Automation of the Work intensively based on Knowledge, a Challenge for the New Technologies

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4. Introduction

The concept of KM should be considered widely, and may integrate internal and external processes [3,4,6,10,16,19,21,28]. Internal processes refer to the way in which the organization systematically collects, stores, retrieves and accesses knowledge from different sources (it is also important the management of the communications between different subsystems of the organization). External processes refer to how an organization manages a number of streams with external groups. The key concepts of KM are dialogue, social networks, building relationships, learning and transformation through interactions with different users, which have their own knowledge [7,8,12,18,20,29,30,36]. Many innovative companies have strongly appreciated the value of KM, in order to improve processes, products and customers services, and to create a competitive advantage. The attention on KM increased amazingly in recent years, companies admit that they are operating in a knowledge economy, and these are the most important value [9,15,17,22,31,39,42,44]. At the same time, KM theories and technologies have reached a maturity level, required for the business confidentiality and support. KM means protecting, developing and exploiting the knowledge value. Strategic KM (e.g. KBOS – Knowledge Business Operating System, available at www.kbos.net) consists of a platform supported by a methodology for KM capacities development, knowledge-focused solutions and knowledge schematization for business organizations, scientific or public [40]. The technology has been purposely designed to provide organizational control, openness and performance. The associated platform supports a unified process and a KM approach that emphasizes the interconnection of knowledge-focused solutions with business strategies, business processes and business performance monitoring. KBOS supports knowledge and KM development, as a part of business operation. Measuring and learning processes are used to increase organizational openness and the monitoring performance. Undoubtedly, in any dynamic environment, whether it's driving a racing car or a flexible production or landing on Mars, the winner is that who has the control of the system. The new knowledge economy is differentiated because there are highlighted the immediate detection of the obstacles and the adaptation, contrary to the traditional emphasis on optimizing the strategies based on the predictions of relevant types of business. Consequently, a large amount of enterprises face the challenge of turning into real-time enterprises, linked to critical requests for beforehand answers, in order to perform a fast and accurate adaptation of the organizational skills to complex and dynamic business environments. These business requirements relate to solutions founded on theories of control (automatic) for systems [1,2,5,11,32,34,37].
This paper is intended to define the essential elements which contribute to the development of the new STs based on KM. For this purpose, are presented successively: section 2, The current economic impact of KM (KM involves economic, cultural and technological approaches, which support the knowledge development and exploitation, the KM objectives within the company and within the different business processes, KM development stages highlight the permanent and rising role of knowledge, as a new production factor, alternative definitions and practical interpretations of KM, organization’s intangible assets exploitation is the prerequisite for competitive advantage, underline some approaches that should not be confused with KM, the main specific determinants, which turn KM into an important tool for business, the main schools related to KM focus on knowledge assets, errors that may go together with the various KM processes); section 3, KM Systems from technological perspective (Content Management Systems and Organizational Memories, Knowledge Taxonomies, Generating services bundles entails the creation of distributed knowledge models, Knowledge-based Systems as Expert Systems); section 4 conclusions.

Successful managers have always used intellectual assets, and acknowledged their value [13,14,35,43,45,46]. But these efforts were not systematic and knowledge sharing was not always done such as to bring important profit to organizations. Structuring knowledge and associated processes, based on a closer technology to the knowledge nature and interpretation, in different and various applications (called semantic technologies incorporating intelligence), lead to efficient and effective problem solving, dynamic learning, strategic planning and decision making. ICT technologies that support KM in various firms, organizations, companies, etc., are called Knowledge Management Systems, noted KMS. While practitioners and researchers continue their efforts to design and build complex intelligent systems, they become conscious of the fact that uncertainty is present not only in human knowledge. Allowing a certain degree of uncertainty in describing complex systems is perhaps the most significant way to simplify them. Different types of uncertainty can be rigorously characterized and investigated in the context of fuzzy sets theory [25,26]. Thus, the ability to operate in an uncertain or partially known environment is one of the basic performances of any real-time intelligent system. These systems must be designed as multi-agent systems with the ability to combine different knowledge-based techniques (with the purpose of acquiring and processing information), with approximate reasoning methods [37,38]. This will enable the system to better emulate the human decision-making process, also characterized by imprecise and time-varying knowledge. Real-time calculation is an area of intense research, since the correctness of a system's functioning in a dynamic and distributed environment depends not only on its performing logic, but also on the temporal aspects involved. Such systems include various solutions of systems, subject to various complex time restrictions, with different granularity levels of the time. Temporal knowledge is an essential element for many applications (planning, process management, dynamic situations management). An intelligent system must have reasoning capabilities that take into account a series of events that may occur in the process: interruptions, limitations on processing time, synchronous and asynchronous nature of the new information occurrence [23]. Considering time must highlight two complementary aspects: temporal information management and formalizing the temporal reasoning on time and in real-time [25]. Some approaches are based on numerical models and other on symbolic representations of time [27]. Reasoning under real-time restrictions has specific characteristics. Real-time operations often involves a temporal reasoning, conversely this is not always true. The management involves a close relation between the process and the management system, which must react to the occurring events. In this context, the management system has certain features of Distributed Artificial Intelligence, if, in the presence of minimal guidance information from a human expert, it can perform complex actions in response to the events coming from outside. In this case, intelligence includes the ability to accept abstract tasks specifications in a general form of goals / restrictions and to produce reasonable actions which are consistent with the specifications. In any real time like KMS there is a fundamental compromise between action and reasoning [24,27].

