us a sufficient definition of knowledge. The definition of knowledge is still a live debate for philosophers. To be qualified as knowledge, according to most thinkers, at least three criteria must be fulfilled. A thought must be justified, true, and believed. These, however, are not sufficient, as many case examples demonstrate (1).

In spite a number of books, reports and studies, neither researchers nor practitioners proposed a satisfying definition of "knowledge". The term is used loosely to refer to a broad collection of organizational practices and approaches concerned with generating, capturing and sharing knowledge that is relevant to the organization's business. Thus many definitions used to describe the confident understanding of a subject, potentially with the ability to use it for a specific purpose, can be more or less considered an *explanation* rather than an exact *definition* (2).

Similar debates about the meaning of knowledge have continued for thousands of years, and seem likely to continue for some time.

3. Problem with the definition – today

Contemporary scientific literature offers a whole array of various definitions of the notion of knowledge – from simple definitions, expressed in one sentence to more complex constructions, demanding many more words. Here are some examples:

"Knowledge is experience or information that can be communicated or shared" (Alle, 1997).

"Knowledge is understanding based on experience" (James, 1907, cit. Schreiberg et al., 2002).

"Knowledge, while made up of data and information, can be thought of as much greater understanding of a situation, relationships, casual phenomena and the theories and rules (both explicit and implicit) that underlie a given domain or problem" (Bennet, Bennet, 2000).

"Knowledge is the capacity for effective action" (Argyris, 1993).

„Knowledge is information about information" (Firestone, 2003).

Why are these definitions so different from one another? Perhaps it is because knowledge is used in different situations and people define it according to their needs. Knowledge has a different function in schools, in companies and in practical life. Even there it depends on specific time and circumstances.

For further explanation it is nevertheless necessary to create a definition, which will be sufficiently general and applicable in various types of environment. From the above mentioned definitions we may formulate our own definition, which fulfils the demands of the criteria we have set up:

"Knowledge is information which is used to solve successfully a problem and can be shared with others to solve or facilitate the solution of similar problems".

What does this definition say?

1. First of all in our definition knowledge is defined as information. In order for information to become knowledge, it must be used in a unequivocal and specific manner: (1) it must be used for solving a problem, (2) the problem must be successfully solved, (3) the solutions to the problem must be available to those who deal with similar problems.
2. Between the notions of "knowledge" and "problem" there is a clear and causal interdependence. *Without a problem there is no need for knowledge.* How do we proceed when solving problems? We seek the necessary information which we use for solving the prob-

lem. With the help of relevant information we analyze the problem and construct the algorithm needed for the solution. We find solutions to problems with the help of information, which we set in motion, in action.

3. The expression "successful solution" is important for our definition. Only the information and the process of using this information for a successful solution of the problem may be qualified as knowledge. If wrong information was used for solving the problem or proper information was used in a wrong way and thus a wrong solution was attained, such "moving information" can not be qualified as knowledge. It is but one method of solving problems through information, the so called method of trial and error.
4. The prerequisite of our definition is that knowledge, as information used for successful problem solving, "the right thing at the right time", may be given to others and used for solving analogical, related or similar problems, is important. Without this prerequisite our definition would be describing information, not knowledge.
5. Our definition of knowledge – as well as all our other concomitant definitions – is an explanation of the notion of knowledge, rather than being purely its definition. This is because the word "successful" is in itself problematic ("to successfully solve a problem"). Without this notion our definition would factually not define the concept of knowledge. The term "successful" is much too vague. What does "successful solution" mean? When solving exact mathematical problems, where algorithms lead one to the solution, or prove that there is no solution, the words "successful solution" are clear and meaningful. In natural sciences we also deal with problems and solutions. Solving problems related to social sciences is more difficult. Algorithms (or other means for finding solutions) generally offer more options for solving problems. The problem solver has not got only one choice. He always chooses according to a specific criterion, or multiple criteria, often according to his or her personal opinion, sometimes preferring economical, political or sociological criteria. Thus a new category is added to the notions of "data, information, knowledge", a category insuring the choice of the "best possible" solutions from a number of existing "successful" solutions. That is wisdom. The well known triad – data, information and knowledge – is thus enriched with a fourth dimension: data, information, knowledge, wisdom.

4. Representation and transfer of knowledge

Data and information may be described with the help of alphanumerical signs and symbols which may be kept and diffused in such forms. If we wish to work with knowledge, conserve and diffuse it, we inevitably must use a different form, the *literary* form or narrative. The representation and diffusion of knowledge through literary form is an essential and crucial aspect by which we distinguish knowledge from information.

The literary form of knowledge representation is often hidden in formal expressions, by which literary forms – narratives – are expressed in symbolic language. A symbolic form, expressed in a narrative, may be an abstract formation; there is always a story, describing knowledge, which is hidden within it.

Here are examples of knowledge representations with stress to their literary forms:

Text form

Literary sources and resources which describe problem resolution procedures, information use, instruction and concomitant solutions – those are the usual and often used materials in education, scientific work and even in day to day life. Knowledge contained in these sources are "mined", studied, further elaborated, diffused and conserved. In these cases the literary form is quite evident.

Picture form

The famous painting by Hieronymus Bosch "Haymaking" tells a story, which anyone who closely observes it can interpret in a narrative form: a pious procession encounters a wagon filled with hay, pious men and women pass by, snatch a small bundle which transforms them into to monsters, the procession falls apart etc. Knowledge expressed in this painting and in its hidden story is evident and anyone can recount it for his or her needs and usage, or for the needs of others.

Titles and names

Titles of narratives and names of persons, such as "The victory of Pyrrhus", "The story of the merciful Samaritan", Pasteurisation", "Xantipe", evoke narratives, which are generally known to people. A solution to the problem is at hand – knowledge – which may be useful for solving similar problems. For example it makes it possible to solve the problem of a marriage with a shrew and swift-tongued woman (Xantipe and Socrates). Narratives are expressed as titles or names – everyone has heard them in different forms and in his turn passes them down enriched with personal experience.

