Abstract of Ph. D. dissertation

Modelling of legal knowledge using semantic networks

The "Modelling of legal knowledge using semantic networks" dissertation deals with the issue of creating ontologies used in the area of law, and complements the state of the art with the original domain ontology in the field of acquisition of property rights by acquisitive prescription in Polish law.

The rationale for taking up such subject is the development direction the legal industry has embarked upon through the use of modern solutions in the field of information and communication technologies (ICT). The dissertation focuses on the issues of applied law ontologies that can be part of the Semantic Web solutions. The Semantic Web idea is based on the evolution of the so-called Web-of-Documents in which users exchange information which they can interpret in a Web-of-Data wherein data is enriched by their meaning, so that the data can also be processed by computers. The development of technology has caused widespread access to many sources of information regardless of its physical location or the language in which it was coded. For this reason, many people have no problem getting information, but rather experience an information overload. Therefore, the increase in work efficiency will depend on the precise selection of information in a short time and in the growing resource of information. A huge amount of information means that this selection must be technically supported by appropriate analytical tools.

Legal assessment is a typical task carried out by lawyers, which takes place in every area of legal activity - in the process of adjudication, in the process of simple legal advice, in strategic legal services. The implementation of Semantic Web solutions in the legal industry will enable, among others, the automation of processes related to the analysis of document contents, and, as a consequence, will speed up the decision-making process. The field of law, due to its specificity (autonomy, lack of precision, lack of coherence, combination of different methods of inference, continuous variability, open texture, interleaving of justification, explanation and argumentation, or the huge role of common sense knowledge) poses some resistance to automatic processing of information, but attempts to break it are still made.

The Council of the European Union in the conclusions recommending the introduction of the European Identifier of Legislation (ELI, European Legislation Identifier) among the properties describing individual legal acts mentions metadata and ontologies. It points out that ontology as an "explicit, formal specification of a shared conceptualisation" is suitable for direct automatic processing and should be created for this purpose. Other advantages of such a description of the legislation and the relationship between different legal concepts include the unification of the understanding of the legal language.
In Polish legal literature, a comprehensive analysis of the problem entailing modelling legal knowledge using semantic networks has not been presented yet. Considering the fact that – as mentioned above – this is an issue from a theoretical as well as a practical point of view, this type of analysis is very necessary. However, it should be noted that although modelling legal knowledge using semantic networks presents a lot of theoretical problems, first and foremost it is a practical task. For this reason, a specific research method was adopted for the dissertation, which is based on a combination of abstract considerations and a case study. In addition to the analysis of the assumptions, methods and boundaries of the so-called applied ontologies, the purpose of the dissertation is the construction of the following ontology for a specific legal institution: the acquisition of property rights by acquisitive prescription. Such a strategy allows one to go beyond purely theoretical considerations and to perceive specific and practical aspects of the problem under investigation.

Knowledge about acquisitive law does not have representation in the form of a graph that could make searching for information using computers more effective. Until now, it has not been of interest to the creators of legal ontologies. Perhaps, the reason for this state of affairs was a certain organizational difficulty, because due to the specificity of the legal branch, it seems that to create such ontologies, exceptionally close cooperation between lawyers and IT specialists is needed. The development of such an ontology requires not only knowledge of the linguistic interpretation of regulations, but also proficiency in extensive jurisprudence.