2. The current economic impact of Knowledge Management

Today, economic and business environment are constantly changing. Competitiveness is neither linear nor predictable in a global knowledge economy, in which the predominant activities are based on knowledge. Business' success depends on its ability to protect, acquire and use its knowledge, namely the company's capability to develop its own knowledge management [8,39,47-56]. The issue of competitiveness by developing its own knowledge, has become a particular concern since 1990, and contains two basic questions: which are the new sources of competitive advantage and new competitive strategies, and how can be designed the business processes, in order to enable the development and implementation of the strategies based on knowledge models? Knowledge economy and information society were identified as cornerstones of the global economy. In 1998, an international report on development stated that "for the countries at the forefront of the global economy, the balance between knowledge and resources tilted long ago to knowledge, so that they have become the most important factor, influencing the living standard, perhaps more than the land, capital or labour. We live in a world that changes every minute. This affects organizations and allows people to change their intellectual capabilities [15,16,29,33]. For the change to be effective, it requires that both organizations and people to change. The key for change and development is its awareness, exchange of
ideas, finding ways to innovate, to place both people and companies ahead of the competition. This involves learning, innovating, adopting a behaviour designed to increase performance and quality. In this way, intelligent people and intelligent organizations need each other. KM becomes more and more important. More companies and firms have built their own knowledge deposits about customers, human resources, suppliers, competitors, etc. In this context, have emerged professions such as knowledge developer or engineer.

**Knowledge management**

Knowledge management can save a company from losing critical capabilities. Important person leaves a company, his knowledge “leaves” with him, and usually “ends up” at a competitor. Knowledge is not related to machines, but to culture. Tacit knowledge is mobile: When an individual changes and stay ahead of it. There are so-called data-obsessed business environments, meaning that they focus only on exploiting the existing universal knowledge. “You can only lead the change and stay ahead of it.” There are so-called data-obsessed business environments, meaning that they focus only on exploiting the existing universal knowledge. “You can only lead the change and stay ahead of it.”

**Knowledge management in the context of knowledge society**

Few are aware that knowledge management is rooted in the history of ancient civilizations, and nowadays it is an extended representation of something already existing. We can say that, viewed from an external reference system, knowledge and their management can be described in the object paradigm framework. We have an abstract class entitled knowledge, from which derives many other subsequently and improved classes in different areas, but each with different features. Over time, the features of these classes have changed: some have disappeared and new ones have emerged, with some new associated methods. Since ancient times, well-organized business had a competitive advantage that enabled them to serve customers as better as possible, thereby maximizing profits, and developing a constant group (loyal) of customers. About 15 000 years ago, this organization consisted in writing on various boards the knowledge that different categories of people (merchants, artists, doctors) kept for later use.

The industrial revolution changed this situation, mainly due to processing lines, allowing mass production. An untrained young man could learn in a very short time how to handle a machine and solve standard problems that could occur. For the first time, productivity could be measured, standards were created, and there could be addressed the issue of optimum and processes’ optimization. The result was an increased productivity, more numerous accessible goods, at reasonable prices, together with the profit increase for the company and its investors. But where begin this introduction for the concept of knowledge in an organizational culture? What really lies behind it? What is its real value? Is there a classification of the companies that use it? Is this an aspect of art management or technology? Can be implemented in the context of current information systems, or they must be modified? What kind of people? What skills and what organizational structures are necessary to generate knowledge? Are there standard architectures or measurement units that can be used? Does a small or medium business afford to dream at such systems in terms of the costs involved? This is very small part of the questions posed by a concept such as knowledge. Although this theory on the KM is now considered to be an important issue in academic circles, it has been acknowledged long before by successful managers, who appreciate its value. Long before expert systems, corporate memory to be in the headlines, these managers were aware that their company’s key assets weren’t buildings or products, but people with their skills and knowledge. After having tired everything else – from the best products and technologies, to virtual monopolies in markets where were competing, for many businesses was concluded that the only resource that could tip the scales in their favour was knowledge. Given a description for the concept of knowledge, what does KM mean in this context? In the simplest terms, management can mean “organization and usage strategies”. But we may extend this concept, to include the knowledge creation, diffusion and application in various types of businesses, to achieve specific goals. Company’s ability to exploit intangible assets has become far more decisive than to invest in, and manage physical assets. Since the dynamics of the market is large, as well as its uncertainty, technologies flourish, competitors are becoming more numerous, and the products and services lose value very quickly, the successful companies are distinguished through their constant ability to produce new knowledge to be embedded in the products and services they provide. In the post-industrial era, the success of a corporation is integrated in its intellectual system. Among the reasons that generate interest in KM, we can mention: Companies focus their primary strategies on knowledge and not on capital, market instability, manifested especially in technology environments and financial markets. KM allows us to make further changes and not vice versa. Peter Drucker stated that no industry or company has a default natural disadvantage or advantage. The only thing that counts is the ability to exploit the existing universal knowledge. “You can only lead the change and stay ahead of it.” There are so-called data-obsessed business environments, meaning that they collect data, but not use even 3% of their volume. Knowledge plays a crucial role in decision making. Knowledge means sharing, flows and dynamics, what traditional information systems do not include in their standard forms. Knowledge is not related to machines, but to culture. Tacit knowledge is mobile: When an important person leaves a company, his knowledge “leaves” with him, and usually “ends up” at a competitor. Knowledge management can save a company from losing critical capabilities.