Formulas and symbols

Some branches of science have created specific forms, wherein a literary content of knowledge description is expressed in symbols. In Chemistry these are specific chemical formulas. The narrative expressed in the formula $C_{10}H_8 + 12\ O_2 \rightarrow 10\ CO_2 + 4\ H_2O$ describes the burning process (violent oxygenation) and an educated chemist is able to explain it in words as well. A description, which would require even several pages of written text (narrative) is expressed in the simple, symbolic language of a chemical formula. Other symbolic formulas which describe complex events and knowledge are to be found in other sciences, e.g. in physics ($E = mc^2$), mathematics ($x_{1,2} = \{-b \pm \mathrm{sqr}(b^2 - 4ac)\}/2a$), philosophy (C&D Rule – Descartes), etc.

Charts (Diagrams)

Mendelejev's table of elements is a chart, which conceals narrations describing knowledge which solves a whole series of factual problems. A user, who is educated in this field, is capable of gaining knowledge from it, enabling him to solve many highly specific problems. He may describe the procedures for solving these problems in words, using many pages. Another type of chart describing the solution to a problem may be in form of a diagram, expressing stock market indexes, weather forecasts, offer and demand of specific goods etc. The divinatory Tarot is also a kind of chart, by which a student of the Socrates´ methods may be able to explain his or her own spiritual state.

Abstract models

Mathematical models enable one to save, represent and disseminate some specific types of knowledge. In descriptive models information processes for solving problems are expressed in an algorithm, in normative models "successful solutions" through one or more criteria functions add further added value. A mathematical model, which conceals knowledge, is the basic element behind most artificial systems of expertise. If it is fitted with a suitable communication set up and user, it can create other forms of knowledge representations, such as formulas, symbols and charts.

Saving and presenting knowledge in to a non-textual environment has advantages as well as disadvantages:

1. If knowledge is expressed in a literary form, i.e. in a descriptive text form, it is saved and shared with other users in this unchanged form. The user can further study and process the text according to his or her needs. This is the *passive source and active user* principle.
2. If knowledge is expressed in symbolic form, i.e. if it is not expressed in text form, it must be adapted in text form later on. This always requires education, qualification and activity on behalf of the user, who must understand the symbolic representation of knowledge and who must also be able to transpose such representation into text (word) form. This is the *active source and active user* principle.

Symbolic forms of saving a disseminating knowledge are important in both scientific and pedagogical work. For a scientifically educated scholar symbolic representations of knowledge save a lot of time and give him additional space for personal interpretation, modification and understanding. An educated pedagogue may create from symbolic representations of knowledge study materials or verbally presented lectures, which are "tailored" exactly to the needs and requirements of his educational environment. He may thus enrich the content of his own experience and subsequently also update it.

5. Distinguish among data, information and knowledge

In everyday language, it has long been the practice to distinguish between information, i.e. data arranged in meaningful patterns, and knowledge, i.e. something that is believed, that is true (for pragmatic knowledge, that works) and that is reliable. The interchangeable use of information and knowledge can be confusing if it is not made clear that knowledge is being used in a new and unusual sense, and can seem unscrupulous insofar as the intent is to attach the prestige of knowledge to mere information. It also tends to obscure the fact that while it can be extremely easy and quick to transfer information from one place to another, it is often very difficult and slow to transfer knowledge from one person to another.

For centuries pedagogical science fails to distinguish the concepts of data, information and knowledge. Students of pedagogical schools learned the same thing in the middle-ages as they do today, namely that the aim of education is to teach pupils *acquirements* and *skills*. These two concepts are never dissociated in pedagogy (3). On assimilation of acquirements and skills stands our entire pedagogical understanding of knowledge as a dynamic and creative process, in which information is used to solve problems. Acquirements and skills are required for that purpose. What is the use for a student to know of a practical problem, even to know when, where, how and what information to use for solving it, when he does not know how to apply the process in practice?

In English there is no plural to the word "knowledge". Knowledge is understood to be something complete, compact and final. Even in Czech, and presumably in other languages as well, knowledge is understood to be a complete, finished a finalised thing. This feeling corresponds well with the afore mentioned definition: knowledge results from the application of information at the right place, at the right time and in the right way – the result of a process (algorithm), in which information has been used for successfully solving a problem (mostly solving a complex problem).

Knowledge is directly connected with the solution of a problem and according to the complication of a problem we may also qualify knowledge as such. If the word knowledge is expressed without an attribute it is expected that this knowledge is the fruit of a solution to a complex (complicated) problem. If knowledge comes from the solution of a simple problem, we can speak of basic or *elementary knowledge*. These concepts are frequently used in pedagogy and didactics of education where they are relevant. On the other hand in epistemology and information engineering they appear to be irrelevant.

Information engineering describes knowledge formalisation in conditional clause of the type

If (A) then (B).

This simple logical implication of the formal description of knowledge is in accord with our definition:

If (A) then (B) = If (you use this information, this way, at this place and at this time) then (the given problem is solved).

For formalisation of knowledge information engineering may use similar logical structures, which allow mod-

elling of more complicated structures. The representation of knowledge as dynamic information is nevertheless maintained.

Some information engineers consider "data" and "knowledge" as different types of information. Here, information is not made from data. Data and knowledge are made from preexisting information – that is "just information", data, knowledge, and problems are used in the knowledge life cycle to produce more information, including new knowledge. In this view the standard triangle "data, information, knowledge" changes to the cycle (Firestone, 2003; Schreiberg et al., 2002). This is logic approach of information engineers who are not interested in the qualitative content of knowledge but deal with its inner structure which is information.

The necessity for distinguishing information from knowledge and knowledge from information arose relatively recently. Ten years ago we were living in an information society. Today we are at the threshold of a society of knowledge, a knowledge society. The cause of this change and the driver of knowledge society is without doubt the market, which has identified, in a competitive market environment, knowledge as the moving force of economic development in a company as well as an authentic company asset. Knowledge has become the strategic potential in the development of companies and institutions and that has directly influenced other sectors of social life, particularly educational and schooling.

The passage from information to knowledge society is logical and necessarily derives from the state of the information society at the end of the nineties of the past century. Information technology, communication, which enables easy, fast and secure transfer of data as well as the progressive increase of information literacy in society, have caused a considerable rise in the volume of available data and information, which have been lying around without being taken advantage of. The situation is similar to that of having warehouses full of good quality and well stocked building material which is simply waiting for an architect, who will design the buildings and choose the construction managers who will build according to his plans. As an architect can draw up a plan for a house or a cathedral, a company manager may propose the manufacturing of goods or the future way of conducting business simply on the basis of knowledge. In the upcoming knowledge society the role of the architect will be taken up by company and institution knowledge management, the role of a construction manager will be taken up by a knowledge engineer.

6. The concept of Ba

The concept of "Ba" was introduced in 1996 by Ikujiro Nonaka and Noboru Konno (Nonaka, 1995). Since then, it has played a major role in the Japanese way of knowledge creation. It now belongs to the *specialized jargon* of those involved in knowledge management east of Europe, whose approach of knowledge management is different from that ICT oriented one in the West. The representation of Japanese culture in this concept makes it not so easy to understand through Western languages using a unique word, clear, distinct and without any shadow. Other misapprehension dwells in the Egyptian mythology which is well known in the West, where "ba" and "ka" are names for two substances of human personality. Here "ba" is associated with divinity and power and remotely resembles the role of "Ba" in the Nonaka concept. (4)

For Nonaka, a "Ba" could be thought as a shared space for emerging relationship. This space can be physical (e.g. office, dispersed business space), mental (e.g. shared experiences, ideas, ideals) or any combination of them. What differentiates it from any ordinary human inter-actions is the concept of knowledge creation. "Ba" provides a platform that a transcendental perspective integrates all transformation needed.

"Ba" may also be thought as the recognition of the self in all. The origin of "Ba" dwells in the European philosophy of Existentialism, where the basic ideas correspond well with Far East culture and thinking. The existentialists reject the methods and ideals of science as being improper for philosophy and argue that objective, universal and certain knowledge is an unattainable ideal. Existentialists do not make the traditional attempt to grasp the ultimate nature of the world in abstract systems of thought. Instead they investigate what it is like to be an individual human being living in the world. Thus every person must make his or her own decisions with only limited knowledge and time. Ultimately he or she is fully responsible for the decision chosen. According to existentialists people learn about themselves best by examining the most extreme forms of human experience.

According to the theory of existentialism Nonaka's "Ba" is a context of the mankind meaning in which data, information, experience and shared knowledge create new knowledge. Thus, we consider "Ba" to be shared space that serves as a foundation for knowledge creation. Processes, which were modelled theoretically in the human mind, Nonaka transposed directly into institutional practice. According to Nonaka the same processes suggested in the human mind are recognised in knowledge based institutions.

Nonaka's Chi-Management (where Chi can be translated as knowledge, wisdom and mind alltogether) is a spiral, continual and vital process involving (a) data, (b) information and (c) mutual share of experience with other people. Nonaka describes this process by a simple formula

$$K = (D+I)\,s$$

K denotes knowledge, D and I denote data and information respectively, s denotes sharing them with other people. A process of creating knowledge K is realised through experiencing and learning numerous data D and information I as well sharing s them with people. The process is depicted by a spiral pyramid ("Chi Pyramid") in which $(D+I)$, where data and information is before

formulating knowledge, is called " Ba of Chi". The syllable "Ba" is represented as a part of the Chi Pyramid which describes the cycle SECI (socialization, externalisation, combination, internalisation).

Eastern and Western concepts of knowledge differ also in historical perceiving of intuitive knowledge:

In the West, intuitive knowledge has often been devalued in favour of rational scientific knowledge, and the rise of science has even led to claims that intuitive knowledge is not really knowledge at all. It seemed to be contradictory to known and checked statement that "management (using knowledge) is many times more art than science".

On the other hand, in the East, the tradition has been to celebrate the importance of the intuitive, in comparison with the rational. (5)

Some Western authors try to formulate equivalents between Japanese concepts and the Western ICT based formulations in order to avoid misunderstandings.

Nonaka and his colleagues are considered to be founders of "Ba" concepts (or SECI scheme) of knowledge creation in an organisation. But not so long ago, in 1966, a similar concept was proposed by Karl Popper in his work "Objective Knowledge". In those days knowledge management was not implemented in institutions. Popper's ideas came too early to become known among managers (6).

7. Product and process approach to knowledge implementation

Knowledge management has moved from an early premature phase, characterized by considerable hype and confusion, to a state of relative maturity, in which the value it brings to business and government organizations is not disputed. The adopters of this new discipline have followed different approaches with varying emphasis on technology, cultural, organizational and managerial issues. Nevertheless, if one looks into the research landscape as well as into the business applications, it is easy to notice that two main perspectives for KM are usually employed: the "product" and the "process" approaches.

The "product" approach implies that knowledge is an object, e.g. thing that can be identified, located and manipulated. This means that knowledge is possible to capture, distribute, measure and manage. This approach mainly focuses on products and artefacts containing and representing knowledge. Usually, this means *content* of documents, their creation, storage and reuse in computer-based corporate memories. Product approach to knowledge treats knowledge as an *entity* and separates it from the people who create and use it: documents with explicit knowledge are preceded and stored in repositories where they can be easily retrieved. Examples include: best practice databases, case-bases which preserve older business-case experiences, knowledge taxonomies and formal knowledge structures.

The "process" approach is directly associated with education and puts emphasis on ways how to promote, motivate, encourage, nurture and guide the process of knowing and sharing. It is a social communication process, which can be improved by collaboration and cooperation and supported by educational and ICT tools. Here, knowledge is closely associated with the person who developed it and is shared mainly through person-to-person contacts. This approach has also been referred to as the "collaboration" or "personalization" approach.

Two possible approaches to study of knowledge are represented also by two more or less separated disciplines dealing with knowledge, namely (a) *artificial intelligence* and *knowledge engineering*, which focus on technologies and (b) *organizational theory* and *education* which deal with organisational learning, self learning, methodology of learning, etc. and where knowledge is separated from person who owns it (6).

