The Importance of an Accounting Ontology

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Many people use accounting terms in their daily activity, without always knowing their exact meaning. Accounting information is the foundation for almost every decision that a company's manager takes. Accounting knowledge is also a concern for developers of knowledge management systems and accounting intelligent systems.
The goal of this paper is to emphasize the importance of accounting knowledge in an organization and the benefits from building an accounting ontology, for the company as well as for the domain itself.
Keywords: accounting, knowledge, knowledge modelling, ontology.

Introduction

Intelligence, reasoning and knowledge were in scientists' attention since antiquity, because they were viewed as human race defining features. With the artificial intelligence researches, we are beginning to speak about computer systems capable to emulate the same features. From this perspective, it is obvious that an accounting intelligent information system will have to hold, accumulate and manipulate knowledge, and then use it in reasoning same as an accounting professional. To reach these desiderata, specialists conceived and developed methods and techniques of acquisition, modelling, representation, searching and finding of knowledge.

Accounting knowledge features

Knowledge is an important concept, both for artificial intelligence and accounting. Defining this concept is however a difficult task, that raised many interpretations and debates in literature, without finding a generally accepted definition. In stead, most authors use the hierarchy of knowledge, to compare knowledge with data and information.

Data present only a potential interest for the user, because they appear as numeric or alphanumeric strings about facts, objects or situations, as a result of actions like counting or measurement. In an organizational context, data generally describe the transactions that are made, and their gathering, saving on hard disks, administration and later finding are the main duties of information systems. Data from a transaction can most often be found as one or more records in one or more tables from a database. But data do not describe the context those transactions were made in and do not offer their interpretation, so data must be processed and aggregated in order to judge and decide on their support.

By processing and refinement of data we obtain information, sitting on the next level of knowledge hierarchy. Data becomes information only if their creator assigns them a certain meaning. Information has the ability to change the manner of perception for its receiver and can have a visible impact for his judgments and behaviours. Although information explains the relations between data, it can't explain why data are in the way they are.

When information is generated and used in the economic activity, from the processes that take place inside organizations, we talk about economic information. This information allow us to follow up the way the human, material and financial resources are used, and as a consequence, they are the key element in the decision process. The specialists assess that about 80% of information that circulate inside an organization is economic information, while 47% of that are accounting information [Horomnea, 2001, p. 34].

Information systems help enterprises to transform data in information, especially by mathematical or statistical calculations, but also by condensation, compression and centralization. Thus, for example, by summing

data from one day's transactions we can obtain useful information such as "daily sales value", "the amount of sales for product X" or "average number of one hour transactions".

On a higher level of aggregation is knowledge, which can be seen as information that was analyzed, compared with former information or correlated with another information. Knowledge is broader, deeper and richer than data and information; it is "a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. In organizations, it often becomes embedded not only in documents and repositories but also in organizational routines, processes, practices, and norms." [Davenport & Prusak, 1998, p. 5].

For many companies, the value for the knowledge they own exceeds far much the value of their assets, and that's reflected by the big differences between companies' market capitalization and their assets value presented in the balance sheet. These differences are usually considered companies' knowledge assets, and from the accountant point of view, they are part of immaterial capital[1]. As a result, in the modern economy, company's knowledge resources tend to become the most important element in the struggle for survival in a highly competitive environment. The human factor, as the owner of these resources, becomes the main element in all the modern management theories and analyses. The employees can not be replaced at any time or anyhow, because each of them possess an unique treasure of knowledge, that's crucial for the organization

The entire company's knowledge treasure falls into one these two dimensions: tacit and explicit. The first one, tacit knowledge, is rooted in personal and professional experiences of each individual, and it's comprised of both cognitive and technical elements [Alavi & Leidner, 1999]. It consist of components like the skills of sales employees in communication with each client, the manner in which the manager applies the decision models, the accountant's choice for some accounting treatment for each transaction, or the interpretation that each manager gives to an internal costs report. In all these examples, above the knowledge that each accounting professional gathered from university courses fell a layer of professional experiences, practices and routines that makes him perceive, understand and (re)act in every situation by a manner that turn him into an "experienced professional".

The second dimension of knowledge, referred as explicit knowledge, is far much easier to express and share, and it is often included in manuals, codes, regulations and internal textbooks. By putting it on the paper, the organization makes sure that this knowledge will not be lost when one employee will leave, and his substitute will quickly assimilate all the routines needed for the achievement of job's responsibilities. The literature presents McDonald's case, which capture in its operating manual almost every aspect of the restaurant management, including coking, nutrition, hygiene, marketing, food production, and accounting [Alavi & Leidner, 1999].

Employees and knowledge gained during their engagement are often lost in the dynamic business environment. Those who remain in the company are unaware of the valuable resources that are hidden in the repositories. It is true that an important part of knowledge is tacit and stored in employee's minds so it leaves with these, but a lot of documents, reports and written procedures stay. But these are stored in archives and most knowledge in a company is thus forgotten short time after it was invented [Dzbor, 2000].

