

Using Ontology To Define Decision Problems Of Enterprises

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Abstract

Competitive Intelligence (CI) allows companies to collect information relevantly and to treat them while ensuring the legality and safety. The definition phase of information needs is an essential step in the process of CI, as it identifies the field to monitor the business and define the scope of the strategic watch. We propose to make a model for the business and its internal and external environment to help decision makers and watchers in the definition of decision problems. We choose the notion of ontology as a way of modeling, as it provides the tools to describe explicitly the conceptualization of knowledge in a specific field. Our goal is to build enterprise ontology which can be used in companies for the definition of information needs.

1. Introduction

To cope with the constant change of economic, geopolitical and technological environment, company should be able to adapt to changes caused by demands of its customers, attitudes of its partners and behaviors of its competitors. Competitive Intelligence (CI) is the most effective tool for the company to find useful information, and to develop the strategy for achieving its objectives. CI is a continuous cycle, whose steps include: (a) Identify information needs and decision problems across the firm, (b) Collect information (conducted legally and ethically), (c) Analyze information and upgrade it to intelligence, (d) Disseminate results to decision-makers, (e) Identify feedback of decision makers and their new needs.

Analysis of CI process shows that techniques and methods used in this approach are useless if the results are incompatible with the needs and strategic objectives of the company. Therefore, the identification of informational needs must be conducted with great interest. Many models and methods (i.e. SWOT, PORTER) are used in enterprises to define the

decision-making needs but they do not cover the overall scope of the company and must be combined to give to firms the global strategic analysis. The purpose of this paper is to build an enterprise ontology named *EntrOnto* for modeling the internal and external environment of the firms, and to show the role of this ontology in Competitive Intelligence process.

According to Fernandez and al. (1997), the construction step moves into following states: specification, conceptualization, formalization, implementation, and maintenance. We followed the same steps in construction of *EntrOnto*. The first part of our paper will concentrate on knowledge domain and terminology of our ontology. In the second part, we present the work done on development of *EntrOnto*. Finally, we demonstrate how to use our model in definition phase of the decision problem of companies.

2. Knowledge Domain of EntrOnto

In this section we describe the various parts of the Knowledge Domain of *EntrOnto*: Internal-Environment and External-Environment of firms. We divided the External-Environment into two parts: MicroEnvironment and MacroEnvironment.

2.1. Internal-Environment

To describe the internal environment of an enterprise, we must describe internal factors and common variables to all firms i.e. hierarchy, structure, human resources, means of communication, goals, etc. Terminology and structure (concepts and relationships) of the *organization-ontology* developed in "TOVE" project meets this description. In this ontology, an organization is a set of *constraints* on *activities* performed by *agents*. Each *agent* plays one or more *roles*, and he is a member of a *division* or a *team*. He consumes a range of *resources* (e.g. materials, labors, tools, etc.) to perform its *activities*, and he has a set of *communication-link* defining the protocol that it communicates with other *agents* in the organization.

Moreover, each *role* has a set of *organization-goals* and it requires a set of *skills* and *authorities* to achieve the *goals*. After our analysis, we deduced that organization-ontology includes most of internal factors which are useful for decision-makers to define decision problems of their firms. We decided to integrate the organization-ontology as it is in our ontology for its accuracy. In the first paragraph of the second section, we will present its structure (concepts and relationships) and how we linked it with the other parts of EntrOnto.

2.2. MicroEnvironment

MicroEnvironment part describes the variables of immediate environment of firms. For Michael Porter, the competition is not limited to only direct competitors. To maintain profits, the firm will have to face four competitive strengths:

- New Entrants: They are looking to quickly make their market position.
- Customers: They have power to negotiate the purchase price, conditions and terms of payment and the quality of service and delivery.
- Suppliers: They have power of pressure, including price, quality and quantity of services.
- Substitute Products or Services: They lower costs without compromising quality or impose a high cost of replacement.