The previous distinguish between the product-centric and the process-centric approaches to knowledge starts the question when should be adopted one or the other approach, and why? A solution proposed in the literature can be summarised as follows (M e n t z a s et al., 2003):

The product-centric approach is more likely to be followed by those companies with a business strategy based on standardized and mature products. The processes for developing and selling such products involve well-understood and well-organised tasks, and the product knowledge is relatively rigid and thus more easily codified. In such cases, developing a strategy around the "knowledge as a product" approach seems more suitable.

The process-centric approach is more likely to be followed by those companies with a value proposition based on developing highly customized and/or extremely innovative products or services that meet unique customer needs. Because these needs vary dramatically, codified knowledge is of limited value. In those cases, adopting a "knowledge as a process" approach, which mainly supports the sharing of knowledge, expertise and judgement, seems more appropriate.

From the technical point of view, information engineers will deal and stress the product-centred approach (they code, move, store, retrieve knowledge among databases as an object) while teachers and trainers will deal with process-centred approach (they present, teach, support teaching and training, elaborate methodologies and didactics of knowledge share among people within education/training process).

Such a roadmap may be useful for some extreme cases, but it seems to be true that both product and process approaches should be adopted simultaneously but with a greater stress to one or to another approach in dependence on the character of the institution. These challenges call for *the integration* of the "knowledge as a process" approach (which will facilitate the leveraging of tacit, intangible knowledge) with the "knowledge as a product" approach (which will enable the consistent management of explicit knowledge, e.g. best practices). See Table 1.

Table 1. Representation of knowledge – as a product and as a process

Knowledge	
as a product	as a process
Systems theory, ICT, artificial intelligence	Education, sociology, psychology, organisation theory
Product-centric approach	Process-centric approach
Knowledge is represented as objects.	Knowledge is shared.
Knowledge objects are captured, organized and shared. Utilization of products and systems that contain codified knowledge.	Knowledge sharing throughout human contacts, relations in companies, at schools, in the society.
Exploitation of organized, codified and easily reusable knowledge. Linking of people with systems that capture and disseminate knowledge.	Elicitation of individual and team knowledge. Networks for linking people, promotion and facilitation of discussions, transformation of tacit knowledge to explicit.
Training is provided by AI and through computer-based courses. Contributing to the organization's knowledge base.	Training is facilitated through on-the-job learning, group brainstorming sessions and one-to-one mentoring. Presence and distance learning and training, discussions, workshops, net conferences.
Massive investment in ICT. Tools include technology document repositories, search and retrieval tools.	

8. Knowledge and Expert systems

Expert systems are based on representation of knowledge in descriptive or normative mathematical models. They aim to replace human reasoning with models and are typical product-centric knowledge management software tools. Such tools are used in stable, concentrated and well-defined domains. In such environments they can enable the knowledge of one or a few experts to be used by a much broader group of workers who need this knowledge. The user normally engages in a dialogue with the system, entering information about the problem or process in order to train the system so that it can act independently of the human. In this sense, expert systems reflect the product approach because their role is to substitute (partially at least) humans and human knowledge in performing specific tasks (7).

It should be noted, though, that the current capability of machine intelligence is such that, for the great majority of business applications, human knowledge will continue to be a valuable resource for the foreseeable future (Murray, 2000).

9. Knowledge elicitation – search and elaboration of texts

Search has become important in the business and educational environment because the total amount of potentially relevant knowledge is on the Internet hidden in documents and texts. Among texts there are hidden other sources of knowledge, such are symbolic representations mentioned in chapter 4. The keyword searches that are provided by most Internet search engines offer a simple and easy way to access a wide range of documents. The effectiveness of such searches is inherently restricted to a relatively simple statistical analysis of the searched document, based on the occurrence of those key terms. The main problem with keyword searches is that not all documents are using the same words to refer to the same concept.

Another approach to search is a thesaurus-based searching tool. It is effective in well-defined domains where the ambiguity of words and the validity of term relationships is not an issue. This search is rather well functioning when looking for robust data and information. In case of soft information and knowledge this search is not satisfying.

Manually assigning documents to the terms of ontology requires significant effort and cost, but in recent years automatic document classification has helped in this regard. The two major techniques that are used to automate document classification are pattern matching, with tools using mainly artificial intelligence based techniques to provide comparisons of documents and grouping of documents, based on the similarity of the concepts used, and semantic analysis, which enables an understanding of the semantic relationships characteristic of a specific language and often of a specific domain, such as the medical or legal domain. These techniques are also used to enable large-scale automatic document classification, often called document clustering or document mining.

Clustering can identify prevailing themes within a set of documents and then group the documents in relation to those themes. Automatic clustering does not replace the need for human understanding of the patterns identified, but it does help users to find patterns that may be overlooked within large volumes of information (Schreiberg et al., 2002).

10. Knowledge structure and knowledge maps

In order to enhance human capability to exploit both product and process oriented approaches to knowledge share, a different educational support is used. The main role of this support is to make tools for the members of knowledge networks – individuals, teams or organizations – which facilitate the creation, sharing and application of knowledge in companies and/or daily life. In an effort to provide a framework that is generic enough to support both organization and individuals and at the same time will offer them clear and concrete directions for the implementation of needed knowledge, special knowledge maps are elaborated.

A knowledge map describes the whole knowledge life cycle, from knowledge acquisition to knowledge use. The knowledge map is supplemented by procedures which make possible to the user to enter relevant document bases, topics, sources, narrative summaries, higher level descriptions, search and retrieval services available, access to multiplatform, heterogeneous sources, including Internet and intranet sites, file servers, databases, popular proprietary formats and legacy information systems, etc.

The usefulness of a knowledge map is that a company can see a high-level view of its existing knowledge, before it decides on a programme of business improvement. The overall approach is based on identifying an organization's key tacit and explicit knowledge and its current approaches for managing knowledge processes. These approaches are mapped to types of knowledge in order to identify knowledge "gaps".