Accounting reports are also backup in archives, but knowledge and information they present shouldn't have the same fate. They contain valuable information, because they offer prior images about business evolution and they are groundwork for future analyses. Although in an accounting information era

[1] immaterial capital or goodwill includes, beside employees' value, the value of customers, structure and business opportunities

this information is, often, one click away, there must be someone to know about their existence and where to search for them.

Building an accounting ontology

Once they are aware of the importance that knowledge has for their company, managers begin to search for the best methods and tools to capture, preserve and disseminate it. Artificial intelligence researchers meet their wishes by developing such methods and tools. But if initially the main method was knowledge acquisition, as an incremental knowledge elicitation and transfer task from domain expert to an intelligent system, now we speak about knowledge modelling, as a stage in the intelligent system development process.

Knowledge modelling paradigm mainly aimed at a perception change. An intelligent system development doesn't mean anymore problem domain expertise transfer from an expert to the system's knowledge base as if-the-else associations in production rules, to build a virtual expert. Thus knowledge acquisition become a modelling process aiming domain understanding, developing an abstract expertise model, building an ontology and some generic and specific models of problem solving, and, finally, knowledge representation and coding in a knowledge base [Motta, 2000]. Also, building domain ontology, generic models for problem solving and reusable application classes means an important support for knowledge management, because they promote knowledge sharing and reuse.

In the present approaches, building an accounting intelligent system primary means to realize a conceptual domain model that will include all the concepts and relations between them (or, in other words, to create a domain ontology), then identify all the domain specific problem solving methods, and, finally, put all these together in an integrated system. Thus, giving some task that will be automated (such as the decision to take a loan for an investment), the main challenge is to identify (or build) a solving method for this problem (such as comparing future profits from the investment with the loan costs) and to bind this solving method to a domain ontology that will describe all the relevant concepts (such as profit, interest rate, profit rate). We can now see how the interest moves from the understanding, elicitation and representation of inferences the accountant manager makes when he prepares this decision, to identify and to understand relevant concepts for this problem and the way these concepts are used in the problem solving process.

The term *ontology* is rooted from philosophy and metaphysics, meaning a systematic reality explanation. In artificial intelligence, this term has a more limited meaning: a formal and explicit specification of a conceptualization [Gruber, 1993]. Ontologies are sets of real objects (concepts, entities, events, actions and processes), properties of these objects and the relations between them in a specified domain. They provide the possible terms to describe knowledge from that domain (or the vocabulary), the meanings that each term can accept (as definitions, restrictions and possible interpretations), and also the relations between terms.

First of all, ontology is a representation vocabulary from a domain, often specialized, conceptualized and independent from the practical applications that will use it. In a second meaning, the term ontology is used to refer to a body of knowledge describing some domain, typically the common sense knowledge. Thus, the representation vocabulary provides a set of terms to describe relevant domain facts, while the body of knowledge is a collection of facts, presented using that vocabulary [Chandrasekaran, 1999].

For a certain domain we can build several ontologies that will differ between them, especially by specificity and the approach angle. Thus, will have generic or high-level ontologies, which are abstract, task oriented and subject independent ontologies, and medium and low-level ontologies, build based on the first ones, with more specificity, which are domain ontologies [Andone & Tabără, 2006, p. 120].

The process of an accounting ontology building must begin with the recognition of the two knowledge categories:

- Factual domain knowledge: knowledge about objects, relations, events, states, causal relations;
- Problem solving techniques knowledge: problem solving methods that specify how to achieve certain purposes.

In the first one we can include theoretical domain knowledge, as we find it in laws, standards, manuals, courses or to domain experts. Thus, we can identify as domain objects categories of assets and liabilities, tangible and intangible assets, account, and suppliers. Each of these objects has properties (such as an asset value), methods (such as to debit on an account) or can start some events (e.g. buying raw material from suppliers). Relations can establish between objects (e.g. the relation between assets and liabilities that result from double entry system), including causal relations (e.g. buying raw material involves to debit raw materials' account and to credit suppliers' account).

A very important aspect when we formalize this kind of knowledge, is the fact that inside an organization there are many unspecialist users or with minimal accounting background that are forced to use terms from accounting vocabulary in their everyday duties. For such a reason, building an accounting ontology always means an organizational agreement about the concepts that are used, the contexts in which they are used and their exact meaning.

The second category of knowledge is only partial included in accounting manuals, because it is mainly tacit knowledge, acquired in years of practice and arisen from experts' large experience. Besides knowledge about accounting policies, principles and techniques and their application, we also include in this category techniques and judgments in which mainly counts professional reasoning and practical sense: assets and liabilities evaluation, applying full disclosure principles when preparing financial statements, or deciding upon an audit report conclusions.

These two categories of knowledge are then involved in modelling, structuration and relation building processes, to achieve at accounting domain ontology. A graphical view upon this process is presented in figure 1.

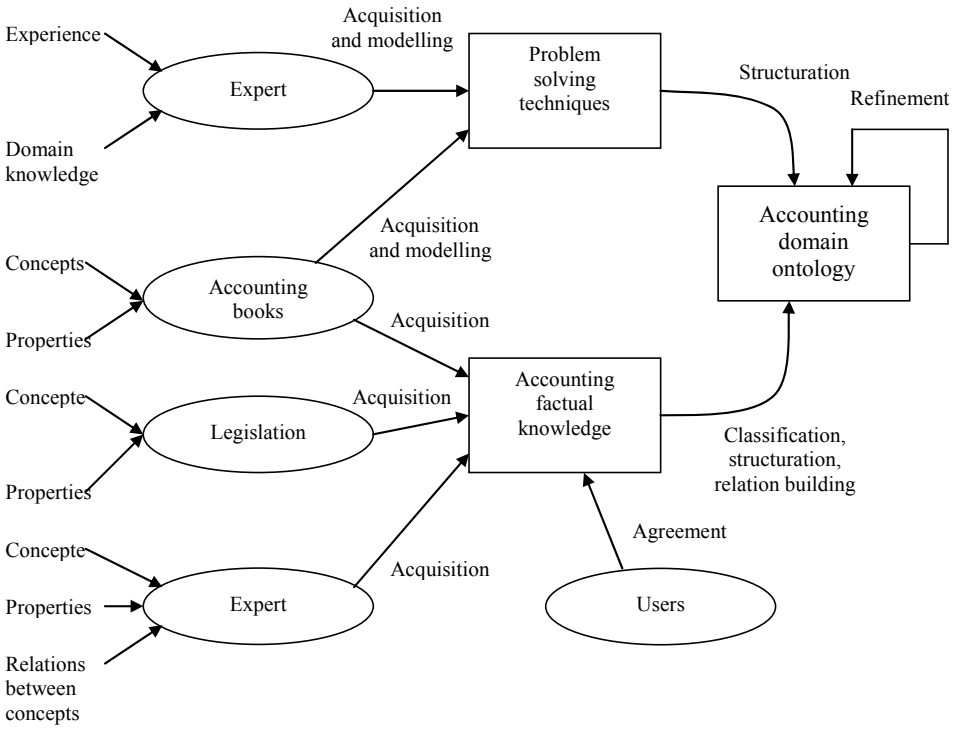

Fig.1. Building an accounting ontology

Building domain ontology presents some obvious advantages, largely describe by literature [Uschold, 1996]. For the accounting domain, we consider that such advantages can be synthesize as follows:

- Setting up a domain vocabulary, shared by all accounting information users, which will enable a better communication between them. Thus, besides usual terms met in all manuals and regulations, every organization develop his own terminology and taxonomy;
- Because seldom in the organization live together several information systems that access accounting data, the existence of an ontology will facilitate interoperability between them;
- Knowledge structuration and conceptualization is one first necessary step towards intelligent accounting modelling. Without an obvious knowledge domain structuration, knowledge acquisition and representation are impossible;
- Knowledge sharing and reuse is a fundamental aspect in a modern organization. After establishing the main domain concepts, the syntax for their representation and relations between them, ontology can be shared with others members of the organization that have similar needs. Building a domain ontology that will be stored in repositories as organizational memories also enables knowledge reusability for future applications that will be developed, without the need for domain knowledge modelling.

The advantage of reusability for an ontology-modeled knowledge receives a special signification when we consider the fact that accounting data, information and knowledge are used by a large number of managers inside and outside the organization. We practically have different and sometimes opposite views, from different managers, each one with his own managerial style and informational needs, on the same accounting transactions and their results. Because of that, the process of knowledge modelling and ontology building for the accounting domain must always take care of the needs and specificity from the others organization's departments.

And, of course, before we start building an accounting ontology, we should take a look at what others already have done, especially those we could, sometimes, have certain relations which, such as our suppliers or customers. Such an informing[2], analyzing and standardization process will significantly shorten the ontology mediation time, mediation which is necessary when many information systems, using the same domain ontology, are forced to communicate or collaborate.

Conclusions

The interest for ontologies grew up lately, once with knowledge management systems, semantic web project or B2B applications. Ontologies became a common thing on Internet, although many people don't realize that: search engines (like Yahoo or Google) use extended taxonomies for web pages classification, virtual shops (like Amazon.com) classifies their products, or the UNSPSC[3] ontology that supplies terms for all the existing products and services.

In accounting, new concepts quickly appear and develop, some of the old one become obsolete or evolve getting new meanings, business restrictions are changing and new kinds of opportunities appear over night. That's way, regardless what subsystems are involved in the modelling process, an accounting ontology must be, first of all, dynamic. This means that the development process is a continuous and collaborative one, and the organizations' employees are permanently involved in it, to cope with the dynamic of today's business environment, in which the survive is indissoluble bind of adaptability.

Building an accounting ontology it is a necessary first step for creating an organizational accounting repository that will allow domain knowledge storing and dissemination. The process has multiple benefits for the organization, as well as for the accounting domain itself.

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[2] we can find examples of ontologies on web at http://www.daml.org/ontologies/keyword.html

[3] United Nations Standard Products and Services Code, http://www.unspsc.org/

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