Ontology based Approach for an Insurance Company Activity Modelling

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Abstract

By their operations variety, insurance companies are faced with a large amount of data, taking into account that an insurance type allows to cover several risks types. Also, the same risk type can be the subject to several insurance types. The risk notion is specific to the insurance domain and the insurance risk significances are varied.

Ontology is a formal, explicit specification of the terms and defines a common vocabulary for researchers who need to communicate information in a certain field.

This paper aims to create an OWL ontology for modelling the activity of an insurance company, providing a solid basis to apply knowledge in the general insurances domain, by defining a set of representation terms for risks, in order for the big insurance companies to discover new information relating to the interaction between risks, to form an overview of the external and internal risk factors to which an insurer is subjected to.

Keywords: OWL ontology, Protégé ontology editor, insurance policy, types of risk
JEL Clasification: *C63, C81*

Introduction

In the context of economy globalisation, a significant number of companies have arisen that migrated to an economic model characterised by digitizing and information technology using, in order to increase the efficiency and the ability of running on different platforms, in real time (Oprescu et al, 2014, pg 21).

Digital economy has a direct impact on promoting employment and on economic and social development, promoting efficiency as the end goal (Comisia Europeană, 2013, pg 2)

In Romania, insurance companies can be state-owned, private or mixed. They collect, transform and redistribute financial resources, in order to gain profit. Their resources mainly consist of insurance premiums and interests.

From an economic perspective, the insurance is the insurer obligation to compensate an insured in case of a loss suffered, beyond his will, at a certain price.

Insurance companies are exposed to certain risks due to the large variety of activities that they operate and the constantly changing process as a result of the insurance market evolution, the competition rules and clients' requirement to benefit from customised products.

The risks faced by the insurance company are generated by several factors, among which: the subscription of the insurance premiums, the inaccurate estimations of the technical reserves, the unpredictable changes in the frequency of damages, the catastrophic damages and a risk series of general nature common to all types of risks. In relation to the level at which they are generated, the risks are structured in the following manner:

- Risks specific to the company;
- Risks specific to the insurance market;
- Risks at the economy level.

Knowledge management (KM) has become a successful tool for companies because it can identify the best optimisation strategies and achieve the transfer of knowledge by operationalising the knowledge management processes, in everyday life.

The solutions provided by knowledge management support information technologies that integrate both formal and informal knowledge, in order to facilitate knowledge acquisition, creation, sharing, searching, refinement, storage, transfer and using. This is meant to support the organisational learning dynamics and to make the organisation more efficient.

The main purpose of KM is to create value, to improve and refine the companies' competences in order to achieve its objectives and organisational targets.

Knowledge must be modelled, structured and interconnected to support its flexible integration. Any knowledge management system can function in a desirable way only if is integrated in an efficient manner in the organisation, in which it operates.

Ontologies have proven to be the right answer to the structuring and modelling of issues by providing a formal conceptualisation of a certain field, which is shared by a group of people in a field. (Gruber, 1995, pg. 907-928)

At the moment, the development of ontologies for knowledge management has reached the point where companies implement such ontologies.

Concepts and characteristics

In recent years, companies are faced with a large amount of data, both from their own databases and from the worldwide web, mass media and life, in general.

The information technology struggles to this problem, but an answer to this problem can be found in a series of both new and traditional concepts, namely semantics and ontology.

The Semantic Web can be defined as a set of technologies designed to ensure a materialised view on the web according to which, at a certain point in time, all knowledge shall be accessible on the web in a format that software applications can understand, process in order to create new knowledge. In other words, software applications will become more intelligent.

The process of creating semantic documents has been a challenge for experts from the ontology domain.

The transition from independent documents and ontologies to the concept of semantic documents has had significant implications for the ontology field. When creating semantic documents, ontology creators have to take into account the fact that the ontology needs to be connected to the document, that introduces new concepts into the ontology. It may be necessary for certain components from the ontology structure to be redesigned and for the relationships to documents to be conceptualised, because these factors are relevant for the utility of the resulted semantic documents. However, the semantic documents method does not require the developers to completely restructure the ontology. Nevertheless, it is not recommended to introduce in the domain ontologies, concepts that do not have any connection between them.

Semantic documents can integrate in their structure several ontologies with different purposes. According to specialised literature, ontologies with different generality levels (i.e. top-level ontologies, domain ontologies, activity ontologies and application ontologies) can be used to represent the architectural components of an information system (Guarino, 1998, pg.3-15).

