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Abstract. This paper is part of a study focusing on the terminological and socio-organizational analysis of a corpus of 18 national and international standards, written in English, in the domains of business continuity activity management and risk management. The aim is to determine whether lobbying by certain countries seeking to impose their own national standards is a decisive element in standardization. First, we present the building of a new tool, called KONTRAST, designed to exploit the terminological variants in a non-stabilized terminological domain. Then we describe the workflow to build an RDF/SKOS/OWL base from an XML glossary and a use case to illustrate the ability of KONTRAST to detect influence networks.

Keywords: ontology; terminology; linguistic variants.

1 Research Context

This work is part of a scientific research project called "NOTSEG"[1] which stands for "Standardization and Global Security, Formulating the global security concept in standardization". The main purpose of this project is to study the industrial standardization of security and risks, and in particular the field of business continuity (BC). One part of this study focuses on the analysis of a corpus of 18 national (see table 1) and international standards (see table 2), written in English, in the domains of BC and risk management. It is important to emphasize that in the field of standardization, none of the standardization bodies are empowered to impose a definition, a term or a concept2. There is one international body, ISO, but its role is mainly to set up technical committees (TC) and working groups (WG) which are responsible for writing international standards.
The corpus includes both international and national texts because we wish to determine the validity of the conclusion reached by the French standardization body,

[1] Call for projects ANR-CSOG 2009.
[2] Humpty Dumpty [15] does not exist in the field of standardization.

AFNOR, in a recent report [1], namely that a decisive element in standardization is lobbying by several countries seeking to impose their own national standards. AFNOR reached this conclusion on the basis of a socio-organizational analysis carried out without examining the texts of standards. Our selection of texts is based on a socio-pragmatic approach [2] adapted to the theme of controversy [3]. In a nutshell, the favored criteria for selecting the texts were the field of study and the stakeholders. We selected the standards in our corpus using the advice of experts of the field as well as our own observation of the proceedings of Technical Committees and Working Groups. The corpus is viewed as a "dynamic archive" which can be continuously revised as research proceeds. This approach differs from an inductive-deductive method based on referential linguistics [4] which builds a corpus around a macro-theme.

Table 1. National Standards

Standard	**Title**	**Country**
BS 25999-1:2006	Code of practice for business continuity management.	United Kingdom
BS 25999-2:2007	Specification for business continuity management	
ASIS SPC.1-2009	Organizational Resilience : Security, Preparedness, and Continuity Management Systems – Requirements with Guidance For Use	United States
NFPA 1600 2010	Standard on Disaster/Emergency Management and Programs.	United States
BCI Good Practice Guidelines 2010.	A Management Guide to Implementing Global Good Practice in Business Continuity Management	United Kingdom
ASTM E 2640 2010	Standard Guide for Resource Management in Emergency Management and Homeland Security, DIN,	Germany
AS/NZS 5050:2010	Business continuity – Managing disruption-related risks	Australia

Table 2. International Standards

Standard	Title	Technical Committee
ISO/FDIS 22301 2011	Societal security — Business continuity management systems – Requirements	TC 223
ISO/CD 22313 2011	Societal security — Guideline for incident preparedness and operational continuity management	TC 223
ISO/WD 22323 2011	Societal security Organizational resilience management systems - Requirements with guidance for use.	TC 223
ISO/DIS 22300 2011.	Societal security - Vocabulary	TC 223
ISO/IEC JTC 1/SC 27/27001: 2005	Information technology - Security techniques - Information security management systems – Requirements	SC 27
ISO/IEC JTC 1/SC 27/27002 2005	Code of practice for information security management	SC 27
ISO/IEC 27031: 2011	Information technology -- Security techniques -- Guidelines for ICT Readiness for Business Continuity (FDIS)	SC 27
ISO/IEC IS 27005:2011	Information technology -- Security techniques -- Information security risk management	SC 27
NF ISO 31000:2010 ISO 31000:2009	Risk management. Principles and guidelines	TMB (Technical Management Board)
ISO/IEC Guide 73:2009	Risk management – Vocabulary	TMB
IEC/ISO 31010:2009	Risk management – Risk assessment techniques	TMB
Draft ISO/IEC Guide 81: 2010	Guidelines for the inclusion of security aspects in standards.	TMB

