Developing Ontology for Financial Investments "Algeria Case Study"

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ABSTRACT
Ontologies combine the basic concepts of a specific domain and the relationships between these concepts, all in a manner understandable by machines. The financial investment is a very important area because of the importance it has in the evolution of life. The popularity of modern investments (mutual funds, stocks, bonds, etc..) continues to grow so that they regularly found alongside traditional investments savings.

In this paper, we construct a financial ontology especially in the field of financial investments.

Keywords

Ontology, Financial Risks, Semantic Web, financial investment.

1. INTRODUCTION
The field of economics and finance is a conceptually rich domain where information is complex, huge in volume. A massive amount of valuable information is produced daily, but its treatment is a hard task and takes time. The new generation of management techniques is essential for economic and financial information to enable efficient production, management and consumption of complex and big information resources[1]. At present, most financial investment domain information produced by information providers is primarily textual, and therefore it cannot be interpreted and processed by computers.This leads to the same problems of Web content management is being presented today. The Semantic Web technologies can naturally be applied in this field in order to overcome its current limitations of information management.

In this paper, our discussion has focused on the collection, organization, representation and formalization of knowledge in finance, especially in the field of financial investment.For this, the main objective is to develop an ontology in this domain, this ontology is to: 1) Facilitate the representation of knowledge of the field;2) Become like upper ontology to other ontologies which details a well field accurate in the field of financial investments and offering assistance to investors to receive financial advice; 3) Integrate in information systems research that is based on the semantic relationships between words such as synonymy.

2. CURRENTFINANCIAL INVESTMENT
From our studies on the financial market to the national grid, we found that the websites of financial institutions contain non-standard financial reporting and provide financial investment services different than their computer environment is based on traditional database server is not guided by semantics.This provides a difficulty for the manager to manage its information including maintenance, reuse, and dialogue with other financial service, same thing for the customer and the user is looking for reliable information and advice on investment Financial.

So how to help institutions find a way to combine ontological engineering and semantic web and the platforms of the existing financial investments based on traditional information and simple web pages to respond the ambitions of managers and customers?

3. ONTOLOGY ENGINEERING
As part of our work we opted for the method MENTHONTLOY[2], [3] and more particularly the steps Support Activities and Technical Activities.

3.1 Specification
In the specification phase of the ontology, we used the techniques proposed for the kickoff phase of the methodology On-To-Knowledge[4], which is to get the first list of terms and relations through session discussion with experts.

In our quest to model the field of financial investments, we have concluded: that of modeling the whole field is impossible considering the scope of the latter, for this reason that our choice is fixed on some investments Financial exists at Algeria, for example: - Bank of Algeria - National Fundfor Savings and Reserve (CNEP) - The National Savings and Reserve (CPA) - Algeria General Society (SGA) - Bank for Agriculture and Rural Development (BADR) - Algiers Stock Exchange.

Several knowledge sources were used during the acquisition of knowledge of the development process of ontologies. The objective of the use of multiple sources was to create an ontology that could be adopted in the future, as many other organizations as possible.

The knowledge that will be represented come from the following sources: - The official websites of banks (http://www.bank-of-algeria.dz,http://www.cnepbanque.dz, http: //www.cpa-bank.dz,http://www.societegenerale.dz,) and the stock of Algiers (http://www.sgbv.dz/) - Official documents of the banks - Quizzes, Forms, Reports, Contracts, ... - definitions of terminology commonly used to describe the savings and investments in the documentation, in advertisements or in the financial press,financial glossaries, advisory committees, associations, financial corporations, authorities, institutes for Financial Education ... - In addition to sources already cited we have worked with specialists in the field and some officials at banks.

As a result the acquisition process, the terms most important of all sources of knowledge were identified in the French language currently used in Algeria. A sample of the terms is listed in table1 below.

Table 1.A sample of terms list

Terms	Description
Livretbancaire	le taux d'intérêt n'est pas réglementé,les fonds déposés sur ce compte sont disponibles à tout moment. La durée du compte est illimitée
Placement or	Placement doué d'une sécurité maximale et d'une bonne liquidité
Obligation	Instrument financier émis par une entreprise, par une collectivité publique ou par l'État.
Action	Instrument financier qui est un titre de propriété d'une partie du capital d'une société par actions
Risque financier	Risque que le gain attendu ou espéré par l'épargnant ne se réalise pas ou que la somme investie soit diminuée.

3.2 Conceptualization

3.2.1 Construction of dictionary concepts

Knowledge relate to objects which are referred through concepts.A concept can represent a material object, a concept, an idea [5].By refining the glossary of terms presented above we will now build a dictionary of concepts (classes).To ensure greater flexibility of our ontology we have designated some concepts from more terms to manage synonyms in a simple way [6], for example the savings booklet takes two terms is "LivretEpargne"in some bank or "CarnetEpargne" by other bank,the Table 2 presents an extract from the list of concepts.

Table 2.Extract from the list of concepts

Concept	Label
EtablissementFinancier	Etablissement financier
CompagnieAssurance	Compagnied'assurance
InvesstissementTitre	Investissement en titre
InvestissementSICAV	Investissement en SICAV
ObligationTauxRevisable	Obligation à tauxRevisable

3.2.2 Taxonomy of concepts

There are a number of possible approaches to develop a hierarchy of classes[7]. We followed a combination of both approaches, from top to bottom and from bottom to top.At first, the most salient concepts are defined in the preceding section,and then they are generalized or specialized,as the case. We could start with some high-level concepts such asbond "Titre in French"and a few specific concepts,for example "TitreCreance", "TitrePropriete". Then we can put them in relation with other mid-level conceptssuch as "Contrat", following the reverse method, a generalization of the concept, eg the general concepts"Title" and"Contract" is "InstrumentsFinanciers".Fig1 shows an extract of this taxonomy.

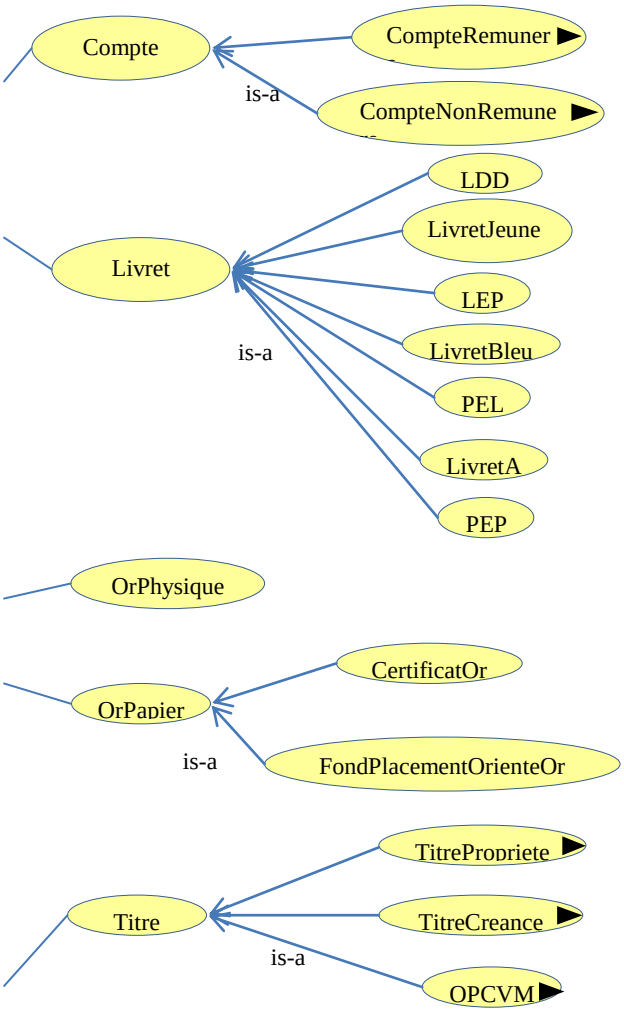

Fig 1: Extract from the taxonomy

In building hierarchies above, we have not limited our taxonomy to a single hierarchical representation of concepts, but it looked kind of relationship between concepts and their properties, the following sections we will present all this.

3.2.3 Description of Object Properties

We have already selected the classes from the list of terms that we created during the acquisition of knowledge in the specification stage. Most of the remaining terms are likely to Object Properties or DataType these classes.

The properties exposed here form themselves a taxonomy that can be hierarchy[8], take a simple example of object propertyinvest in "investirDans"is general it can be specialized depending on the type of investmentinvest in savings "investirDansEpargne"orinvest in financial placement "investirDansPlacement"and the hierarchy may continue after the specialization of each relationship.Fig 2 shows an extract from the list of Object Properties.

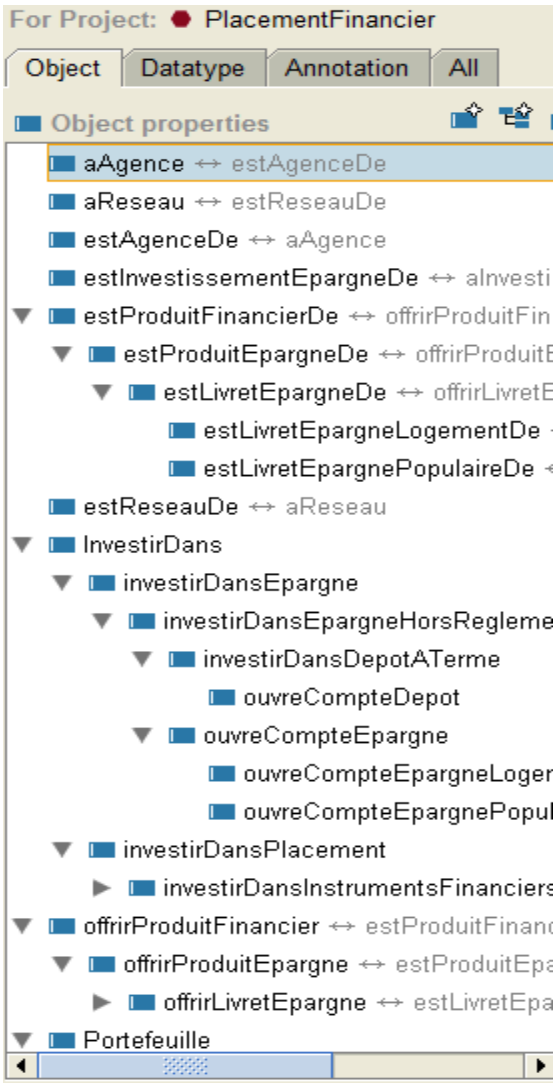

Fig 2: Extract from list of Object Properties

For each property must be defined the Domain and Range and Property Characteristics is Transitive, Symmetric, Functional, or InverseFunctional. The figure 3 below shows an example of Object Property that is network of "estReseaude" link between the network "Reseau" (Domain) and Bank "Banque" (Range) with two characteristic Functional and Transitive.

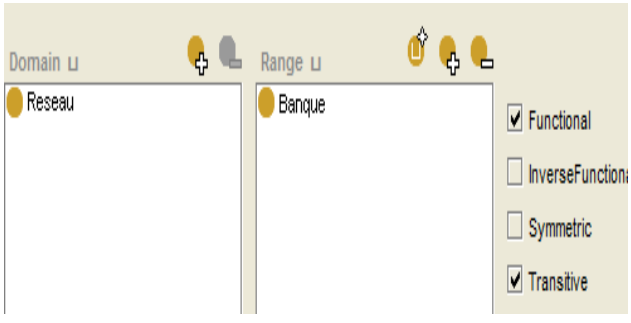

Fig 3: Domain and Range and Property Characteristics of the Object Property "estReseaude".

3.2.4 DataType

After defining the classes and their Object Properties of our ontology, we must describe the internal structure of classes. An excerpt from the list of properties DataType is shown in Fig 4.

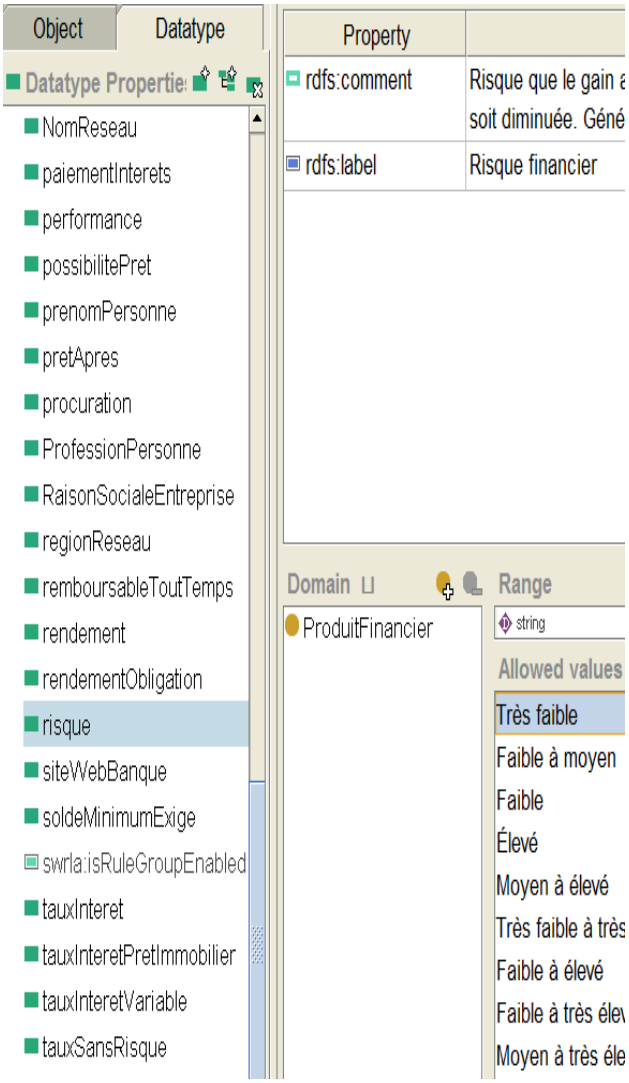

Fig 4: Extract from the list of DataType.

3.2.5 Individuals

The last step is to create instances of classes in the hierarchy. Define an individual instance of a class requires 1) choosing a class; 2) creating an individual instance of this class; and 3) enter property values. Par exempleBADR, BNA, CNEP, CPA are individuals of class bank " Banque", each bank is required values forDATATYPEas" désignation", "adresse", "siteWeb", or object properties as investments and savings provided by the bank, egobject propertyoffering savings booklet "offrirLivretEpargne"which takes values of the classsavings booklet "LivretEpargne".An extract from the list of individualsis shown in Fig 5.

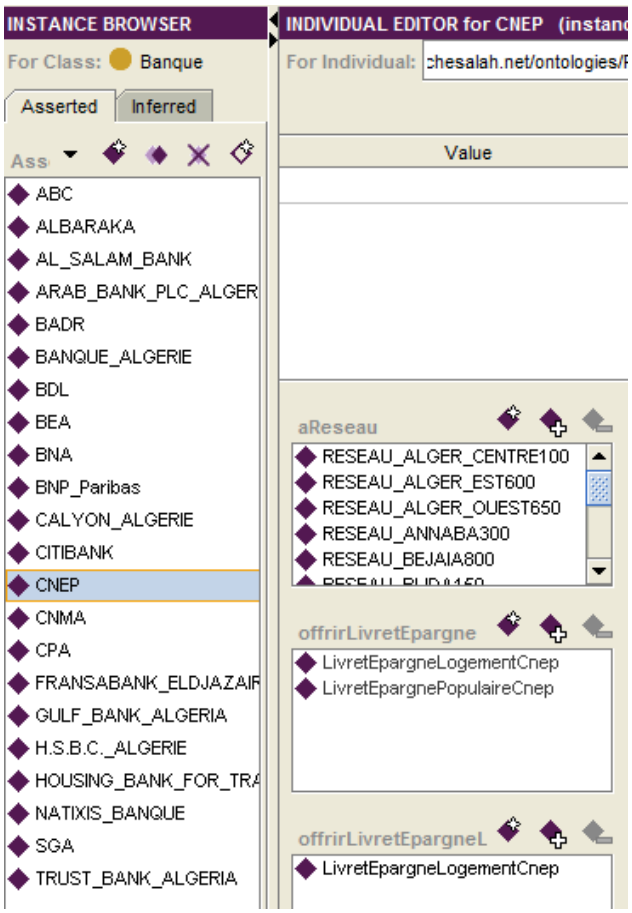

Fig 5: Extract from the list of Individuals.

3.3 Formalization and implementation

One of the major decisions in the process of developing ontologies is to choose the language of representation.Our ontology is designed for use by applications that need to process the content of information instead of just presenting information to humans.For this reason the developed Ontology is implemented using Web Ontology Language (OWL) [9]that facilitates greater machine interpretability of Web content than that supported by XML, RDF, and RDF Schema (RDF-S) by providing additional vocabulary along with a formal semantics. Other reason OWL is the most recent development in standard Ontology languages, endorsed and recommended by the World Wide Web Consortium (W3C) to promote the Semantic Web vision. We build the Ontology using Protégé-3.4.4 as Ontology-editing environments.Protege3.4.4 (http://protege.stanford.edu/) is a free, open source ontology editor and knowledge-base framework. The Protégé platform supports two main ways of modeling ontologies via the Protégé-Frames and Protégé-OWL editors. Protégé ontologies can be exported into a variety of formats including RDF(S), OWL, and XML Schema. Protégé is based on Java, is extensible, and provides a plug-and-play environment that makes it a flexible base for rapid prototyping and application development.

3.4 Evaluation of the ontology

We use the RACER[10] inference engine to test our ontology.It is designed for reasoning on description logics and accepts as input an OWL file.The main services offered by RACER are:consistency checking (satisfiability, coherence) andthe classification test (subsumption).

3.4.1 Consistencychecking

The test of consistency provided by RACER is performed based on the class description (conditions). It ensures that no definition of a class conflicts with another (the absence of conflicting classes) i.e. check that for each class, there must be at least one individual member of this class.A class is considered inconsistent if it can have no instance. The result of the test is shown in Fig 6.

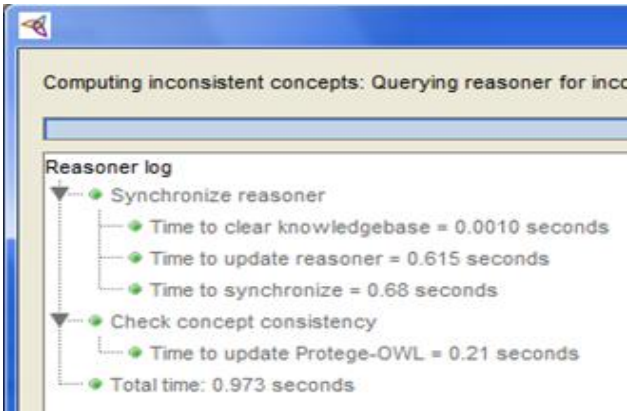

Fig 6: The test of consistency results.

3.4.2 Classification test

The classification test to check if a class is a subclass of another class or not.Once the classification test is performed on the class hierarchy containing the logical expressions, it is possible for the classifier to infer a new hierarchy «inferred ontology class hierarchy» which is a hierarchy where classes are classified according to the relation superclass / subclasses.The result of this test is shown graphically by Protégé-OWL.

3.4.3 OWL Test

Protégé-OWLprovides a mechanism to execute a configurable list of tests on the ontology we are currently editing.These tests are available through the menu «OWL→Run Ontology Tests → Test Stings». They are used mainly to verify the conditions specified in the ontology.After checking our ontology the test result is no error. Fig 7 presents the classification test results.

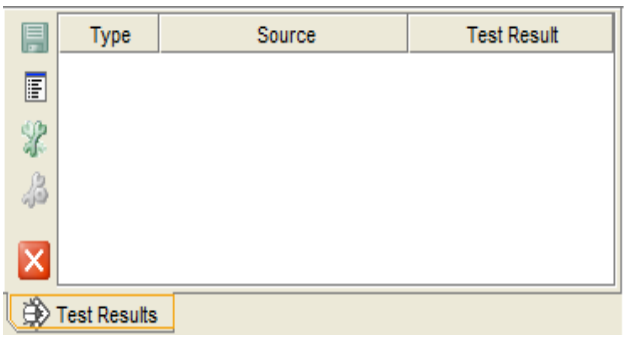

Fig 7: Classification test results.

3.5 Documentation of the ontology

ProtégéOWLgenerates the documentation automatically, Fig8 shows an overviewof the documentation of our ontology in HTML format.

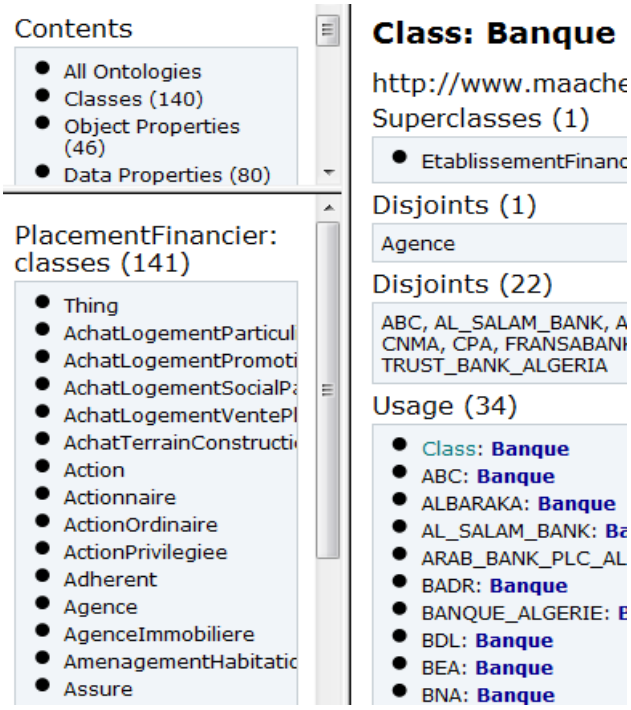

Fig 8: Documentation of the ontology in HTML format.

4. EXPERIMENT RESULT

To validate our ontology in practice,we can test the search expressions to show the ability to respond to user queries on a semantic level, we take a simple example: a web user is looking for financial investments where the risk (Corresponds to DataType"risque" in French)is very low (Corresponds to value "Très faible")and the rate of interest (Corresponds to DataType"tauxInteret") greater than or equal to 2. We used the language SPARQL [11]recommended by W3C to write the structure of the query, implementation is done under SPARQL Query panel in PROTEGE.Running the query produces results with the specific name of the investment and the associated rates.Fig 9 presents the description of query and their execution result.

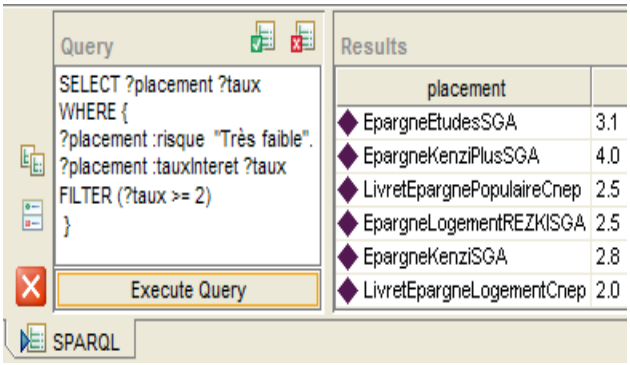

Fig 9: Result of query in SPARQL Query panel in Protege.

5. RELATED WORK

There are numerous efforts to create ontologies on financial domain. Works of [P. Castells & al, 2004][1], they have developed an ontology for the domain ofeconomic and financial information and an ontology-based platform that provides a) the integration of contents and semantics in a knowledge base that provides a conceptual view on low-level contents, b) an adaptive hypermedia-based knowledge visualization and navigation system and c) semantic search facilities. Other worksAn financial ontology that has been created for Bankinter for the first eBanking case study in DIP[12], this financial ontology consists of several ontologies at different levels of abstraction: services and products; and channels, users and currencies, this ontology does not aim at covering the whole financial domain but focuses mainly on modeling conceptually the mortgage domain. The ontology has been designed to be modular enough to allow refinements in the context of the current domain and extensions to other domains in the financial area.Works of [Bai Li, Liu Min. 2009][13]a novel ontology-augmented XBRL[14] extended model and a system architecture are proposed to analyze the complex and huge in volume and highly valuable financial information by adopting semantic web technologies to provide more insightful semantics and a sharper level of representation. The model can provide a support in ontology level to solve the inadequate semantic of XBRL with financial concepts and their relation in the analysis and decision of financial statement and reporting.
In continuity of those works we proposed a financial ontology in a field most accurate that is the financial placements.

6. CONCLUSION

This paper presents a case of actual use in the management of economic and financial information specifically financial investments, its limitations when it comes to actual content, the steps taken to develop ontology in this area to answer the needs of content providers such as the organization, representation and formalization of their knowledge.

This ontology can be easily integrated into a web platform that presents financial investments so well organized with an acceptable semantics level, this platform can provide a reliable semantic search that responds the ambitions of customers. At the same time, our ontology can be used as an upper ontology to provide a global concept for financial investment services want to integrate ontologies in their environment.

Future work will concentrate on an expert system integrated with this ontology to provide financial intelligent assistance to various users, this ontology Advisor will be based on semantic rules and analysis of actions and production of the expert. Meanwhile we will consider a distributed semantic web application based on this ontology adviser, to show the importance of our research.

7. ACKNOWLEDGMENTS

Our thanks to the experts and all persons who have contributed towards development of this ontology, especiallybanks officials.

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