Annotation instances represent the first step towards integrating ontologies and documents, for semantic documents. However, in most cases, these instances are not sufficient to achieve an accurate ontology integration. Annotation instances can act as a first link to other classes and instances, bringing together the domain and application ontologies, on the one hand, with the document, on the other.

In order to develop an intelligent system, a knowledge base must be created, encompassing all general and specific knowledge necessary to the system in question, in order to solve problems from a well-defined field.

The first step of ontology creation consists in deciding on the inclusion, exclusion and the hierarchical structure of the ontology concepts.

By analysing the available data sources, an ontology represents a versioning project containing several elements. The experts in the field represent a very important knowledge source.

In order to create an ontology, the knowledge engineer have to take into account the following factors (Noy at al, 2001, pg.1-25):

- The ontology domain and the ontology purpose;

- The design guidelines to ensure a coherent development;
- Available sources;
- Potential users and use cases;
- Applications accepted by the ontology.

There are several methods and languages that can be used to create an ontology. The ontology offers a common vocabulary for a domain and is constituted of elements such as: setting the classes in a taxonomic hierarchy, the relationship between data and data types, inheritances from other ontologies and inference rules (Băjenaru et al, 2015, pg.139-156).

A recent development in the standard languages used to define ontologies is Web Ontology Language (OWL) that describes concepts, but, also, provides other facilities. This language allows using inference tools on the ontology data. It consists of three different sublanguages: OWL Lite, OWL DL and OWL Full which have different functions. In OWL, the classes are regarded as sets of individuals and are described by using formal descriptions. Classes are organised in a superclass/subclass hierarchy, known as taxonomy. One of the OWL-DL characteristics is that these superclass/subclass relationships can be computed automatically by a reasoner (Soartje et al, 2006, pg. 187-201).

Ontology for modelling the activities of an insurance company

Companies are beginning to understand the fact that the semantics is very important when the systems and people will communicate between them. Based on this understanding, it is important to collect the ontology that describes the language used in the activities carried out.

Modelling an insurance company activity contributes to improving the efficiency by proposing an automated method for information searching. For this purpose, ontologies are used to model the domain and to create, organise and update the risks faced by the insured. (Bajenaru et al, 2015, pg.139-156). The ontology aims to study the things categories that there are or will be in the interest field.

There are different types of ontologies.

The ontology was implemented in the Protégé ontology editor. This editor has the following advantages: extensibility, plugins, an Application Programming Interface and documentation to write its own plugin (Niculescu et al, 2009, pg.73-88).

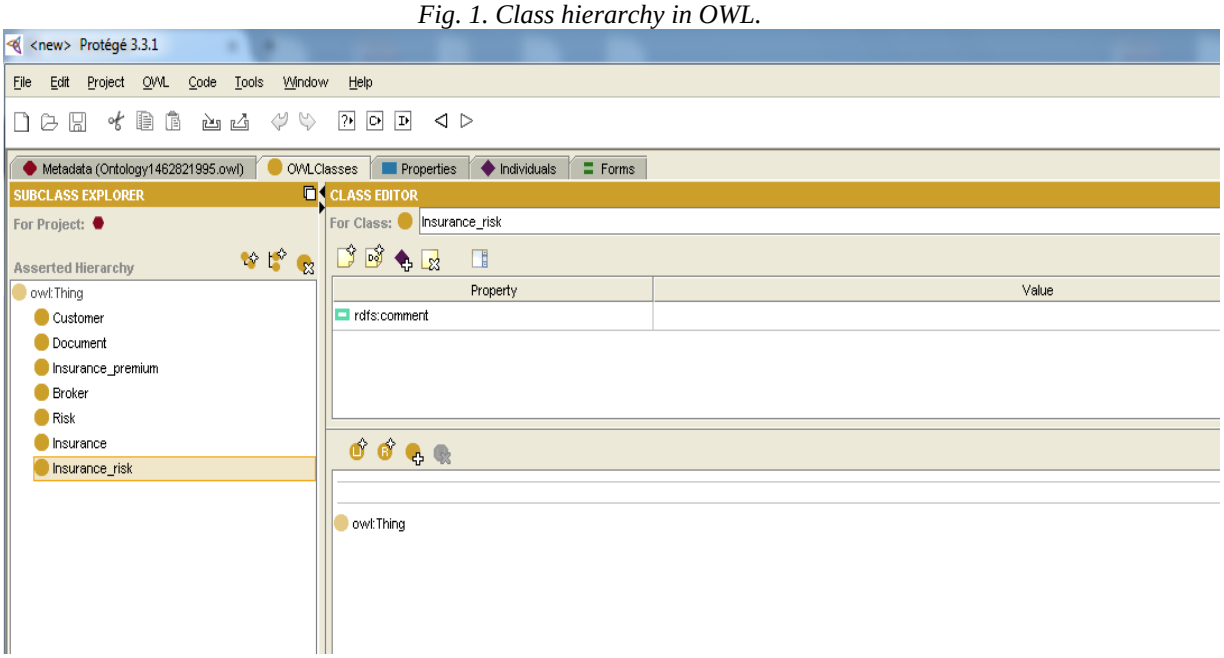
The Protégé-OWL editor allows users to:

- Load and save OWL and RDF ontologies;
- Edit and view Semantic Web Rule Language (SWRL) classes, properties and rules;
- Define logical characteristics of classes as OWL expressions;
- OWL individual edit for semantic web.

Forwards, the application for modelling an insurance company activity is presented that was created with Protégé OWL editor. An OWL ontology includes: Individuals, Properties and Classes. OWL classes are regarded as sets of individuals and the owl:Thing class represents all the individuals, as all the classes represent subclasses of the owl:Thing class ((Soartje et al, 2006, pg. 187-201).

The OWL ontology for modelling an insurance company activity has seven classes: Customer, Document, Insurance_premium, Broker, Risk, Insurance, Insurance_risk (figure 1).

Fig. 1. Class hierarchy in OWL.

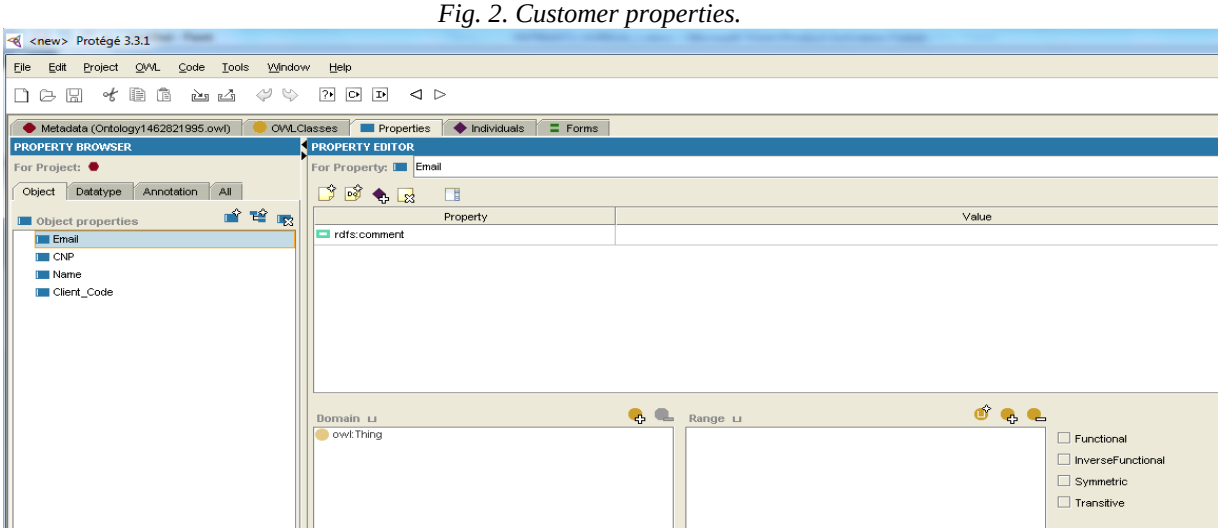


Source: made by the author.

The OWL ontology has two types of properties, namely datatype and object properties. The properties represent the relationships between individuals.

The Customer class (figure 2) contains the following properties: Client_Code (integer), Name (string), CNP (integer), Email (string).

Fig. 2. Customer properties.



Source: made by the author.

An ontology with a set of classes individuals represents a knowledge base that consists of a set of concepts that have attributes and are connected between them.

Modelling the activity of an insurance company and using the developed ontologies can be implemented into a Web platform (Băjenaru et al, 2015, pg. 139-156).

Conclusions

Due to the rapid development of information technology, the business environment has experienced a series of significant changes.

The competition between companies is based on technologies that have a crucial role in modelling the global economy based on knowledge and information.

The author offers in this article a solution for modelling the activity of an insurance company. The method has the following benefits:

- It conducts an analysis of the insurance field knowledge;
- It can be integrated in other systems for the insurance companies.

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