**Knowledge Management involves economic, cultural and technological approaches that support the development and exploitation of the knowledge assets**

The development of electronic commerce, of intelligent business on the Internet, and of distributed processing and communication technologies, have brought fundamental changes to the business models, companies and economies. Customers, suppliers, business partners are increasing their requirement from businesses, in all exchange processes. Organizations are exploring new markets, new services and products,
forcing technological progress, business strategies, globalization and production cycles decrease. Businesses should be able to offer a wide range of services, to increase income and productivity. To address all these complex requirements, for the future, businesses need new types of specialized tools, new types of advanced services, to support new types of businesses. Technologies can sustain the creation of intelligent enterprises, which will not only provide better services to the customers, but will categorically support the business efficiency, by building relationships with suppliers and other business partners, on a more flexible basis, and more adapted to the real time events, and to constantly changing requirements. There is an increasing recognition for the importance of knowledge, as a critical resource for organizations, within the business community. Conventionally, it has not been considered with an explicit systematization effort. Currently, a great deal of researchers and experts from different areas, strongly believe that this resource must be addressed explicitly, semantically and actively. Knowledge economy researchers have changed their views from to those of 10 or 20 years ago. Until recently, we perceived knowledge as a public good, a basic tool of any organization, difficult to quantify, reproduce, diffuse, and difficult to use effectively.

The knowledge economy differs from the traditional economy in several key areas. The knowledge economy is not described by crisis, but rather by wealth. Unlike many exhaustible or insufficient resources according to the real needs, knowledge is currently increasing with each appliance. The impact of the knowledge location diminishes. There can be created virtual markets or organizations that provide research opportunities and global benefits, associated with speed, agility, better and better real-time time reaction. Many organizations rely on knowledge to create strategic advantage and innovation capacities. KM enables organizations to optimize intellectual capital, which is often dispersed, fragmented and can be easily lost. Thus, it can generate innovative work, absolutely necessary for the intelligent enterprise, based on human and artificial agents that must and are able to cooperate. The purpose of such an approach remains to effectively increase the quality, reduce production cycles and costs, and to satisfy the customers more effectively. In an economy based on markets with different complexity types, consumers are more educated and demanding. They can provide feedback to manufacturers, about designing quality and the manufacture of the products and services, from consumer’s view. This has generated new and radical changes in the business world. Despite recent technology progress (networks, architectures and semantic web applications, Web interfaces, intelligent wireless communication devices, multi-agent systems, natural language processing interfaces, business intelligence applications, etc.), businesses need to be able to respond completely, accurately and in real time to the social, cultural and industrial challenges. The enterprises need to be converted into real-time enterprises (RTE Real-Time Enterprises) or agile enterprise [24]. KM has widely proved its utility and the benefits it can bring to the organizations, providing adequate pragmatic and financial justifications, in order to be developed and generalized. Computer networks, along with Internet technologies (in a continuous process of development) allow a rational and controlled distribution of knowledge, increasingly wide. These issues make the business processes to be faster and efficient.