In this paper, we present the building of a new tool, called KONTRAST, which aims to exploit the terminological variants in a non-stabilized terminological domain. The BC domain was used as a training ground and results show the potential of this kind of tool. Moreover, KONTRAST relies on an ontologico-terminological resource designed with RDF, SKOS and OWL languages. Its architecture makes it possible to describe the different competing terminological systems (glossaries, terminological guides, etc.) of our corpus all together in order to study variants and dependency clues.

2 Related Work

Recent evolutions in standards (via the so-called 'management standards' of information security) are at the heart of our analysis. Like technical standards and quality standards, security management standards contribute to giving structure to practices and to the ways in which information is organized, evaluated and controlled in organizations. The processes of international industrial standardization apply not only to the artifacts of technical devices (in technical standards), but also, from the beginning of this century, to organizational methods and the evaluation process of these devices. This includes state regulations, especially in standards of management. As a result, domains such as "business continuity" and "resilience" now possess standards of "security management".

Industrial standards are generally studied within management science and engineering, and we are not aware of studies in Natural Language Processing (NLP) that deal with them. However, many studies have been conducted in the field of terminology and knowledge engineering. In recent years, terminology, a "theorized practice" [5], has evolved rapidly, particularly to meet increasing manufacturing needs, giving rise to a symbiotic relationship between terminology and knowledge engineering [4]. The resulting approaches, which blend formal ontology and terminological resources, are highly varied and depend greatly on their context of operation. [19] proposed the OTR (Ontological and Terminological Resources) metamodel which has many unique features. The OTR metamodel was built in a multilingual perspective and emphasizes the context of use of the terms. Both terms and concepts are represented as OWL-DL classes. Lemon (Lexicon Model for Ontologies) [22] is "an RDF model for representing lexical information relative to ontologies". Its focus is on bridging the gap between terminological and semantic resources by providing an interchange format. [7,8] proposed the generic model of ontoterminology, that is to say a terminology in which the notional system is a formal ontology. In this framework, a terminologist needs to work with users and experts in the field in order to build a consensual conceptualization of the field in question. This representation is first translated into an ontology, then the specialized terms provided by experts are associated with concepts.

For manufacturing companies working in several different geographical locations or with many subcontractors, such as those in the automotive or aviation sectors, the use of specialized vocabulary that is shared and controlled is mandatory. Lately, [6] built a prototype of a Business Rules Management System, (BRMS) based on an OWL ontology in which concepts are expressed by using the SKOS language. Designed and produced for Audi in the context of the European project ONTORULE, BRMS relies on a “lexicalized ontology” which is mainly intended to formalize business rules written in natural language by experts from the respective skills. The main goal of this system is to upgrade and speed up the process of sharing information between business units which use different terms to name identical procedures.

In a field close to that of the NOTSEG topic, business continuity, [23] presented an ontology of financial risks. First, the study acknowledged the omnipresence of alphabetical glossaries and their failure in terms of practical utility, except for a referential use. The author therefore built an ontology based on a conceptual representation from existing technical references in the field. As an expert, he was able to choose a unique conceptualization that led to univocal concepts whose relations were checked and validated by other experts. The terminological component of this work comprises two “vocabulary lists” in alphabetical order. In the medical field, the increase in terminologies has become an issue, especially for the indexing process. One basic solution is to rely on UMLS[3] but as [24] pointed out, this choice is somewhat naïve, and has practical consequences especially on the health of patients. In order to preserve the specific characteristics of different terminologies used in a medical information retrieval system, [24] proposed, for the end-user, a system with a multilingual and interdisciplinary “interface terminology”, combined with specialized terminologies which are generally monolingual.