Our ontology includes PORTER forces in his conception because they are useful in step of

requirements definition in CI process. We chose the terms: customer, supplier, competitor, partner and product for modeling Porter forces, and the terms: has_customer, has_supplier, has_competitor, has_partner and buy for modeling their relationships with the company.

2.3. MacroEnvironment

MacroEnvironment part contains global variables that affect the company. PESTEL analysis draws the outlines of the enterprise environment by six key criteria: Political, Economic, Socio-cultural, Technological, Ecological and Legal. This type of analysis provides the ability to objectively display the variables that may affect the strategic operations of enterprises. We chose the term macroenvironment_factor for class that represent all PESTEL factors and the term macroenvironment_category for class that represent all possible categories of macroenvironment_factors. Then, we chose the term affects for the relationship that connects macroenvironment_factor to organization. Decision makers will use this relation to specify the influence type and the influence degree of macroenvironment_factor. And we chose the term belongs for relationship that connects macroenvironment_factor to macroenvironment_category. It will be used for classifying the factors in their own categories.

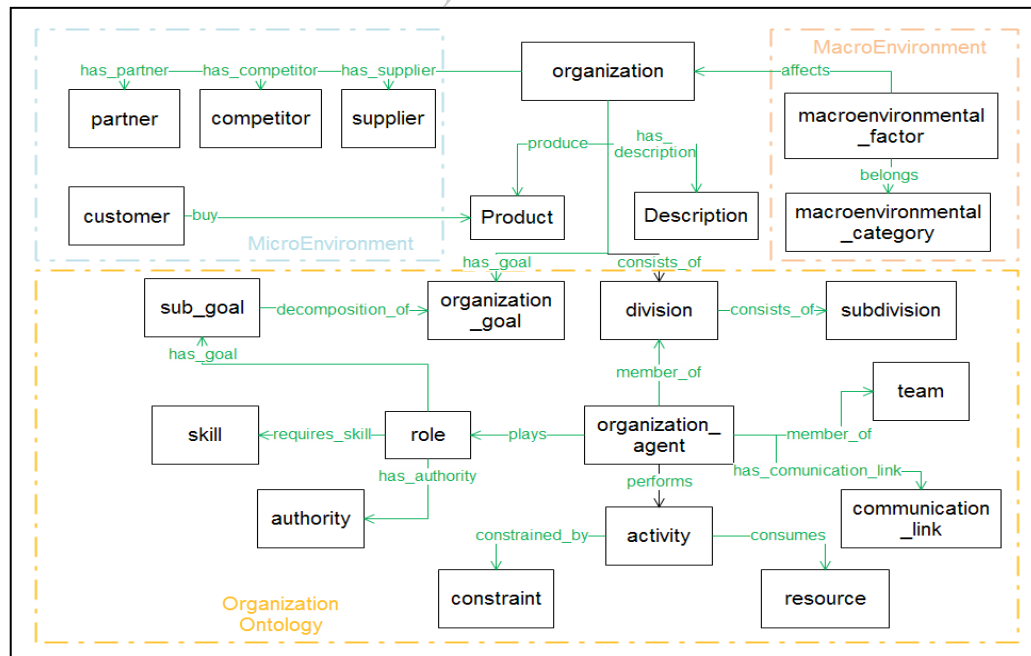


Figure 1. Diagram of binary relations created on conceptualization step of EntrOnto Ontology.

3. Building EntrOnto

3.1 Conceptualization Step

We summarize the work done in this step in a diagram of binary relations (Figure 1). In this diagram, the concepts are represented by rectangles and the relationships by arcs (from source concept to target concept). The choice of these concepts and these relationships is taken from the concepts and the models that we presented in the first part. With this structure, we guarantee to decision makers an overview of all the elements that can help them to find decision problems that they should solve to improve the situation of their companies.

Each concept and each relation of EntrOnto has a set of attributes. We give some examples in the following table:

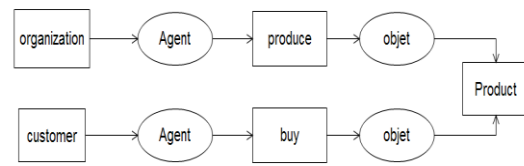
Table 1. Some Attributes of EntrOnto

ATTRIBUTE	CONCEPT	TYPE
Short_Name	Organization-agent	Character string
Type	Organization	Character string
Country	Organization,	Character string
Creation_Date	Product,	Date
Employees_	Organization,	Integer
Number	Division	
Turnover	Organization,	Float
Website	Division	Character string
Address		Character string
Social_	Organization	Enumeration
Situation	Organization	
Telephone	Organization	Character string
Experience	Organization-agent	Float
Start_Date		Date
End_Date	Organization-agent	Date
Price	Organization-agent	Float
	Activity	
	Activity	
	Product	

3.2. Formalization Step

There are currently several formalisms for representing ontologies, such as conceptual graphs (CG) and description logics. A conceptual graph is a graph composed of two types of nodes: concepts and conceptual relations, and arcs are used for linking. In graphical form of CG, concepts and conceptual relations are represented by rectangles, and relationships with circles and arcs are used to link the relationship with concepts associated. The graphic form of the CG makes it easy to interpret, modify or create new ones. This facility helped us in our ontology. The following example shows an extract of our formalization which shows the relation between organization, customer and product.

Figure 2. Extract from Conceptual Graph created on



Formalization step of EntrOnto, concepts are: organization, product and customer, and conceptual-relations are: produce and buy.

3.3. Encoding Step

For coding, the ontology must be formulated with a knowledge representation language such as OWL. OWL (Web Ontology Language) is used to describe the ontologies by setting the classes, subclasses, properties and sub-properties, relations and instances. We use Protégé-4 Framework for creation and editing of our ontology. Protégé is a system developed in Java by collaboration between Stanford University and Manchester University. It is free and open source and provides a flexible user interface. The validation is done by Fact ++ reasoner integrated with Protégé-4 to infer new facts and to verify the consistency of our model. The following figures show the class hierarchy and relation hierarchy of our ontology on Protégé-4.

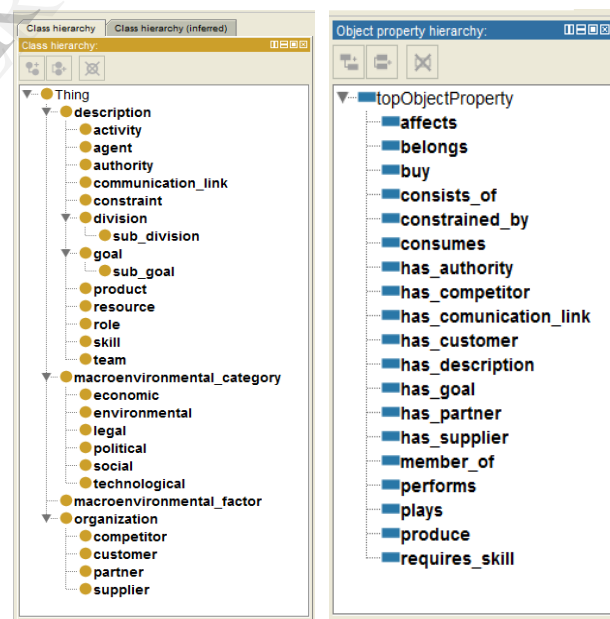


Figure 3. Class Hierarchy and Relation Hierarchy of EntrOnto on Protégé-4

4. Using EntrOnto

4.1. Watchers Tasks

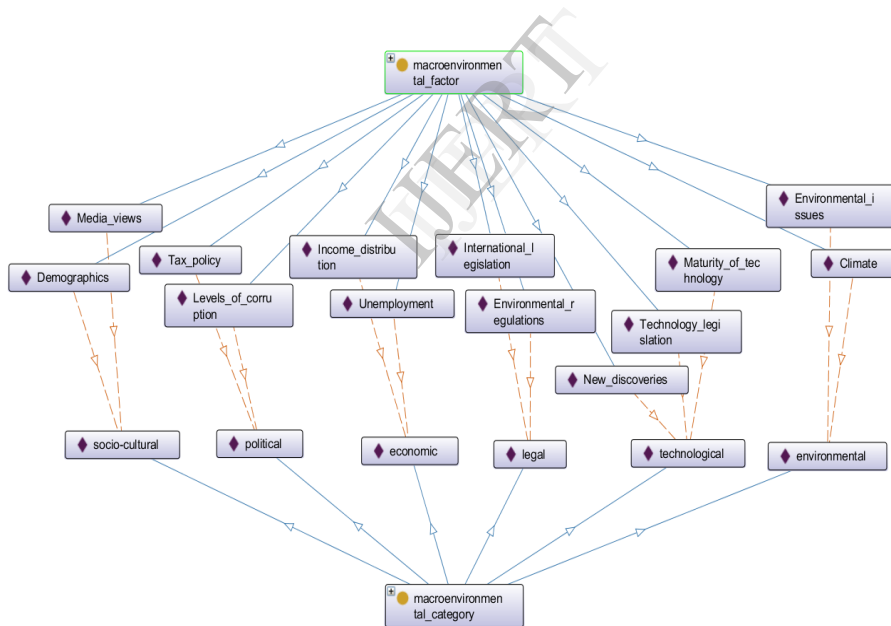
The Watchers are the managers of research, processing and analysis of information sources for responding to needs of decision makers. The Watchers are looking in various information sources and they communicate the results to decision makers in order to make the right decisions for improving the economic situation of their companies. EntrOnto provides to watchers a base of informational and strategic needs which are common between most of firms. The watchers are responsible for:

- Installing Protégé-4 tool and implement EntrOnto to make it available for decision makers of their firms.
- Creation instances/individuals of classes, relationships and attributes.
- Adding classes or relationships on EntrOnto those appear useful.
- Maintaining EntrOnto and check its consistency after each change.

Individuals (instances) are the basic, "ground level" components of ontology. They include concrete objects and they give to decision makers a knowledge base of its internal and external environment.

4.2. Decision Makers Tasks

The role of decision maker in competitive intelligence process is to identify decision problem and to define informational needs for watchers and to analyze the results in order to find solutions. To perform this step, the decision maker must be a person who knows and who masters the environment of his firm. Entronto is the tool which provides the necessary knowledge base to decision makers in order to detect issues that can become decision problems. This tool highlights the various relations between the variables of enterprise environment which are not evident and which can give more opportunities to firms. Decision makers can access to EntrOnto using the "OntoGraph" tab of Protégé-4 tool which visualize graphically the concepts and their relationships. The Figure 4 is an export of extract of EntrOnto from "OntoGraph" tab of Protégé-4. Decision-makers can find and give the decision problems listed on Table 2 using the individuals illustrated on Figure 4.



The figure (Figure 4) shows some instances of two concepts of EntrOnto: macroenvironment_factor and macroenvironment_category.

Figure 4. Example of some instances of macroenvironment_factor class and macroenvironment_category class.

Table 2. Some Decision problems interpreted from instances of EntrOnto

Instance	Decision Problem deduced
Demographics	What is the population's growth rate and age profile in client countries?
Media_Views	What are the popular media in customer country can be used to advertise our product?
Tax_Policy	Could any pending legislation or taxation changes affect our business, either positively or negatively?
Unemployment	What is the unemployment rate? Will it be easy to build a skilled workforce?
New_discoveries	Are there any new technologies on the horizon that could radically affect our business?
Climate	How climate could changes the attitude of our customers?

5. Conclusion

In this paper, we suggest an ontology which models the enterprise domain and its environment. It will help managers in phase of identification of informational and decisional problem. This is a sub goal of our goal which is the construction of a dedicated CI platform for companies using the new techniques of Web Semantic. We hope eventually enhance our ontology by inference rules using SWRL language to improve the processing of automated reasoning. These rules will allow the systems to perform logical reasoning called inferences and reaching conclusions that can assist managers in its decisions. The next step is the conception of the rule base and the implementation of this base in EntrOnto.

6. References

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