The objectives of KM at company level and within various business processes

KM’s purpose is to capture the tacit knowledge, required in business processes and to support everyone who works with it to re-share it, in a more and more available format, to the widest masses of potential knowledge consumers [6,18]. With this knowledge, the effective odeling of business processes will be easier. In addition, KM aims to enhance the organizations’ performance, by explicitly designing and implementing some tools, processes, systems, structures and cultures to enable the creation, distribution and use of all types of important knowledge for business performance [5,21,53,55,56]. KM becomes operational through new projects, processes and activities. Knowledge is unanimously recognized as the major source for competitive advantage. This knowledge-based paradigm is able to justify the fact that the essence of the company’s activity is the creation, organization and use of knowledge assets. Their efficiency in these processes influences the performance. Despite all efforts to manage their own knowledge, the companies have not always been able to achieve all KM goals, because of major barriers in terms of organizational cultures: the culture defines the relationships between the individual and the organization’s knowledge, showing who is responsible to manage certain knowledge; culture creates the context for social interactions, thus establishing what knowledge should be used in a particular context; culture can generate processes by which knowledge can be created, identified and distributed within the organization. The first significant problem of the KM is the capture of knowledge. Once this impediment is overcome, and knowledge can be forwarded in a rational manner, then the benefits begin to appear. KM is a very topical issue and only successful managers have become conscious of this for some time. For many years have been developed and applied concepts which, in one form or another, were related to KM, with various ways of involving knowledge, such as: expert systems, best practices, learning organizations, training systems, knowledge-based systems, with all their forms: symbolic, connectionist, based on relations such as production rules, qualitative fuzzy relations, uncertain knowledge with Bayesian processing, imprecise or fuzzy knowledge, weak and strong structured knowledge, case-based systems, diagnosis systems, systems based on knowledge models involving developed reasoning structures, classification systems, planning systems, and many others [23,26,27,32,37]. As a result of the KM, have been developed systems that collect, organize, describe,
intelligently process and distribute knowledge in business processes and beyond. In a study on intelligent business impact on business, the author [26] proposes six essential attributes of knowledge based products and services: (1) learning. The more frequently used, both these systems and their users become more skilled, (2) capitalization through use. The default services are improved through an intensive use (3) prediction. Knowing what the user wants, these systems can recommend what would be useful for the future (4) interactivity. There is everything between the system and the user (5) justification. Systems based on complex knowledge models record and explain past actions in order to synthesize a profile (which can be a form, a pattern of a customer, product, event), used in various intelligent functions for classification, planning, forms recognition, diagnosis, training, (6) customization. It offers a unique configuration for certain individual specifications, in real time and without charge. During 1960’s and 1970’s, technologies have been designed to support the static processing of an increasing volume of data. The development of electronic commerce, in the 1980-1990 periods, proves how information technology could effectively help accomplishing specific business processes. It is the period during which were made enormous efforts for the synthesis of algorithms, systems and applications that meet the Touring test’s utmost. With the considerable power increase of distributed computing, was launched a full review of the business processes, business environments, arising a whole series of new requirements, such as: openness to new business opportunities, leading to decentralized and competent methods for decision making; developing methods and systems receptive to the natural capacities of the human brain, hence closer to natural intelligence; ensuring an operational and successful partnership between the providers, sellers, customers and other parts, directly involved in business processes. Knowledge is a fluid mixture of conceptualized experience (i.e. whom was found, at one time, a sufficient representation in terms of a operating semantic), values, contextualized information, expert ability and intuition, which together should allow the creation of new and innovative experience.

Knowledge is the core of KM

This is seen not only as a new development direction for the company’s management, but also as a new interdisciplinary approach. KM should lead to the creation, distribution and exploitation of the knowledge specific to an enterprise, in order to synthesize new values, and for its whole complex of business processes. The ability of the companies to exploit their intangible assets (knowledge) is by far the most important issue in ensuring a competitive advantage. As markets change, technologies flourish, competitors multiply and the products and services become obsolete, successful companies must have the ability to consistently create new knowledge, disseminated in real time (i.e. fast, as the current needs require, regardless where comes from), and to incorporate it into new services and products. According to these definitions, we consider that it would be appropriate to effectively develop new KM practices, for the following reasons: (1) Knowledge Integration is the engine of the economic prosperity. (2) The unpredictable nature of the markets requires giving up the traditional approaches of knowledge management, the related technologies (communications technologies, information technologies that enable the absolutely rational handling of knowledge), and the various theories of management. (3) KM can support changing comprehension and effective action in a positive way, even if the change has occurred and has not been understood yet. (4) By its strong interdisciplinary and integrative nature, KM can support more accurately the management of the more and more complex economic systems or processes. (5) Forgetting the past may lead to its abnormal repetition. Without a way to capture and integrate the past experience, any new development process can generate chaos. (6) Tacit knowledge can best contribute to maximizing the desired effects.

Knowledge has different implications for KM, as follows: As a state of mind, focusing on individual access to personal knowledge enrichment and their application to the organization’s needs, a state of knowledge and comprehension. KM must permit processes of learning and understanding the information’s semantics, and KMS must provide access to knowledge sources; As an object. In this case, knowledge are seen as entities that can be stored, used and transferred, or on whom can operate, with the same basic implications for the knowledge management and for KMS; As a process, through the effective application of the experience. KM focuses on the creation, share and distribution flows and processes, and KMS should be able to interconnect the various knowledge sources, either surface or depth knowledge; As a condition for access to information In this case, knowledge are practical and operational methods of gaining access to content, being actually an extension of the second perspective. KMS’s role is to provide practical mechanisms for locating and retrieving relevant information; As a capacity for the rational use of information through learning, in order to solve problems that the organizations are facing, but closely related to ICT technologies, using different models and systemic approaches. KMS’s role is to improve the intellectual capital, expertise and collective intelligence.

Figure 1 shows the connection between KM and Business Management. These views of knowledge lead to different approaches for KM. For instance, when knowledge is seen as an object or as a condition of access to information, then KM focuses on issues of developing and managing knowledge models. If the prospect is the one of a process, then KM should focus on knowledge flows, in order to create, share and distribute them. If the perspective is of ability, then we must focus on the skills identification and management, comprehend the strategic advantage of the experience and must support the creation of intellectual capital. The major
implication of these perspectives is that each suggests a different strategy for KM and a different perspective for the systems that support KM, i.e. KMS.