Using a very similar approach, [21] proposed EHTOP (European Health Terminology/Ontology Portal), a unified access to thirty-two medical ontologies. ETHOP, which is accessible by end-users or software, combines different terminologies in a generic meta-model and then performs “semantic harmonizations”. Also in the medical field, [17] presented three operational approaches to explain how they build and use onto-terminological resources. These applications are built on the same cornerstone principles, which can be summarized in the formula “Terminology comes before reasoning”. In other words, the linguistic and documentary characteristics of medical language must be taken into account by encouraging knowledge expressed in natural language, even though calculability and automatic processing are reduced. In their paper, the authors pointed out the difficulty of developing bridges between terminological resources and existing ontologies, since differences in granularity and finalities make concept alignment problematic.

These examples show that knowledge management has been most successful in fields where the goal is to build a system which unifies different terminologies by "deleting" terminological variants. Our approach, on the contrary, aims to exploit terminological variants by storing them with some annotations and by building linguistic and socio-organizational relations between them.

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[3] Unified Medical Language System - http://www.nlm.nih.gov/research/umls/

3 Linguistic Hypothesis for a Contrastive Approach

As mentioned in the introduction, our project aims to detect the writing and editorial tracks left by an expert representing a country in which a standard S1 exists, and who contributed to the writing of an international standard S2. We postulate that the traces left in standard S2 by this expert reveal the nature and the range of his influence on the content of the standard. We further postulate that these tracks of influence can be detected by comparing the two texts S1 and S2, provided that the texts are written in the same language; this is the case for the corpus of standards which is written in English. To detect these tracks of influence, we make the following more specific assumptions:

Assumption A1: One way to impose a model, procedures or concepts in the target standard S2 is to use language expressions borrowed from the standard S1.

By language expressions, we refer to a sequence of tokens no longer than a typographic sentence. Two additional assumptions, A2 and A3, specify A1 and sub-categorize the notion of language expressions.

Assumption A2: A way to impose a concept in the target standard S2 is to use the terminological unit (TU), either simple or complex (that is to say composed of several tokens), which is used in the standard S1.

We use the expression "terminological unit", and not "term" or "word", in order to indicate that from a linguistic point of view, processing is carried out on the lexical level of the specialized language. In other words, when an expert wants to impose the conceptualization and the cultural representation of the associated concept in an international standard, he uses the terminological unit used in the national standard.

Assumption A3: A way to impose a concept is to use both the same TU and similar defining utterances of this TU.

By similar defining utterances, we mean utterances that are identical from a syntactic point of view but that may exhibit some lexical variants. In fact, using the same TU is not sufficient to impose a concept. It is also necessary for the definition of this concept, which anchors the conceptual and cultural model of the expert in the standard, to correspond to the one the expert wants to impose.

These assumptions are the result of our observations of meetings of technical committees which are in charge of writing standards[4]. Discussions and negotiations concerning the choice of a TU are sometimes heated and always lengthy. All the experts interviewed confirmed the strategic importance of TUs and their definitions because they express the notional system of experts and condition the implementation of standards.

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[4] Discussions and temporary versions of texts within technical standardization committees are confidential. Nevertheless, our participant observation was essential to understand and acquire knowledge about the topics discussed. They are the core of information we used to conduct interviews with experts.

Unlike many other domains where the identification of terminological units requires using natural language processing tools which look for candidate terms through specialized texts [16, 17], certain specificities of standards make it possible to skip this step. In fact, glossaries and terminologies are extremely frequent in the field of process standardization. Each standard supplies its own vocabulary used with the aim of "stipulation" [9]: every standard begins by a section called "Terms and Definitions" (T&D) which presents the terms employed in the text of the standard, generally in the form of an alphabetical glossary.

Two definitions of “Resilience”, which appear in two national standards and in two international ones are shown in Table 3. Two of the definitions vary only in the use of the determiner “the” and the other two vary in the use of the determiner and of “disruption” rather than “incident”. An automatic processing based on plagiarism detection algorithms can be used to identify this kind of similarity (see below section Workflow).

Table 3. Examples of variants in definitions

Standard	Terminological Unit	Definition
ASIS SPC1 (2007)	Resilience	The adaptive capacity of an organization in a complex and changing environment
BCI Good Practice (2007)	Resilience	The ability of an organization to resist being affected by an incident
ISO DIS 22300 (2001)	Resilience	adaptive capacity of an organization in a complex and changing environment
ISO IEC 27031 (2011)	Resilience	ability of an organization to resist being affected by disruptions

Furthermore, the “T&D” section of a standard quotes or reproduces the definitions of a preexisting standard. These networks of quotations, which are not always explicit, make up a complex system of borrowings and of references, both within each standard (internal network) and between standards in the corpus (external network). Moreover, a definition may contain some additional information.

control
means of managing risk, including policies, procedures, guidelines, practices or organizational structures, which can be of administrative, technical, management, or legal nature
NOTE Control is also used as a synonym for safeguard or countermeasure.

risk management
coordinated activities to direct and control an organization with regard to risk
NOTE Risk management typically includes risk assessment, risk treatment, risk acceptance and risk communication.
[ISO/IEC Guide 73:2002]

Fig. 1. Examples of additional information and borrowing

Two examples of definitions extracted from “T&D” sections are shown in figure 1. The first example shows that a definition can be completed with a note which introduces a relation of synonymy: “Control is also used as a synonym for..”; the second example shows a whole-part relation “Risk management typically includes ..” and a terminological borrowing with the indication of the source [ISO/IEC Guide 73:2002]. It should be pointed out that the semiotic system to signal a borrowing within a standard is not yet standardized.

Two examples of different definitions of the same terminological unit, “all-hazards”, extracted from a national standard (NFPA) and an international one (ISO) are shown in table 4.

Table 4. Examples of different definitions for the same terminological unit

Standard	Terminological Unit	Definition
ISO DIS 22300 (2011)	all-hazards	naturally occurring events, human induced events (both intentional and non-intentional) and technology caused events with potential impact on an organization community or society and the environment on which it depends
NFPA 1600 (2010)	all-hazards	An approach for prevention, mitigation, preparedness, response, continuity, and recovery that addresses a full range of threats and hazards, including natural, human-caused, and technology-caused

In the first step of our research, terminological units and definitions were manually extracted. Work is in progress to develop tools based on extraction patterns in order to automatize this step, which will nevertheless always be checked by an expert. The result of this extraction is a structured glossary [10] associated with additional information which stores the tracks of borrowings and references of “T&D”. This information is processed to build relations in different “T&D” entities in KONTRAST (see below).

KONTRAST has been designed to represent different notional and terminological systems. Although our approach is based on the operational properties of ontologies in RDF/OWL, we do not use the terminological approach proposed in [18]. KONTRAST also differs from the OTR metamodel [19] which represents terms as classes rather than instances. This is why we chose not to use the terms “ontological and terminological resource” or “ontoterminology”. We prefer to use the term ontological contrastive glossary.

The synthetic glossary structured in XML [10] was manually constructed from the T&D sections of the corpus of 18 standards, and a DTD based on [13] was used to validate the glossary. Because of the assumption explained above, namely that these T&D sections are the expression of the notional system used by the experts who wrote them down, KONTRAST has been built from the glossary which contains 633 definitions of terms. As the building of KONTRAST aims to represent as faithfully as possible the different conceptualizations expressed by definitions of terms, we did not attempt to choose between different variants of the terms, but rather sought to bind them. That is why we introduced more abstract representations, based on predefined classes of "Skos: Concept", "Skos:Collection", "Skos:ConceptScheme" and one new class "U_Concept", in order to group notions and terms together, and to identify each token term within the glossary with a unique identifier (URI). With regard to this URI, unlike AGROVOC [12] which uses alphanumerical URIs which are poorly readable by humans, we chose to build a concatenating device [12].

Moreover, for reasons explained in detail in [3], KONTRAST contains structured and linked data about the standards bodies, technical committees, working groups, presidents, secretaries, etc., involved in the writing process of standards. Briefly, one of the objectives is to help to comprehend the reasons for the terminological variants by taking the organizational level into account. These organizational data are linked to the terminological data using the URI device.

4 Workflow

The ontological contrastive glossary of KONTRAST was automatically populated from the XML glossary (cf. supra). XSLT templates were written to transform terms and relations into RDF/OWL triples. The integration was performed using similar procedures as in [21]. To ensure consistency, different references of the same entity within the glossary (for example the name of the standard) must have the same unique identifier (URI) in KONTRAST. In spite of the thoroughness of technical writers, some morphological variants occurred in the corpus; they were solved by regular expressions.

During this populating step, relations were automatically computed in order to bind terms which have identical, almost identical or similar definitions but which are not explicitly referenced as such. This proved necessary because in T&D sections, instead of referencing existing definitions, the definitions are frequently quoted in full; this induces certain variants, and as a result they are not identical from a graphical, morphological, and even sometimes from a syntactic, point of view. One reason is that national standard bodies do not have the same typographical and discursive conventions. In order to solve this issue, an algorithm, based on basic plagiarism detection techniques [20] and described in [12], computes the proximity between two definitions and chooses to link these definitions, depending on the computed value, with one of the following three relations :"skos:exactMatch", "skos:closeMatch", "skos:relatedMatch". All these data were then imported into Protégé4, consistency was checked with OWL tools, and ultimately validated by a linguist for the terminological part, and by an expert in the field for the socio-organizational part.

Presently, KONTRAST is an RDF/OWL base stored in a SPARQL EndPoint, describing 291 U-Concepts associated with 633 terms and definitions, 18 standards with their Technical Committees, Working Groups, and several thousands of relations between them. In comparison, the terminological guide ISO 73:2009 which is considered as a reference in the field contains 51 terms and definitions. Furthermore, complex queries written in SPARQL can be carried out to search through the SPARQL EndPoint.

Figure 3 illustrates, for “Communication and consultation”, different relations between two occurrences of this term in standards, one which appears in ISO/IEC Guide 73: 2009 and another one which appears in NF ISO 3100:2009. One [skos:exactMatch] relation links these two [skos:Concept], and each one is linked with several T&D. Socio-organizational data are not displayed on this figure.

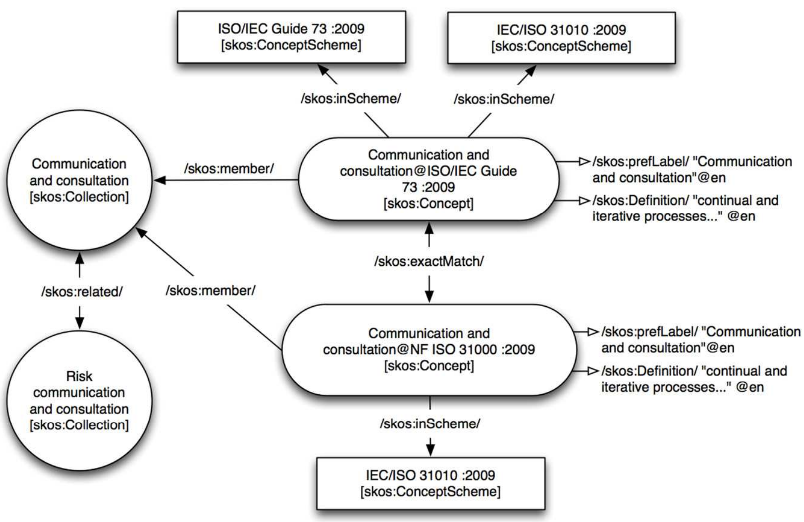

Fig. 3. Examples of relations of two TU

5 Use Case

KONTRAST can model all the terminological data from the texts in the corpus together with the socio-organizational data. With around one thousand individuals (standards, terms, standard bodies), it is a powerful tool for analyzing the BC field.

One of the assumptions formulated by the NOTSEG project [3] is that the identification of quotations or borrowing of parts of definitions within the texts of standards can be used to track lobbying networks. Tracing these inheritances back to their source may make it possible to identify clusters of similar standards and thus to clarify the terminological choices which governed the writing of these standards. Exploring relations through KONTRAST is the means we have been using to track down these networks of influence. Let us give an example: an expert suspects the terminological influence of a national standard, NS, over an international one, IS. One way to confirm this suspicion is to search KONTRAST for a couple of terms (t1, t2) with definitions related by: "skos:exactMatch" or "skos:closeMatch", t1 coming from NS, t2 coming from IS under the condition that the publication year of NS is earlier than that of IS. It is very straightforward to write this query in SPARQL language [12]. We consider that two categories of users could be interested by KONTRAST [25]. First, users we call "Readers": they will use end-user functionalities designed to navigate through the ontological terminological glossary, using iconic and graphic visualizations. Second, users we call 'Explorers": they will use the Sparql language to rummage through the data, searching for complex links to check a hypothesis or to compute and quantify terminological facts. They could also use some reasoners (Fact++, Hermit, etc.) from Protege or other platforms to perform consistency or abstracting checking in order to advance the terminological stabilization of an emerging field.

6 Conclusion

We have described the research context, pointing out the lack of referees in the field of standardization and the importance of lobbies in the writing process of standards. Then we have presented the specifications of KONTRAST which is dedicated to the management of terminological and socio-organizational data. We have stressed the decision to use languages such as RDF, SKOS, OWL, in order to be compliant with Linked Data specifications. We have briefly illustrated the power of this kind of tool by describing a use case aiming to detect influence networks. This work on standards, related to the socio-organizational context of their production and communication, should provide information to identify or critically assess the new technopolitics already existing or under development in the field of security and crisis management [3, 26, 27].

Acknowledgments

This research project received support from the Agence nationale de la recherche and the Conseil Général des Hauts de Seine through the Institut du Numérique ECRIN.

References

1. Scuto, N., Projet Notseg D4.1; Cartographie des travaux et des acteurs dans le domaine de la sécurité sociétale et du citoyen, AFNOR, Paris (2010).
2. Chateauraynaud, F., Lost in Arlington, carnet de recherche “Socio-informatique et argumentation”, *Hypotheses.org*. En ligne: http://socioargu.hypotheses.org/1533 (2010).
3. Juanals, B. Les acteurs et les textes de la normalisation internationale de la sécurité sociétale. Construction d'une approche communicationnelle, submitted to *Revue Sciences de la Société,* 25 p. (2011).
4. Condamines, A., Linguistique de corpus et terminologie. *Langages*, 157(1), L. Depecker éd., 36-47 (2005).
5. Roche, C., Terminologie et ontologie. *Langages*, 157(1), L. Depecker éd., 48-62(2005).

6. Omrane, N., Nazarenko, A., Rosina, P,. Lexicalized ontology for a business rules management platform: An automotive use case, Proceedings of the 5th International Symposium on Rules (RuleML, Industry focused session), Fort Lauderdale, Florida (2011)
7. Roche, C., Le terme et le concept : fondements d'une ontoterminologie, Actes de la conférence TOTh 2007, C. Roche éd., Annecy, Institut Porphyre, 1-22 (2007).
8. Damas, L., Tricot, C., L'ontoterminologie pour la recherche d'information sémantique, Actes de la conférence TOTh 2010, C. Roche éd., Annecy, Institut Porphyre. 101-116 (2010).
9. Depecker, L., Contribution de la terminologie à la linguistique. *Langages*, 157(1), L. Depecker éd., 6-13 (2005)
10. Malik, M., Construction d'un glossaire contrastif, Deliverable ANR-NOTSEG (2011)
11. Juanals, B., Minel, J.-L., Writing and Monitoring in International Standardization, Theoretical Choices and Methodological Tools, Proceedings of IMET2011, Florida, USA (2011).
12. Lafréchoux, M., Juanals, B., Minel, J.-L. KONTRAST : création d'un glossaire contrastif à partir d'un corpus de normes internationales, accepted at JADT 2012, (2012)
13. Joseph, J., Le projet NucSTML Structuration d'un dictionnaire de spécialité en vue de sa publication sur internet Bénéfices du langage XML, Actes de la conférence TOTh 2009, C. Roche éd., Annecy, Institut Porphyre, 181-196 (2010).
14. Agrovoc http://aims.fao.org/standards/agrovoc (20th December 2011)
15. Carroll L., *Through the Looking-Glass*. Macmillan & Co, (1872)
16. Charlet, J., Baneyx, A., Steichen, O., Alecu, I., Daniel-Le Bozec, C., Bousquet, C., Jaulent, M.-C., "Utiliser et construire des ontologies en médecine, Le primat de la terminologie.", *Technique et science informatiques*, vol. 28, n°2/2009, pp. 145-171 (2009)
17. Charlet J. Szulman S. Aussenac-Gilles N., Nazarenko A., Hernandez N., Sardet E., Delahousse J., Pierra G., Apport des outils de TAL à la construction de la plateforme DaFOE, TALN , 461-463, (2009)
18. Roche C. Le terme et le concept : fondements d'une ontoterminologie, Actes de la conférence TOTh 2007, C. Roche éd., Annecy, Institut Porphyre, 1-22 (2007)
19. Reymonet A., Thomas J., and Aussenac-Gilles N., Modelling ontological and terminological resources in OWL DL. In Proceedings of ISWC '07 workshop "From Text to Knowledge: The Lexicon/Ontology Interface" (OntoLex '07), November 2007.
20. Clough, P., Old and new challenges in automatic plagiarism detection. *National Plagiarism Advisory Service*, vol. 41, pp. 391-407 (2003).
21. Grosjean J., Merabti T., Griffon N., Dahamna B. & Darmoni S. Multiterminology cross-lingual model to create the European Health Terminology/Ontology Portal, *Proceedings of the 9th International Conference on Terminology and Artificial Intelligence*, Kyo Kageura & Pierre Zweigenbaum (Eds.), Paris, INALCO, pp. 119-122 (2011).
22. McCrae J., Spohr D., and Cimiano P, Linking lexical resources and ontologies on the semantic web with lemon. In *Proceedings of the 8th extended semantic web conference on The semantic web: research and applications - Volume Part I* (ESWC'11), Grigoris Antoniou, Marko Grobelnik, Elena Simperl, Bijan Parsia, and Dimitris Plexousakis (Eds.), Vol. Part I. Springer-Verlag, Berlin, Heidelberg, 245-259. (2011)
23. Gresser J.-Y. Ontologies des risques financiers — Continuité d'activité, gestion de crise, protection des infrastructures critiques financières, Actes de la conférence TOTh 2010, C. Roche éd., Annecy, Institut Porphyre, pp. 155-176 (2010).
24. Roumier J., Vander Stichele R.,& Romary L., Approach to the Creation of a Multilingual, Medical Interface Terminology, *Proceedings of the 9th International Conference on*

Terminology and Artificial Intelligence, Monique Slodzian & al. (Eds), Paris, INALCO , pp. 13-15 (2011).

25. Juanals B. Lafréchoux, M., Minel J.L. 2012. Kontrast, une méthodologie instrumentée pour analyser les variations terminologiques dans des textes industriels *6° Toth2012*, 19 p., Chambéry, juin 2012
26. Juanals, B., Minel, J.-L., Writing and Monitoring in International Standardization, Theoretical Choices and Methodological Tools, *Journal of Systemics, Cybernetics and Informatics* (2012).
27. Juanals B. Lafréchoux, M., Minel J.L. The Standardization Process : Exploring the Battlefield, *Fourth International Symposium on Process Organization Studies*, 10 p., Kos, Greece, June 2012