11. Knowledge based higher education

Strategy of knowledge based education combines standard educational methodology, didactic and training tools and new ICT based approaches with stress toward business and technological orientation. Knowledge based curriculum consists of a number of smaller, clear-targeted courses. Methodology focuses on rewarding and compensation schemes for knowledge-sharing and tries to create knowledge-sharing cultures among students, teachers and administration. Being involved in the market environment the university has to also address rewarding mechanisms and principles of the market knowledge organization. Each activities fall in one of the two main approaches: product and process.

For a university, as well as for a company, four main organizational measures for knowledge based courses should be applied (modified according to Davenport and Prusak, 1998):

1. Creation of knowledge repositories concerned with the content of a course.
2. Improvement and facilitation of access to knowledge for students.
3. Improving the culture and environment for knowledge share among inner participants and for knowledge exchange among other educational institutions.
4. Focus on knowledge as a value.

1) In building of repositories much energy has been spent on treating knowledge as a "product", an entity separate from the people who create and use it. The typical work entails elaboration of documents with embedded knowledge, such as memos, reports, presentations and articles, and storing them in a repository, from where they can be easily retrieved. Another less structured form of knowledge is the discussion database, in which participants record their own experiences on an issue and react to others' comments. Three common types of repository are often used in education:

a) External knowledge. It may often be a source of competitive intelligence. External knowledge repositories range from information delivery "clipping services" that route articles and reports to executives and to advanced customer intelligence systems. Some of the most important external sources are case studies of the best practices and results of benchmarking.
b) Internal knowledge, e.g. research reports, study materials, methodological materials, internal projects, legal and organizational documents.
c) Informal internal knowledge, e.g. discussion databases full of know-how, some times referred to as "lessons learned". This is softer, more experiential knowledge that must be interpreted and adapted by the user in a new context.

2) The second measure for knowledge based education focuses on providing access to knowledge or facilitating its transfer among individuals. Whereas the first category aims at capturing knowledge itself, knowledge access focuses on the students and other prospective users of knowledge. Practices recognize, that finding the person with the knowledge one needs, and then successfully transferring it from one person to another, are difficult processes.

Technological implementations of this task ask for highly skilled professionals, external out-side consultants and collaborators.

3) The third measure involves attempts to establish an environment conducive to more effective knowledge creation, transfer and use. Here, building awareness and cultural receptivity is necessary as well as making significant inroads towards changing teachers perceptions of their work. There is important also make significant changes to the performance appraisal and quality assessment system.

4) The fourth measure focuses on managing knowledge as a value. In an organization knowledge is an asset and thus it can be considered as goods and/or know how. Being goods knowledge can be sold, being know how knowledge is held back or also sold.

In education, on the other hand, knowledge is a value. Being value it is shared with other people and/or disseminated and valorisated. This category focuses the university's attention on how it is increasing or decreasing its effective use of knowledge as a value over time (Fig. 1).

12. Life cycle of knowledge in companies

The knowledge processes in each organization can be classified within the following four groups of activities:

1. Acquisition
2. Organization
3. Sharing
4. Creation
5. Use

Knowledge acquisition processes include the identification of knowledge needs. Before starting the process the company should know what knowledge and expertise

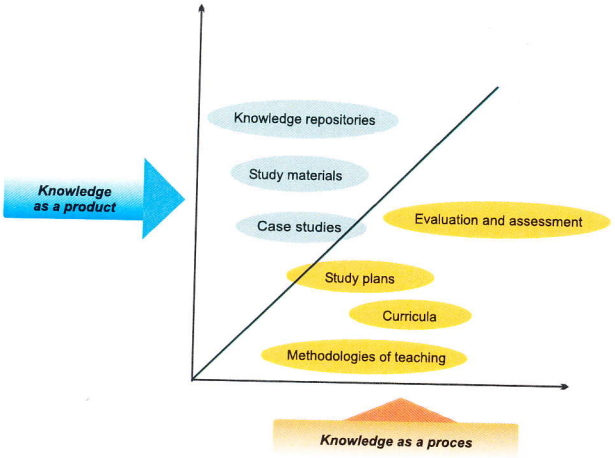

Fig. 1. Product/process approach in education

exist both inside and outside them. In many cases, the company is searching for knowledge outdoor even though it is present at home. One way to increase internal knowledge transparency is by creating knowledge maps, which support systematic access to parts of the organizational knowledge base.

Knowledge organization includes the interpretation, analysis, codification, indexing, aggregation, filtering, synthesizing, packaging, archiving and linking of knowledge. After knowledge has been acquired or created, it must be carefully organized and preserved. Companies should identify core areas of their organizational knowledge base and establish a pragmatic selection process for knowledge to be saved.

Knowledge sharing includes mechanisms for knowledge distribution among targets. In making knowledge share available and usable across the whole organization, the critical tasks are: (1) who should know what, (2) to what level of detail, and how can the organization support these processes of knowledge distribution, (3) how IT-supported knowledge-sharing infrastructures can facilitate the efficient exchange of knowledge within the business environment and outdoor experts through an electronic network.

Knowledge creation is assigned to solution of problems and consists of all activities intended to produce new knowledge both at the individual and at the collective level. The main processes for individual knowledge creation rely on creativity and on systematic complex problem solving. Collective knowledge creation involves the learning dynamics of teams. Management must ensure that team members have complementary skills and that each group as a whole has defined realistic goals. Moreover, cultural issues such as an atmosphere of openness and trust play significant role and allow the intensity of communication that makes collective learning results superior to individual ones.

Knowledge use includes the application of knowledge in corporate services or products and in supporting the delivery of value to customer. The complex evaluation quality assessment process is necessary. The potential user of knowledge has to see a real advantage in order to change his or her behaviour and adopt the knowledge assets provided (Romhardt, Probst, 1997).

Knowledge related activities need technological support and organizational structure that directs, facilitates and supports the use of knowledge within both the company or educational institution. It should be guaranteed by (a) *knowledge manager* and (b) *knowledge engineer* (Davenport, 1996).

The responsibilities of *knowledge manager* positions include:

- promoting and educating staff on knowledge-sharing processes, technologies and resources,
- identifying and sharing external information from research groups, marketing publications, Internet websites, etc.,
- collaborating with firm experts to write detailed learning histories and capture best practices,
- developing new formats and mechanisms to share knowledge assets effectively, and monitoring and measuring the use of knowledge bases and tools,
- coordinating with other KM team members to ensure consistency and synergy.

Knowledge engineers are people able to capture knowledge, organize it into a form anyone can use, and periodically update and edit those knowledge assets. The responsibilities of knowledge engineers positions include:

- capturing and organizing knowledge assets and supporting the use of knowledge-oriented software packages,
- managing and monitoring knowledge tools (e.g. discussion databases),
- making knowledge assets appealing and persuading by designing and implementing target group-based distribution facilities and informative displays.

13. Life cycle of knowledge in education

The life cycle of knowledge in organisations is described as a list of activities, the performance of which ensures acquisition and use of knowledge within educational process; here is a typical managerial "step by step" procedure of the knowledge life cycle:

- Identification of internally and externally existing knowledge.
- Planning what knowledge will be needed in the future company life.
- Acquiring and developing the need of knowledge.
- Distributing the knowledge to where it is needed.
- Fostering the application of knowledge in the business processes of the organization.
- Controlling and maintaining the quality of knowledge.
- Disposal of knowledge when it is no longer needed.

From the education point of view, the life cycle of knowledge in the education process is rather compli-

cated. In education, the property "to be knowledge" and "to be information" depends on a) time and b) place.

a) Dependence on time

Knowledge, which is shared for a long time, can convert to information. Stories are popularly known, there is no necessity to repeat them. The name of the story is sufficient to call to mind the story, and relevant solution of the problem. Thus, knowledge becomes "information about information".

Examples of knowledge which changed to information in course of time: The Parable of the Good Samaritan – the name of this knowledge is sufficient to call to mind the story. The name evokes the historical story and the relevant lesson. Other example: The pasteurisation – the name reflects process described in the story about Louis Pasteur and evokes known algorithms.

Also tacit knowledge can convert to information. Tacit knowledge shared "face to face", often changes in "patterns of behaviour" and needs not to be shared again. Patterns of behaviour are commonly known, respected and emulated in generation.

Examples of the patterns of behaviour can be seen among members of our younger generation: many of them live ecological/sustainable style of life – they need not listen to relevant stories with relevant knowledge content.

b) Dependence on place

What is knowledge for a pupil? – It can only be information for a student. What is information for a researcher? – It can be knowledge for a student. The property "to be knowledge" or "to be information" depends on the level of the study.

Generally, in the curriculum, some knowledge presented at bachelor level of study, becomes information at master level of study. The process works similarly in doctoral study. A similar process is seen in adult education: some knowledge presented in further education, is presented in the form of information in courses for regular students.

In education, the process of the knowledge life cycle is the following:

- Identification of knowledge claims (domains) in the curriculum.
- Knowledge acquisition and elicitation.
- Distributing the knowledge to where it is needed.
- Fostering the quality of knowledge in the curriculum using feedback from practice.
- Controlling and maintaining the quality of knowledge.
- Dissemination and valorisation of knowledge throughout the educational market.

14. Conclusion

The reader of the following articles will be confronted with many concepts and terms which have been outlined, analyzed and discussed here. In a relatively short time span specialised agencies have already appeared in the areas of knowledge engineering a knowledge management. The goal of these preludes is to inform the specialised reader about problems solved in other areas of specialisation. The overview is nevertheless incomplete and does not take into consideration many other problems which we encounter in theory and practice. The terminology and concepts may even be interpreted and understood differently, according to specialisation. The concept of a knowledge unit, for example, has a different meaning in pedagogy, in information engineering, or mathematical modelling of knowledge processes. An information engineer will usually understand knowledge as an object, which he or she must attempt to structure, code and save in a database, whereas a pedagogue will understand knowledge from the point of view of content and will consider the best means, how to deliver such knowledge to the pupils.

This special issue of the Scientia agriculturae Bohemica magazine outlines a conceptually rigorous yet theoretical approach for research and managing knowledge in order to enable organizational growth, better education and contribute thus to the future that will operate and thrive in the knowledge economy and knowledge society.

15. Notes and remarks

(1) There are a number of alternatives proposed, including Robert Nozick's arguments for requirement that knowledge 'tracks the truth' and Simon Blackburn's additional requirement that we do not want to say that those who meet any of these conditions 'through a defect, flaw, or failure' have knowledge. Richard Kirkham suggests that our definition of knowledge needs to require that the believer's evidence is such that it logically necessitates the truth of the belief.

(2) An example of definition that is more explanation than definition was given by Davenport and Prusak (1998), who define knowledge as "a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices, and norms". This definition highlights two important types of knowledge: explicit knowledge and tacit knowledge (see also Nonaka, Takeuchi, 1995).

(3) See relations between "*epistêmê*" and "*technê*" in Plato's dialogues which are discussed in paragraph 2.

(4) The Egyptian ba is what we might call someones personality. It would leave the body at the time of death. At this time, it would look for the person to which it belonged. The ba is everything other than the body that makes a person an individual. The ba is also the link between life on earth and the afterlife. Because of the ba's ability to move between the tomb and the world of the living, it was often depicted as a bird, but with a human head. The ka is usually translated as "soul" or "spirit" The ka came into existence when an individual was born. A person's ka would live on after their body had died. Some tombs included model houses as the ka needed a place to live. Offerings of food and drink would be left at the tomb entrance so the ka could eat and drink.

(5) The Upanishads, for instance, speak about a higher and a lower knowledge, and associate lower knowledge with the various sciences. Chinese philosophy has emphasized the complementary nature of the intuitive and the rational and has represented them by the archetypal pair yin and yang.

(6) Karl Popper (1966), Objective Knowledge, "A Realist View of Logic, Physics, and History", Clarendon Press, 1972. ... When referring to human knowledge, I shall usually have this objective sense of the word 'knowledge' in mind. This allows us to think of knowledge produced by men as analogous to the honey produced by bees: the honey is made by bees, stored by bees, and consumed by bees; and the individual bee which consumes honey will not, in general, consume only the bit it has produced itself: honey is also consumed by the drones which have not produced any at all (not to mention that stored treasure of honey which the bees may lose to bears or beekeepers). It is also interesting to note that, in order to keep up its powers to produce more honey, each working bee has to consume honey, some of it usually produced by other bees... "To consume" means here, first of all, "to digest", as in the case of the bees. But it means more: our consumption of theories, whether those produced by other people or by ourselves, also means criticising them, changing them, and often even demolishing them, in order to replace them by better ones... All these are operations which are necessary for the growth of our knowledge; and I again mean here, of course, knowledge in the objective sense...

(7) Expert systems and other knowledge-based systems that aim to replace human reasoning with artificial intelligence are typical product oriented software tools. Such tools are used in stable, concentrated and well-defined domains. The user normally engages in a dialogue with the system, entering information about the problem or process in order to train the system so that it can act independently of the human. In this sense, expert systems reflect the product approach because their role is to substitute (partially at least) humans and human knowledge in performing specific tasks.

REFERENCES

ALLE, V.: The Knowledge Evolution: Expanding Organizational Intelligence. Boston, Butterworth-Hewinemann 1997.

ARGYRIS, C.: Knowledge for Action. San Francisco, Jossey-Bass 1993.

BENNET, A. – BENNET, D.: Characterizing the Next Generation Knowledge Organisation. Journal of the KMCI, 2000, No. 1.

DAVENPORT, T. H.: Some Principles of Knowledge Management. Retrieved from http://www.bus.utexas.edu/kman, Graduate School of Business, University of Texas at Austin, Strategy and Business, 1996.

DAVENPORT, T. H. – PRUSAK, L.: Working Knowledge. How organisations manage what they know. McGraw-Hill; Harvard Business School Press 1998.

FIRESTONE, J. M.: Enterprise Information Portals and Knowledge Management. Butterworth-Elsvier 2003.

MENTZAS, G. – APOSTOLOU, D. – ABECKER, A. – YOUNG, R.: Knowledge Asset Management. Springer 2003.

MURRAY, A. J.: Knowledge Systems Research. Knowledge and Innovation Journal, KMCI, 2000, No. 1.

NONAKA, I.: The Knowledge Creation Company: How Japanese Companies Create the Dynamics of Innovation. Oxford Press 1995.

NONAKA, I. – TAKEUCHI, H.: The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation. Oxford University Press 1995.

ROMHARDT, K. – PROBST, G.: Building Blocks of Knowledge Management – a practical approach. In: Proc. KM and EU, Utrecht, 12–14 May, 1997.

SCHREIBER, G. – AKKERMANS, H. – ANJEWIERDEN, A. – HOOG, R. – SHADBOLT, N. – VELDE, W. – WIELINGA, B.: Knowledge Engineering and Management. Cambridge, Massachusetts, Bradforde Book, MIT Press 2002.

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Preludia ke znalostem.

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Znalostní společnost je charakterizována jako společnost znalostní ekonomiky, výroby a obchodu založeného na znalostech. Znalosti se stávají hybnou silou ekonomického rozvoje a jměním toho, kdo je vlastní a umí využívat. Většina odborné a vědecké literatury se proto zabývá působením znalostí v organizaci. Znalosti ale ovlivňují a mění sociální a kulturní prostředí a jejich uplatnění ve společenském životě může příznivě ovlivnit, nebo i změnit kvalitu života.

Monotematické číslo časopisu Scientia agriculturae Bohemica obsahuje odborné články, které se zabývají studiem znalostí ve třech různých oblastech: (1) Teoretické vymezení pojmu, zavedení metriky, interpretace znalostí v různých typech prostředí. (2) Reprezentace znalostí, transfer znalostí a implementace znalostí v různých prostředích pomocí matematického modelu a metodologie matematického modelování. (3) Sdílení znalostí v institucích a školách a tvorba znalostně orientovaného kurikula.

V článku se představují, popisují a vysvětlují vybrané pojmy z oblasti znalostního inženýrství a provádí se analýza vybraných problémů s cílem předložit čtenáři odborný text, který ho uvede do problematiky, řešené podrobněji v prezentovaných článcích. Rozebírají a analyzují se zejména následující problémy:

Definice a vymezení pojmu znalost. Termín „znalost" používají lidé v nejrůznějších souvislostech po staletí. Ve filozofii se pojmem znalosti zabývá epistemologie. Již v Platonových dialozích se k pojmu znalost (epistêmê) přiřazuje pojem dovednost (technê). Toto spojení používá pedagogika dodnes při formulaci svých cílů: „...naučit žáka znalostem a dovednostem." Exaktní definice znalosti dosud neexistuje, jednotlivé vědy si formulují vlastní definice vyhovující specifickým cílům. Místo definice pojmu znalost se tak setkáváme spíše s vysvětlením pojmu znalost. Pro aplikace znalostí v oblasti vzdělávání, managementu a informatiky vyhovují následující dvě pracovní definice:

(1) Znalost je informace použitá na správném místě, správným způsobem, ve správném čase k úspěšnému vyřešení (komplexního) problému.

(2) Znalost je informace o informaci.

Znalost je úzce spojena s řešením problému. Není-li problém, není znalost.