Organizational knowledge may come from the following sources: customers – their needs, who should be contacted, purchasing power, etc.; production – market-specific products, who are the end users, which are the selling prices, what are the manufacturing costs; financial – financial resources, conditions for capital acquisition, and at what costs; people’s practical knowledge – available expertise, the quality of the provided services, expenses with the experts. Current KM tools are dealing with the following issues: (1) creation and acquisition – knowledge analysis and engineering packs, data mining, odeling knowledge related to explicit knowledge representation (ontologies, the ondeling of the enterprise and its processes), knowledge abstraction models for semantic web services (2) sharing and distribution – knowledge bases, intelligent marketing, intranet enterprise portals that allow access to explicit knowledge and communication between experts, case-based knowledge retrieval and processing, document management, semantic hypertexts, semantic web, (3) development and access for coalitions creation – decision-making support systems, assisted training, planning based on knowledge and on adaptive systems (planning, diagnosis based on genetic algorithms and neural networks theories), intelligent agents technology.

Figure 1. The relationship between KM and Business Management

3. Knowledge Management Systems from Technological Perspective

KM should support the increase of the value created by the organization, based on the increase of the information and knowledge rational processing capacity. Rationality refers to both the human factor, whose cognitive functions must be further developed as multiple aspects of intelligence, as well as to the technological component. All these goals involve people, information, flows, systems and techniques, tools, best practices, alliances, communities of practice, social networks. The systems affected by KM use have evolved from ICT tools for different economic or technical applications based on calculations or databases (1980), followed by advertising and communication tools, and then accompanied by sophisticated platforms for collaboration, search, and business processes odeling using Petri nets. Examples of such systems are: agents, authorization systems, deposits for various useful practices, blog sites, business intelligence systems, case-based systems, collaborative filtering and classification, data mining, expert systems, e-learning, heuristic software, management of ideas, intellectual property inventory, knowledge portals, metadata, neural networks, online communities of practice, knowledge networks based on different open architectures, dynamic systems based on Petri networks, semantic networks, intelligent enterprise, mapping and knowledge maps, decision support systems, recommendation systems, business knowledge portals, etc. Knowledge Management Systems (KMS) emerged more than 30 years ago, starting with systems based on a central knowledge deposit, and continuing with distributed systems that offer a total autonomy to the user (Distributed Knowledge Management Systems- DKMS). These systems were based on technologies such as databases, data warehouse, the latest including reasoning capabilities, in the spirit of AI. With the growth of the Internet technologies, most systems in this category have been modified, gaining web interfaces, known as web portals. Groupware technologies, such as LotusNotes platform, were used in the development of KMS.

Content Management Systems and Organizational Memories

These are known as Content Management Systems (CMSs). A large number of companies have resorted to such a solution to solve problems of best practices management, of learned lessons management, to develop new products, for customer knowledge management (CKM), human resource management based on knowledge. Metadata, content-centred work teams, knowledge maps, contextualization of the flows are examples of applications using CMSS. Advanced systems in this category include features related to the authorization of forms (templates), maintaining the integrity of Web pages, archiving, version control. The
Ontologies are formal models of a domain. According to Gruber, the ontology can be defined as an explicit specification of a conceptualization. In other words, an ontology is a domain model which is described explicitly. Borst considers ontology as a formal specification of a conceptualization, seen more like a consensus, and not as an individual point of view. Moreover, this conceptualization should be expressed in a computer readable format. As a formal model, ontologies represent knowledge in a format that can be processed by computer, thereby improving communication between humans and a computer program or between two programs. Semantic descriptions improve integration and access to information. Several different syntactic forms will be encoded in the same semantic information, thus overcoming the limitations of the keywords-based search. Based on the ontology that explains the relationships between concepts in a formal way that can be understood by the computer, the computer is able to execute a reasoning. Ontologies can be classified according to their degree of generality, as follows: (1) basic ontologies are conceptualizations that contain specifications of certain concepts and relations, independent of the domain or problem, based on formal principles derived from linguistics, philosophy and mathematics (e.g. DOLCE – a Descriptive Ontology for Linguistic and Cognitive Engineering ) (2) generic ontologies, containing general knowledge about a specific area, (3) ontologies of the domain are rarely reusable and specific to a particular area. Another classification criterion is the specifications’ detailing degree: comprehensive ontologies in the domain, which are automatically learned; generic ontologies, comprehensive, OWL-s, which contain few restrictions, but offer little in terms of ontology; basic comprehensive ontologies. The current World Wide Web has more than 4.2 billion pages, and most of them are in a format that can be interpreted by humans. As a consequence, software agents, cannot understand and process this information, and a great deal of the Web potential remains unexplored. In response, researchers have created the Semantic Web vision, where data has a structure and ontologies describe the semantics of data. The idea is that ontologies help users organize information in taxonomic concepts, each with its attributes, and to describe relations between concepts. When data is marked using ontologies, software agents can better understand the semantics and thus the data, data will be mapped and integrated into a more intelligent way, for a wide range of tasks. In information systems, ontologies are viewed in a more pragmatic way. Thus, ontology is seen as a kind of comprehension of a represented field. Conceptualization refers to an abstract model of the phenomena in the world, by identifying the relevant elements of these phenomena. Ontology is a key factor that enables interoperability in the Semantic Web. It is important for the Semantic Web because it allows applications to accept the terms used in communication, providing precise notions that can be used to compose messages. For the receiver, ontology helps understanding the messages, by providing the correct context interpretation. Thus, ontologies can improve systems’ interoperability, among different organizations and fields. However, it has been widely discussed that there is no single universal ontology. It is clear that ontologies have to deal with the same
problems of heterogeneity, as any other information. The attempt to enhance the interoperability of the
systems, is based on the reconciliation of ontologies used in different systems. Reconciliation is often
approached by manual or semi-automatic integration of ontologies. The technical problem is to solve the
ontological mismatches that occur in semantic integration.

