

About knowledge management in virtual organizations

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Abstract: Knowledge management is a real important issue in economy because more than ever we need an efficient control of information on the market, of the way it is processed, interpreted and then used in day by day decisions. The present international economical situation generated by the well known crisis, indicate the lack of organization and control of knowledge in organizations. And if we think that the Internet, respectively that virtual identity that almost every physical organization have is the key that make the difference, then we can consider knowledge management in virtual organizations an important thematic to pay attention. The paper presents the characteristics and what we presume that knowledge management should accomplish in a virtual organization together with an architecture that implies the use of Semantic Web technologies.

Keywords: Virtual Organizations, Semantic Web, Knowledge Management, Knowledge Representation

Introduction

Each year, companies worldwide are spending millions of dollars or euros on buying and installing software to help them in carrying out activities, but most of this money actually is spent on determining this software to communicate with other software. This is because it overlooks the fact that not the material resources or technology provide maximum profit, but the knowledge that the organization holds.

In a context where **knowledge** is vital for an organization, knowledge management becomes an imperative. Every organization must have its own knowledge management in order to benefit from the increased value, efficiency and ultimately profit.

A **knowledge management** system is an information system specifically designed to facilitate coding, collection, integration and dissemination of knowledge [1]. Ease of communication offered by the World Wide Web has facilitated the exchange of knowledge and social participation, which in turn created a strong community type which removes geographical and time barriers and in which its members can share information and knowledge for mutual learning or problem solving in a virtual mode [3]. This type of organization is the virtual one.

According to Krebs [11] a **virtual organization** can be seen as a typical organization of knowledge. The virtual organization doesn't have a hierarchical structure as classical one, but a horizontal structure, with limits impossible to define, and it depends of the effectiveness of knowledge management. Virtual organizations are considered virtual communities [3] where social and technological combination of features makes the management of these organizations to be a difficult changing challenge, a territory not yet fully explored.

It is necessary to create an infrastructure for sharing knowledge from one participant to another within the organization either it is a person or a computer. A first aspect of creating this infrastructure is the **representation of knowledge** within the virtual organization.

This is where **Semantic Web** technologies are involved that enables to encode knowledge in a practical and efficient manner allowing the software to automatically capture processes within the organization [13].

Members within organizations interact and share knowledge building a common knowledge base. Therefore they need a common vocabulary to describe and represent this knowledge, vocabulary that can be created using W3C standards. Therefore, we believe that the tools within a knowledge management system must ensure the *development* of knowledge resources, *purchasing*, *storing*, *coding*, *distribution*, *sharing* and *use* of knowledge. In the following we will present the premises of our research.

1. Starting point

We had in mind the following premises when we start to analyze the knowledge management in virtual organizations:

- *Knowledge* is recognized as a decisive mean of competitiveness for different companies, businesses - and is well known that the company is a basic link in the value chain that guides society. Knowledge is the key resource for the transition from traditional society to knowledge society, a step made by mankind to a fully globalized world that has reached a higher development in all fields;
- *Knowledge representation* is how the coding, the expression in one form or another of knowledge is done in a particular field. It is vital representation of domain knowledge for specific processing operations and automatic sharing of knowledge by computers. Was found over years of research that the intelligence of a system is ensured by optimal processing capacity of knowledge, which depends essentially on their mode of representation;
- *Semantic Web technologies* fall within the scope of most knowledge representation languages shared within the Web space. Therefore, they are intended for knowledge representation for all that means organizations on Web. Semantic Web is actually a set of standards, languages, environments and development tools for Web page content with metadata annotations defined so that intelligent agents can achieve more efficient reasoning about services offered by sites. Technologies are under development by researchers together with industry organizations under the coordination of World Wide Web Consortium (W3C);
- *Management knowledge* targets administration and knowledge transfer within an organization;
- *Virtual organizations* are modern forms of classical organization, adapted at ICT changes. Are interdependent, geographically dispersed and are constantly changing and adapting the organizational structure. Knowledge management in virtual organization plays an important role because the way knowledge is managed in this virtual space is more important than the actual product.

Given the above assumptions, we can say that we can not talk about knowledge management if we don't talk about representation; or we can not talk about Semantic Web if we don't talk, also, about knowledge representation. Also, we believe that, in terms of virtual organizations, they may not exist in the future, without a knowledge management conducted using Semantic Web technologies. This is shown visually in Figure 1.

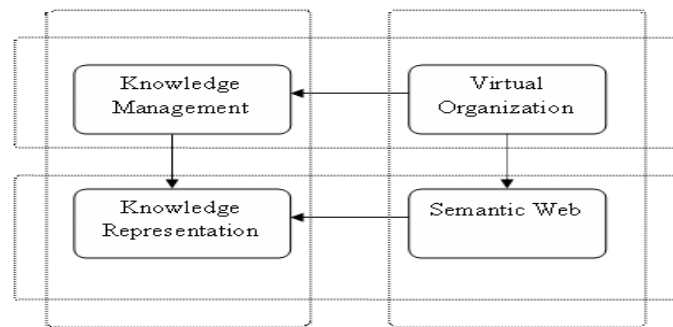


Figure 1: Analyze of KM in virtual organizations

2. KM in virtual organizations

Knowledge management in virtual organizations must provide *methods and techniques of knowledge representation for web documents* to be "understood" and processed automatically by machines. We consider the knowledge representation the transposition of knowledge into preset formats (by a community of interest) after a certain vocabulary. They are in fact some languages that meet a certain grammar.