The solution to the scientific problem formulated in the work also has a utilitarian dimension. The Polish official statistical studies do not specify the number of non-contentious probate (lat. jurisdictio voluntaria) relating to acquisitive prescription. However, based on data from the Portal of Public Courts Judicature, the scale and significance of the problem can be estimated. According to the information of the Ministry of Justice regarding the Portal, "the scope of published judgments has been determined by a team of judges and does not provide for sharing content excluded or irrelevant from the point of view of legal and information values or repeating judgments." Well, for the keyword "ownership" in the Portal there are 3484 judgments, of which 1689 refers to the keyword "acquisitive prescription". Thus, the judgments regarding the keyword "acquisitive prescription" are about half of the judgments (48%) related to the keyword "ownership", which the judges selecting the content of the Portal considered as important judgments from the point of view of legal and information values. This means that the institution of acquisitive prescription belongs to important and problematic issues of civil law. In the case of many properties in Poland, due to social and political factors over the last century, an unregulated legal situation may be indicated, in particular, non-compliance of entries in the land and mortgage registers with the actual legal status. It can be assumed that negligence results from a low legal culture and the lack of appropriate tools that would facilitate a basic diagnosis of the legal situation and help to indicate a solution to the problem of consolidating entries in the land and mortgage registers with the actual legal status.

The aim of the dissertation is to analyse the method and limits of modelling legal knowledge with the use of semantic networks and conceptualization of the institution of acquiring ownership through acquisitive prescription as well as the construction and presentation of the proprietary legal ontology model (UsucapiONTO ontology). The scope of the dissertation
includes an analysis of the content of the applicable Polish Civil Code and Supreme Court decisions in terms of the concepts (definitions) that can be implemented in the form of ontologies for semantic webs in Semantic Web standards for the institution of acquiring property rights by acquisitive prescription. The ontology is implemented in OWL (Web Ontology Language). The scientific problem of the dissertation is to identify the limitations of creating ontologies used in the field of law and the construction of legal ontology for the institution of acquiring property rights through acquisitive prescription. The dissertation conceptualized the institution of acquiring property rights by acquisitive prescription and presented the proprietary model in the form of legal ontology. Modelling was carried out using the method presented by M. Uschold and M. King, adjusting it accordingly to the problem of building legal ontology. The meaning of concepts was determined on the basis of the Polish Civil Code, and then ways to interpret these concepts in doctrine and judicature were determined. A dictionary was constructed and the concepts in the ontology were structured by indicating the relationship between these concepts. As a result, the UsucapiONTO ontology was created, which was implemented in OWL. The completeness of the ontology in the assumed range was verified. The three inference mechanisms were used to formally evaluate defined inferences as well as ontological consistency. The UsucapiONTO ontology documentation was prepared and published on the Internet. The UsucapiONTO ontology is a tool for a programmer interested in creating software in the area of knowledge engineering supporting the work of lawyers, but also for people seeking specific legal knowledge (and not only information). The construction of the UsucapiONTO ontology means that there is an implemented formal model of legal knowledge in the field of acquiring property through acquisitive prescription and it is possible for non-legal professionals to build specific application solution. In addition, the UsucapiONTO ontology can be a reference for algorithms that automatically generate ontologies. Therefore, it is possible to verify the effectiveness of such algorithms and their further development.

Practical and theoretical goals were achieved within the scope of the dissertation. The main practical goal was:

[C1] Creation of an ontology for the institution of acquiring property right through acquisitive prescription.

This goal was achieved by constructing the UsucapiONTO ontology, which was based on an analysis of civil law, judicature and doctrinal views. A formal evaluation of the UsucapiONTO ontology was made using automated inference mechanisms (reasoners). The ontology constructed in this way may serve various practical purposes, for example, the construction of a search system for institutions acquiring property rights by acquisitive acquisitions, decision support programs in this area or other applications that use knowledge about this institution (knowledge sharing).

The work also had a theoretical goal:


These issues are initially discussed in Chapter 1. The construction of the UsucapiONTO ontology made it possible to reveal and clarify these preliminary findings. The basic practical problems of using semantic webs for modelling legal knowledge concern the following issues:
[P1] The dynamics of law. A change in the law may question the existing structure of the relationship (in particular hierarchy) of concepts. With the development of law, new relationships arise between concepts that combine legal concepts with specific conditions or effects, or existing relationships are removed. Such changes cause conflicts in existing conceptual structures, and thus the evolution of law forces the creation of ontologies that will be able to take into account the dynamics of the legal system.

[P2] Definitions of legal concepts. