

Application of the concepts of knowledge management in the conception of an Intelligent System for the Recovery and Organization of Knowledge in Biodiversity – SISBIO

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Abstract

The present work intends to describe the process of knowledge management used in the conception of an Intelligent System for the Recovery and Organization of Knowledge in Biodiversity - SISBIO. It consists of a computer program devoted to the promotion of the chain of biofuel, area chosen because of its relevance at a world-wide level and of extreme importance in the context of the megadiverse countries, among which is Brazil. Knowledge management was introduced conceptually in the conception of the system and translated into functionalities that aim at the potencialization of the identification and generation of biobusiness between the main agents of the chain of biofuel promoting the economic, social and environmental development.

1. Introduction

Rapidly occurring weather changes, the strong growth and population concentration, the high prices of oil and political-institutional crises have been generating a strong demand for renewable fuels or biofuel. Brazilian legislation classifies biofuel as a "fuel derived from renewable biomass for use in combustion engines or according to regulation, for another type of energy generation, that can substitute partial or total fossil fuel". The main investments for the generation of biofuel are the sugar cane, mamona (*Dilodendron bipinnatum*), African oil palm, sun, wind and water, among others.

In this scenery, Brazil appears as a great supplying potential of world-wide energy which had its megadiversity and production capacity diversified in practically all areas of its territory. As main examples, we can mention the production of biodiesel from oleaginous plants such as mamona (*Dilodendron bipinnatum*), babassu (*Orbygnia martiana* or *Orbygnia speciosa*) and palm in the Northeast, palm and soy in the North, soy, mamona and cotton in the central-western region, soy, cotton and sunflower in the Southeast and finally soy, cotton and sunflower in the South of the country. However, this strong demand for the production of renewable energy must be structured in a sustainable way, bringing about benefits for investors, small agricultural producers, generating research centers, besides guaranteeing the conservation of the environment through the adequate management of natural resources. Brazil is in a situation favourable to the

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stimulation to a new agricultural development through the production and commercialization of biofuel and to familiar agriculture.

This structuring of the biofuel chain becomes necessary due to the unprepared situation of the sector in relation to the strong demand, thus generating, an economic, social or environmental unbalance. In this sense, the development of SISBIO, based on concepts of knowledge management can become an important tool in the production of strategic information and promote the generation of biobusiness.

In chapter 2, we will be describing the main concepts of knowledge management used as a reference in the conception of the system and their relation with its functionalities. In chapter 2, we will be describing SISBIO, highlighting its importance and its functionalities. In chapter 4, we will be presenting some conclusions.

2. Knowledge management

Many transformations are taking humanity to the age of knowledge. In this sense, it can be affirmed that the ways of thinking that reach human society, from Cartesian thought to complex thought, are already modifying the performance of public or private organizations. It is in this new strategy that a great diversity of information is taken into account coming from the most varied knowledge areas.

Globalization and the advent of the new technologies of information and communication (ICT's) are factors that have contributed significantly to this revolution in the forms of knowledge management applied to the world of organizations and public administration. This is so because the time and space barriers have visibly been broken. The focus of this new form of organization must be established on the acquisition, storage, processing and dissemination of information and knowledge.

Knowledge management is based exactly on this new form of organization and has the identification of information and production of strategic knowledge as its main function, involving all the flow that ranges from the identification of information sources to the dissemination of that knowledge. This process must be made in order to identify business-oriented chances, to optimize investments and to manage human actions, besides protecting the internal production.

According to Francini, "the subject "Knowledge Management" borders the diverse knowledge areas of the organizations, being mainly multidisciplinary, since the degree of knowledge of the organizations considers the set of abilities of the diverse areas that compose them, such as Planning, Marketing, Operations, Finances and Human Capital Management, among others, which, in their set, when duly applied, will have to allow the organizations to be able to get competitive advantages" (Francini, 2002).

For Ann Macintosh, "knowledge management does not only intend to manage capitals of knowledge, but also of the management of the processes that act on these capitals. These processes include: developing, preserving, using and sharing knowledge. Therefore, knowledge management involves the identification and analysis of the available and desirable capitals of knowledge, beyond the processes related with them. It also involves the planning and the control of the actions to develop them (the capitals and the processes), with the intention of reaching the aims of the organization " (Macintosh, 1997).

For Cândido, " knowledge management can be defined as a set of techniques and tools that allow us to identify, analyze and manage, the intellectual capital of the company and its associated processes in a strategic and systemic way, " (Cândido, 2003).

For Moresi, "knowledge management can be seen as the set of activities that intend to develop and control all types of knowledge in an organization, aiming at its use in the achievement of its objectives" (Moresi, 2001).

The consolidation of knowledge management has been taking place in an extremely fast way and many initiatives have already been revolutionizing the globalized and increasingly competitive world. It uses concepts, models, methods and techniques coming from several knowledge areas, amongst which we can highlight cognition sciences, education and information. In this sense, the Information and Communication Technologies are considered the ideal tools for the implantation of these management systems, since they work with advanced management data base techniques. Artificial intelligence appears as a strong differential in this process.

To know all the possible data of the real world where a business-oriented activity is developed, to know and to know how to evaluate the rules used, as well as to be able to anticipate new facts of this real world immediately create the basic elements of competitiveness when answering to new (and sometimes not perceivable) necessities of market.

In the conception of SISBIO, many concepts of knowledge management have been applied and translated into devices with the aim of identifying, collecting and producing strategic information that can promote the biofuel chain. For this, some sources of information have started to be monitored and pre-analyzed by SISBIO.

2.1 Knowledge management in the biofuel chain

The biofuel chain, due to the strong world-wide demand and its importance for the development of the country, needs a knowledge organization and production of strategic information. In this sense, knowledge management appears as an important conceptual skeleton focused on the promotion of biofuel. Thus, we can affirm that the vision of knowledge management for chain of biofuel must basically comprehend a vision on the sources and types of information produced daily. The following questions were used as a reference: How does the chain of biofuel work? b) who are the main agents of this chain? c) Which are the main sources of information of this chain? d) Which is the legislation and which are the main documents and international agreements that conduct the chain of biofuel? e) which are the main markets, financing sources and possibilities of generation of biobusiness?

Currently, a great amount of information connected to biofuel is reproduced in sources of general information, such as Internet sites and also specialized sources, such as the ones in scientific magazines and even in governmental, enterprise and sites of the third sector. Knowledge management intends to process and transform this great amount of information into knowledge of high aggregate value. Moreover, knowledge management intends to map the main processes that involve the chain, with the creation, for example, of a bank of better practices. SISBIO performs this process turning the analysis of the specialists more agile and trustworthy, in the area of biofuel.

So that the production and commercialization of biofuel occurs in an effective way, we must take into consideration some aspects such as sustainability of the energy matrix and the local communities, generation of jobs and income, optimization of regional and antropized areas, besides the identification and exploitation of financing sources and the international markets of biofuel. This means that the management of the biofuel chain is directly related to the equipment and available raw materials, of the productive processes and models of agriculture practised in different regions, exploitation of chances generating added value, jobs and income for the local communities that practise familiar agriculture, organization of the communities in cooperative works, beyond the essential requirements for the conservation of the environment.

It is expected thus, through the implementation of the concepts of knowledge management in SISBIO to make the monitoring possible of all the processes that involve the chain of biofuel in real time, turning the processes of decision making faster, efficient and necessary.

3. SISBIO

SISBIO device – (Intelligent System for the Organization and Retrieval of Knowledge in Biodiversity, provides institutions, rural producers, and investors with immediate and precise access to relevant information for the processes of decision making. This is so, because the system is capable to generate dynamic reports and extract occult knowledge from a database. The system uses a methodology that makes an organization possible of information coming from structured and not structured databases, generating extremely relevant knowledge for governmental institutions, customers and investors (Costa, 2003). The device, besides producing, integrating and processing a great amount of relevant information, forms a net of relationships between the actors that form a biobusiness. Moreover, SISBIO has its linguistic development based on ontologies that provides a more efficient and precise recovery of the necessary information.

The term ontology, generally used in the field of philosophy, is used in the present work as a form of representation which aims at sharing the knowledge of the same domain communicated between people and systems. In this sense ontologies intend to bring a common agreement of a certain domain through the relation between indicative words or expressions that represent a context. They are used in the construction of Systems Based on Knowledge (SBC).

The construction of ontologies enables a better performance of the system, mainly in what is related to the precision and contextualization in the return of the consultations performed by the user. In relation to the search by key-word, a system that uses ontologies presents a wide advantage, mainly when bigger texts are inserted in the search field. In this sense, we can affirm that the bigger the text, with a limit of 10.000 words, the greater the efficiency of the search, due to the process of representation of knowledge performed on the basis of ontologies, which allows the system to not only perform a research by context and through logical key-words and connectors.

We can highlight two main relevant points of SISBIO.

The first one is the management of all the processes executed on the non-structured data inside the flow of information, that is, of the storage to the consultation made by the user (Hoeschl, 2003).

The second point is the cyclical process of recovery, where the user describes the subject to be searched on and the system returns the search by degree of similarity in relation to the context described. This process is only possible due to the use of a technique called Dynamically Contextualized Knowledge Representation - DCKR. This technique consists of a dynamic process of analysis of the general context that involves the problem focused. Moreover, the documents are retrieved through pre-defined indexes, that can be valued by the user at the time of the consultation. The user can, for example, perform a search on a certain area or type of biofuel. For this, it must attribute weights to these indexes, so that the filters that diminish the area of search of the system can be activated, allowing a more specialized recovery.

Another functionality that deserves prominence is the Relations Net, a methodology based on the theory of graphs capable to identify possibilities through the relationships between the agents of the process. Here, it is used to generate biobusiness through the identification and relationship between the ontologies that represent knowledge and the needs and availabilities of the investors, agricultural universities, producers that have aims in common.

SISBIO presents the modules of gathering, storage, analysis, relationship, besides the editor of ontologies and informative notes.

The gathering module is responsible for the monitoring of open digital sources. Gathering Intelligent agents are created, which monitor specific digital targets. The automatic gathering agents that gather pre-defined information of each informational source are indicated by the specialists of the domain and stored in the knowledge base of the system.

The storage module is responsible for the organization of knowledge based on the semantic ontologies and its semantic relations. Each new document included in the system, either by means of the observers or Informative Notes, is automatically indexed and stored in the same structure. This module prepares the information to be retrieved and analyzed in the analysis modules.

The analysis module is responsible for the textual and graphic search through matching between the case presented and documents stored in the knowledge base. Informative notes are retrieved, apart from the documents of the base, which are documents inserted manually generally containing strategic analyses and information.

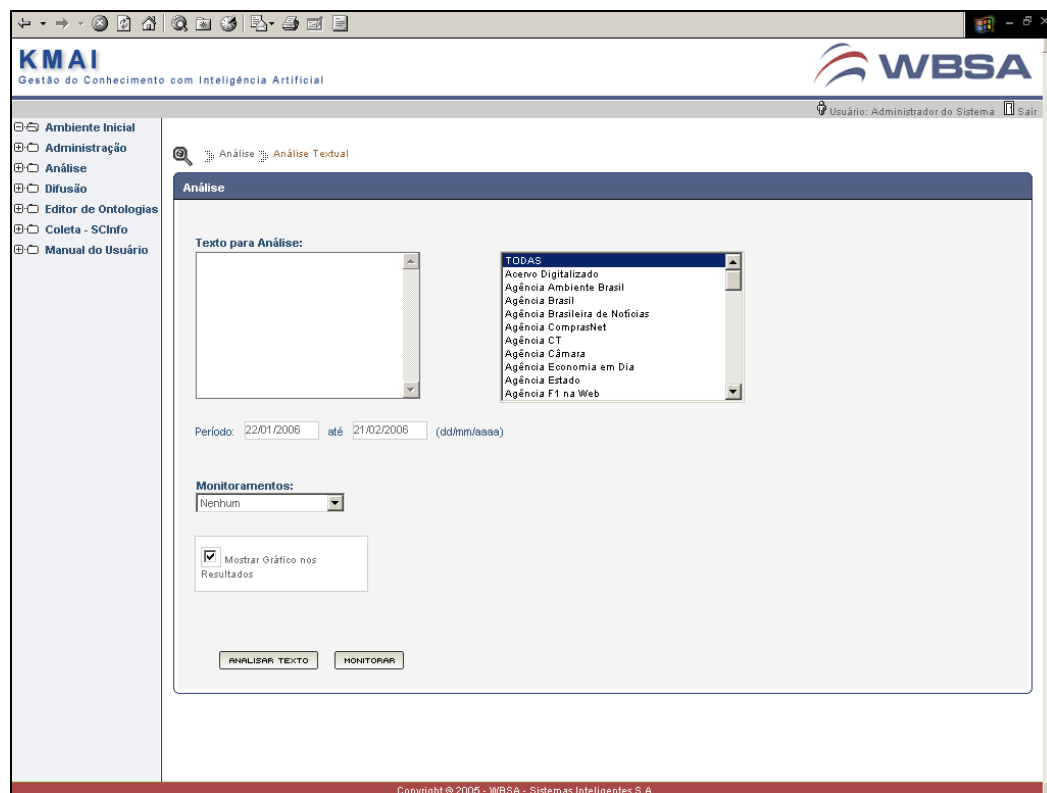


Figure 1
Mean interface of Analysis Module

The relationship module is the environment that allows the identification of chances of biobusiness through the registration of technological innovations and research being developed, agricultural producers, besides investors and prospective agricultural land owners. The module is fed by the insertion of the data of the agents that compose the biofuel chain, each one containing their peculiarities.

The editor of ontologies an environment for the creation and registry of the ontologies and its relations through the identification of relevant expressions and the ones that represent the knowledge domain. The figure below demonstrates the publisher of ontologies and the form of classification of the expressions and their relations, that can be connected, synonymous, type and part of.

The screenshot shows a web interface titled "Ontologias" with a sub-header "Inclusão de Novas Relações". The form is divided into two main columns. The left column contains several text input fields for defining a new relationship: "Domínio:", "Termo:", "Sinónimos:", "Isso é tipo de:", "É um tipo disso:", "Isso é parte de:", "É parte disso:", and "Conexos:". The right column, titled "Relações existentes no Dicionário", contains a list of checkboxes for selecting existing relationships, with sub-sections for "É tipo de:", "Sinónimos:", and "Conexos:". At the bottom of the form are two buttons: "VOLTAR" and "RELACIONAR".

Figure 2
Editor of ontologies

The informative notes environment is prepared to insert in the knowledge base documents produced for analysts and specialists of the domain, generally containing relevant and strategic information for the generation of biobusiness.

4. Conclusion

Knowledge management is a very important instrument in the organization of the chain of biofuel due to the fast need of adequacy of the sector to world reality. The increasing demand for the production and commercialization of biofuel allied to the great amount of information produced by diverse sources demands a process where this knowledge management is able to also foment biobusiness, adding value to the products and also to the differentiated productive processes.

The development and use of SISBIO in this process turned the process of decision making and knowledge organization of the biofuel chain more agile, transparent and efficient. With this, it is expected to foment new biobusiness and to contribute for the economic, social and ambient development.

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