Web documents in this way can become not only human-readable but machine-readable. Knowledge representation on the web is done using different tags to mark words and then enrich them with a specific exactly meaning [14].

In terms of knowledge management, the ability to add annotations to the content of documents is one of the most powerful tools that can be applied in knowledge management architecture [8].

What the Semantic Web can provide and what any company needs is a universal solution for knowledge representation on the Web to provide easy access to them, so the organization will be "visible" to potential clients.

We studied domain literature to see proposals for knowledge management models and we mention [4], [5], [6], [7], [8], [9], [10], [12] and the conclusion is that a majority of the proposals focus on using ontology and some models combine data mining techniques or expert systems.

Was analyzed at what level these technologies have been applied both on the Romanian market and also on international one and we observed that organizations in Romania, which have identity on the Internet (have developed a presentation site), not currently use these technologies and within virtual organizations abroad only large companies have started in the last three years to focus attention on the advantages they can get by using Semantic Web technologies.

In an interview with Jay Myers, head of web development, we learn how BestBuy used in its web pages RDFa semantic markup language. The aim was to improve visibility on Internet of the online stores held. For semantic representation, BestBuy uses ontology GoodRelations [15], a semantic vocabulary for describing electronic commerce products or details about the store. BestBuy therefore used as Semantic Web technologies: ontology and RDFa.

Other company, BBC, is using RDF representation for web resources and ontology like DBPedia and others created specifically for each type of program they have.

Other large companies already using Semantic Web technologies are Facebook or Yahoo.

3. A proposed model for knowledge management on web

The proposal made in this article is an initiative in this respect for organizations in Romania. We believe that "soon" and not "in the future" many sites in Romania will be developed using these technologies and in particular the ones for search optimization, following the example of big companies from abroad.

The proposed model has as main objectives to accomplish the following:

- implementation of an ontology on knowledge of the virtual organization;
- integration of RDFa tags along with HTML tags to create semantic content;
- development of semantic search over RDFa tags and over ontology records.

The architecture is presented in Figure 2.

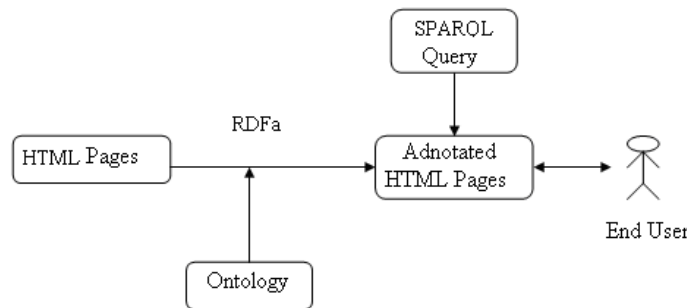


Figure 2: Architecture of KM on Web

From the scheme we may notice that in the HTML page are added RDFa tags created according to the specified ontology. Annotated pages then can be queried using SPARQL – the specific web query language. The interaction between end user and organization's site containing annotated pages is two-way - it can perform both queries and view the search results.

Architecture can be divided into two levels, first is the semantic annotation and the second is the semantic search. At the first level we create the ontology and semantic annotations are inserted into the HTML web pages, at the second level the request in SPARQL format is sent to a SPARQL endpoint with references to ontology created the first level and then answer with the query result is received which is returned to the end user.

This architecture needs some functional requirements. We capture some of them:

- Software requirements: for that we need the tools to develop first the web application for virtual organization, meaning the web site. This kind of tools can be any web programming language (eg. PHP), an web server like Apache and HTML language to create these pages;
- Hardware requirements: hardware requirements are simple, requiring only a station connected to the Internet;
- Semantic Web components: are the knowledge representation languages for creating web ontology: OWL, RDF, etc. and for annotating web pages after ontology we need RDFa. For queries we need SPARQL language query. We can also use SPARQL endpoints or RDFa extractor validated by W3C.

Conclusions

This study is intended to be a research about knowledge management in virtual organizations. For that we established what knowledge management should accomplish in the context of virtual organizations and

what we need to apply. We also investigated the domain literature for different knowledge management models on web.

We proposed a KM model in which Semantic Web technologies play an important part. We searched also for existing implemented knowledge management models that already use these technologies among virtual organizations from Romania and abroad. The results are poor and this mean the proposed model presented here can be a realistic solution for this organizations. The difference between existing models that we fund only in organizations abroad and the one proposed here is that our model uses multiple Semantic Web technologies to cover a wider area of problems that knowledge management must accomplish and not only one or maximum two of these technologies. It is a general architecture so it can be adapted on different kind of organizations. The next step is to analyze every tool involved in architecture and develop and implement such a system for knowledge management on web.

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