**Knowledge-based expert systems**

To understand various phenomena in the real world, scientists depend on mathematical odeling. Often,
the phenomena are extremely complex and beyond the odeling power, or building a mathematical model is
an impossible and unattractive task. In this case, researchers are trying to loosen the model, by using
heuristics in order to reason about information missing from the model, and about phenomena that the
model is representing. In other cases, we cannot completely understand a particular phenomenon and we can
be content with an incomplete model. It can be said that a series of mathematical models cannot precisely
emulate the phenomena around us, in which case partial models are built. To solve these cases, researchers
use Artificial Intelligence (AI) techniques for the synthesis of reasoning means, for understanding complex or
incomplete phenomena. Perhaps the most significant success of AI was the development of knowledge-based
expert systems ES). Ess were defined in different ways, but all definitions have one common feature, which
suggests that expert systems are artificial means used for emulating the way in which experts in a particular
field solve problems. Edward Feigenbaum, one of the best known researchers in AI, defines an ES as an
intelligent program that uses knowledge and inference procedures in solving difficult problems, or which
require significant human expertise for their solution. Knowledge required in a particular domain, together
with the inference procedures used, can be viewed as a model of expertise of the best practitioners in the
field. ES knowledge consists of facts and heuristics. The facts constitute a group of information publicly and
generally available, accepted by all experts in the field. Heuristics have a particular character, consisting in
rules of a good reasoning (rules of plausible reasoning, rules for a good prediction) that characterize the
expert-level decision, made in a certain field. An ES’ performance level is fundamentally a function of size and
quality of the knowledge base it possess [27].

**Generating services bundles requires creating distributed knowledge models**

Services are economic activities in which customers and suppliers exchange objects with economic value.
Nowadays, on-line services bundles are a remarkable scenario. This scenario is influenced by several
economic and technological forces, in connection with the notions of service, pack, on-line services bundles
offer and distributed knowledge models based on ontologies [33]. The Internet has contributed to the
emergence of two trends in the last decade: business globalization and the ICT revolution. The Internet has
dramatically changed the habits of home users, the businesses and government organizations, and is
considered a key source of information, a way of reducing operational costs and a communication channel
with the customers. Both from the customer and provider’s perspective, the Internet has several important
advantages. First, the geographical boundaries, that have hindered relations between customers and
suppliers, disappear. Secondly, the Internet provides temporal flexibility and increased comfort for
customers. The access to many online stores reduces the costs. The suppliers’ operational costs are reduced
through a faster process, controlled by the machine. From a customer perspective, online shopping and
online data capture reduces time and money expenses. For the case of business – customer (B2C) economic
activities, Internet was used for the supply of physical goods such as books, CDs and PCs. From the economic
perspective, services become more and more important, and will be offered increasingly via the Internet. At
the same time, globalization and developing new business and economic principles lead to the adoption of a
new way of selling products and services: bundle supply [21,40].

The bundle is selling two or more bundled products, often at a lower price than the price of the products
considered separately. The term of product is often used to designate goods, but is a generic term for goods
and services. The product is defined as the basic result of any type of industry; goods are defined as physical
objects or devices, and services are defined as actions or feats. The Internet allows the integration of the basic
services that come from multiple vendors into a single package, in cases where such cooperation has not been
possible until now. The Internet is a tool often used primarily to trade goods. Customers can create a complex
good (personal computer), consisting of several elementary components and can order it online from sites
such Dell or Cisco. These actions are eased by a component-based description of the goods, suitable for the
composition of complex goods. So-called product configurators (software systems that are designed to
compose, shape or configure complex goods, consisting of several elementary components) exist on the
market for decades. Here we can mention: R1/XCON, MICON, VT and Cossoack. These systems have a
common denominator: the components used to compose complex goods are tangible, and the aggregation is
based on the physical components. This is not suitable for services because of their intangible nature.
However online odeling of complex services requires similar mechanisms. Software support for services
bundles has also gained importance for the off-line tasks. In the past, a business was working as an
independent entity to provide business results to its customers. Nowadays is frequent the case in which
several suppliers work together to offer their services, because they could not be provided working solitarily. Creating systems based on distributed knowledge models, facilitates the collaboration between different suppliers. A first step in creating these groups of value (where the supply is generated on-line or off-line) is to perform a business analysis to examine the financial feasibility of such cooperation.