Reprezentace a transfer znalosti. Zatímco data a informace můžeme popsat a přenášet pomocí symbolů, znalost lze předávat v podstatě pouze ve formě textu, tj. literární formou („story"). I když se často setkáváme s jinými formami sdílení znalosti, literární forma je v nich vždy obsažena. Příklady: a) Textová forma (příběh, popis historické události, vysvětlení algoritmu). b) Obraz (znalost je skryta v příběhu, který obraz popisuje). c) Jméno, výraz (jméno „Xantipa", nebo výraz „Pyrrhovo vítězství" – zobrazují znalost vysvětlenou v příbězích, které jsou všeobecně známé). d) Vzorce a symboly (fyzikální nebo chemické vzorce představují někdy dlouhé studijní texty s popisem řešení problému). e) Diagramy, schémata (Mendělejevova tabulka, Tarotové karty – představují texty, které může odborník interpretovat). f) Abstraktní modely (matematický model, např. model lineárního programování představuje řešení komplexního problému, které je vyjádřeno formálně pomocí soustavy funkcí; odborník je schopen řešení popsat slovy). Jestliže je znalost reprezentována literární formou (příběhem), předává se ostatním v nezměněné formě. Uživatel je pasivní účastník sdílení. Pokud se znalost předává v symbolické formě, uživatel musí mít odpovídající vzdělání, které mu umožní symbolické vyjádření převést do slovní (textové) formy; zde je uživatel aktivní, protože může textový obsah přizpůsobit konkrétním potřebám, např. výuce.

Rozlišování mezi pojmy „data – informace – znalost". Znalost je všeobecně uznávána jako něco celistvého a konečného – to odpovídá i výše uvedené definici, kde znalost představuje výsledek řešení komplexního problému pomocí vhodných informací. V anglickém jazyce má slovo znalost pouze jednotné číslo – i to vyjadřuje, že je chápána jako celistvý integrovaný objekt. Data, informace a znalosti se často zobrazují v hierarchické posloupnosti jako pyramida, kde data tvoří základ, informace střed a znalosti vrchol. Toto schéma ale vyhovuje spíše organizaci a uspořádání v datových skladech než potřebám znalostního managementu a znalostního inženýrství. Znalosti jsou motorem, který vyžaduje tvorbu dalších informací, tvorba dalších informací vyžaduje vyhledávání a zpracovávání nových dat. Životní cyklus znalosti vyžaduje produkci více informací, tento proces zase více dat – tj. prioritní činností je tvorba informace a znalost je tedy možné chápat jako informaci v pohybu, v procesu řešení problému. Data, informace a znalosti jsou měřitelné objekty, na které lze zavést metriku. Metrika obsahuje míry různých dimenzí: když přiřadíme objektu jméno (metrika nultého řádu), můžeme na objektu definovat a) data (metrika 1. řádu) – vlastnosti objektu, které lze popsat alfanumerickými symboly a uspořádat do vektoru; b) informace (metrika 2. řádu) – vztah mezi objektem a objekty v jeho okolí, které lze popsat symboly, funkcemi a uspořádat do matice; c) znalosti (metrika 3. řádu) – postup při řešení komplexních problémů, který lze popsat slovy, např. formou příběhu.

Koncept Ba. Byl zaveden Nonakou v roce 1996 a představuje „japonský koncept" tvorby znalosti. Nonaka ukazuje, že procesy, které vytvářejí novou znalost v lidské mysli, jsou stejné jako procesy, kterými se vytváří nová

znalost v podniku nebo ve výzkumu. Konceptu *Ba* odpovídá i *Chi-Management* (znalost a moudrost integrované v myšlenkových pochodech). Tvorbu nové znalosti popisuje Nonaka jako spirálový cyklický proces čtyř činností: socializace, externalizace, kombinace, internacionalizace. V některých článcích v tomto monotematickém čísle se ukazuje, že analogický proces probíhá rovněž i při tvorbě matematického modelu ve fázích a) meta-model, b) model, c) analýza a rozbor, d) implementace.

Znalost jako produkt nebo proces. Znalostní management a znalostní inženýrství identifikují dva aspekty znalostí: znalost, která se chová jako objekt, a znalost, která má charakter procesu. Tyto dvě vlastnosti se projevují v přístupech k využívání znalostí v podnicích a ve školství, kde – podle konkrétních podmínek – se zdůrazňuje jedna nebo druhá vlastnost znalosti. Znalost jako produkt je chápána jako objekt (entita), se kterým lze manipulovat: přenášet, hodnotit, prodávat, ukládat, vyhledávat. Obvykle se jedná o obsah dokumentů, nebo know-how jedinců nebo podnikového know-how a tradice. Znalost jako proces bezprostředně souvisí se vzděláváním a s ním spojenými aktivitami: metodologií, metodikami, didaktikami, technologiemi vzdělávání apod. Jedná se o sociální komunikační proces podporovaný technologiemi, např. ICT. Znalost jako proces je vázána na osobu nebo umělou inteligenci, která sdílení znalostí zprostředkovává.

Znalostně orientované vzdělávání. Vzdělávaní založené na informacích využívá psychologii, filozofii vzdělávání, didaktiky a metodiky. Znalostně orientované vzdělávání zahrnuje řadu dalších oblastí, jako např. znalostní management, epistemologii, teorii systémů, umělou inteligenci, teorii míry a teorii hodnoty. Znalostně orientované kurikulum zahrnuje znalosti do studijních plánů a představuje osobitou složku vzdělávacího procesu. Znalosti se zde stávají podnětem akvizice nových informací, jejich reprodukce a integrace. Ve znalostně orientovaném kurikulu se studují: metodologie a organizace vzdělávacího procesu, technická podpora znalostně orientovaného vzdělávání, evaluace a hodnocení vzdělávacího procesu.

Životní cyklus znalosti v podniku a ve vzdělávací instituci. Znalost v organizaci prochází pěti stadii: akvizice, organizace, sdílení, tvorba nové znalosti, užití. V každém ze stadií plní svoje funkce znalostní manažer a znalostní inženýr. Znalost v podniku představuje jmění a zboží. Podnik novou znalost může odprodat, nebo ji ukládá a tají jako své know-how. Znalost ve vzdělávacím procesu představuje hodnotu, kterou vzdělávací instituce dává k dispozici zájemcům o vzdělání. Životní cyklus znalosti ve vzdělávání je závislý a) na místě a b) na čase, ve kterém se vytváří, produkuje a předává.

data; informace; znalost; metrika; míra; matematický model; znalostní mapa; definice znalosti; reprezentace znalostí; transfer znalostí; koncept Ba; produktově orientovaný přístup; procesně orientovaný přístup; expertní systém; akvizice znalostí; životní cyklus znalosti v podniku; životní cyklus znalosti vysoké školy

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