The complexity of this analysis increases with the number of participants to the group of suppliers. Automatic reasoning through intelligent systems can help business analysts to cope with this complexity, when performing such a business analysis in which are included the services bundles. Software tools can help analysts to model possible services bundles and to examine their financial feasibility. Choosing the services to be embedded in the services bundles, determines the providers which will participate to the value creation. Generating a complex good, composed of several simple elements, requires that these elements are described in a such a manner to withstand the composition. The description of services differs from the description of physical goods or software components. When consumers purchase a good/service, they are interested in the benefits of that good, not in the good itself. However the sites that sell goods, are describing them by their physical properties or by the functionalities generated by their physical properties. It is not necessary to describe the goods through their physical properties. Not the same can be said about the services, for which the correlation between them and the customer's demand can be based on the benefits offered. A services bundle is obtained through the use of Web services as business processes. Web services are software applications that are used in the Internet. Services are defined as the economic activities through which suppliers and customers exchange benefits. These benefits can be objects with economic value, such as money or other physical assets. We use conceptual modeling and automated reasoning techniques to support the use of the services bundles overlaying software, and to establish the link between clients and services. This approach differs from other approaches in computer science in which the requirements (customers' needs) find their counterpart in the available services, based on physical properties or functionalities. Services can be viewed as an activity of changing benefits. Modelling a services bundle is overlaying an overlaying that provides a set of benefits and requires giving up other services. The first of these was aimed at integration and interoperability resources for groups of suppliers, characterized by complex goods and services, as well by supply chains. FrUX's main objective is to understand the overlaying and to provide ICT-based services and services bundles that automatically adapt to the groups of users. The ontology of services facilitates the automation of the services bundles generation process, a task traditionally performed by the employees that make contact with customers. On-line software applications can replace human staff in providing services bundles, generated according to customers' current needs. The necessary condition is to formalize and implement the suppliers' business logic. The automatic process of supplying services bundles can also be used off-line, in order to increase efficiency of the tasks performed by staff.

**Service-Oriented Architectures**

A SOA (Service-Oriented Architecture) defines the internal relations between different functional elements of an application, called services, through well defined interfaces [5]. These interfaces are defined in XML, creating neutral implementations and services based on standards. This allows the full interoperability of the services built on unparalleled systems and facilitates the decoupling of services. SOA is the evolution from object-oriented models, which dominated the software development in recent decades, in order to accomplish the following business requirements: (1) support for dynamic capabilities (2) better foundations for intelligent systems or semantic solutions (3) reuse of existing applications, (4) enhance the user’s potential. SOA provides the infrastructure that allows the development of dynamic capabilities. Such capabilities are necessary for business networks that emerged in the mid 90's as a competitive strategy, based on decoupled processes, and linking the enterprise with customers, suppliers and business partners. Dynamic capabilities are generally needed in agile organizations, consisting of constant changes of the designing team, in task forces, alliances and other informal structures. The advantage of a decoupled system consists in its adaptability to constant change. Each service can be easily changed and new services can be added, with an increased level of autonomy and intelligence. A SOA implementation allows the company to better influence the present aspects of technology, the increased profit’s transparency in their data and real-time processes, redundant synchronized systems, and marking new and existing process on a dynamic map, operationally defined. The In system-based SOAs can be built individual services with object-oriented design, or other alternative. The most important advantage of the SOA is the interface. Compared with the COBRA architecture, which offers concepts similar to SOA, SOA is based on XML. By creating the interface in the web services defining language, based on XML (WSDL), services were moved to a more dynamic and flexible system interface. We can say that the fundamental difference between SOA and previous developments is that it is built using XML, acknowledged as the most important software standard of our era, and web services standards based on XML.

**UDDI and WSDL.** Universal description, discovery and integration (UDDI) is a services registry in which businesses can browse and list web services. UDDI provides an open model, extensible for web services description, and highlights numerous technologies and business standards like XML, HTTP and DNS protocols. UDDI uses WSDL to describe web services' interfaces as a set of ports; a port is the draft of an
abstract type of port to a concrete communication protocol used to invoke web services. Simple object access protocol (SOAP) for interactions between all SOAP components is based on XML, and has three major parts to define a message exchanged between two components. Today, the SOAP specification describe how to use SOAP, single or in combination with HTTP.

**WSEL and WSIL.** Web Services and Point Language (WSEL) is an XML format for describing the non-operational characteristics of the services’ end point, such as service quality, cost, and security. Web Services Inspection Language (WSIL) define how a solicitor can find the description of a XML web service on a web server, allowing these solicitors to easily search for XML web services on the web server.

**DAML-S.** DAML-S is an ontology for web services based on DAML, and provides to the web services providers a centred set of constructions, to enhance the language for describing the properties and capabilities of their web services, in an unambiguous way, able to be interpreted by computer. The DAML-S web services increase will facilitate the automation of the web services’ tasks, including the discovery, execution, composition and interoperability of the web services.

**BPEL.** (Business Process Execution Language). BPEL4WS provides a language (originally developed by IBM, Microsoft and BEA) to specify the formula for web services’ behaviour, in business’ interaction processes. BPEL4WS defines an interoperable integration model that should facilitate the expansion of automated integration processes both within the company and in business-to-business spaces. BPEL4WS’ specifications provide an XML-based grammar for describing the logical control, required to coordinate the web services participating in the process. This grammar can then be interpreted and executed by an orchestration engine, which is controlled by one of the parties. The engine coordinates various activities within the process, and compensates the system when errors occur.

4. Conclusions

There is a big interest in organizational knowledge and knowledge management systems (KMSs) from the transition into the knowledge economy, where knowledge is viewed as the principle source of sustainable competitive advantage. Although knowledge management (KM) is primarily concerned with how people and organizations utilize their knowledge assets, one key to doing so efficiently is to employ technology to facilitate the KM process. Consistent with the growing interest in organizational knowledge and KM, many ICT researchers have been promoting a class of information systems, referred to as KMSs. The objective of a KMS is to support construction, sharing and application of knowledge in organizations. Technical advances in the processing and storage capacity of computers, together with the linkage of these computers into networks of distributed nodes, have greatly increased the capability of organizations to deliver goods and services. With these increased capabilities have come heightened expectations for quality, accuracy, responsiveness, and capacity. Particular topics of interest on KMSs include, but are not limited to: Organizational knowledge management approaches, Information management challenges, Service Oriented Architecture (SOA) software environments, Semantic web services environments, Information modeling and the representation of semantics, Intelligent software tools and services, Information management systems in practice. Semantics is the study of meaning. Conventional expert system shells are too slow for real-time environments, and their inference process is unbounded. We need a reactive, interruptible system that can assimilate data and asynchronous events, and present the operator with a reasoned opinion in a timely manner. Speed alone is not enough. In practice, it is common to find organizations making use of one or more of the following (technical) systems and concepts to support their KM efforts: Knowledge Maps, Taxonomies, Enterprise search engine, e-collaboration tools, Information repositories, Expert Systems, Data Mining / Knowledge Discovery systems, Case-based Reasoning / Question-Answering tools (for Helpdesk and/or Contact Centers), E-Learning and/or Learning Management Systems (LMS), Enterprise Information Portal, Intellectual Capital (IC) measurement tools. Expert systems are examples of relevant knowledge-based methodologies that have much to contribute to KMSs because they manipulate knowledge to implement various tasks. The KMSs based on Agent Technology (KMSAT) tries to provide computers the capabilities of performing various intelligent tasks for which their human users resort to their knowledge and collective intelligence. At present, KMSAT is a highly economically important field due to its ability of approaching new sets of problems, different from those dealt with by the classical systems, such as: perception, decision making, planning, diagnosis, natural language comprehension, enterprise KM, learning, STs, web service interfaces, etc.

Organisations are subject to a number of challenges and opportunities that cannot be successfully resolved with the current technologies. ICT markets are dominated by relational databases, algorithmic procedures, objectual programming paradigms and stack-based architectures. Installed databases are huge, costing around 2 trill. $ (Hardware, software, services). A key factor for the global expansion are the telecommunications and the use of services bundles on existing structures. Processing speed or storage capacity doubles every 12 or 18. We are witnessing a period of explosion of infrastructures, information sources, communities of interest and knowledge that characterize global markets developed around the concept of network. Due to increasing demands and complexity of the systems, current ICT approaches are
unable to bear the massive integration and interoperability between different subsystems. Infrastructure challenges include security, self-protection, scalability, web services, grid architectures, parallelism, massive distribution. Solutions in this regard must be able to solve the complexity of the systems of systems and provide the businesses with value, at costs and risks ever smaller compared to the previous ones. Automation of the work intensively based on knowledge and arguments is of great interest. In the field of business has been invested heavily in enterprise applications that automate transaction processing. These systems based on records allow scalability. Competitive differentiation in different industries is not related to the work intensively based on knowledge. Current applications are too rigid, difficult to integrate and extremely expensive to replace. Current solutions must be able to link up applications, data sources and services in a user-friendly manner, close to the user, to allow real-time interaction, dynamic analysis and support for decision making. Automation of the work intensively based on knowledge involves much more than just interoperability. The essence of this approach is founded on the calculation based on knowledge (knowledge computing). Current ICT focuses on acquiring information relating to a job, dependent on circumstances. But the knowledge necessary to achieve a job’s objectives is intimately related to the employee itself (education, experience) or to learning. Experience is difficult to acquire, and when the employee leaves, the organization loses this experience plus the relational capital. New KMS approaches must include massively automation of the work intensively based on knowledge, but also all the reasoning theories and methods necessary for fulfilling tasks.

References
[14] Leigh Tesfation (2006) – Notes on Learning, Department of Economics, Iowa State University, USA

[52] papers.snn.ca/axl3/papers/snn/abstract_id=1182253
[56] www.iei.liue.se/content/1/c4/58/58/Magnusson_Berggren%202008.pdf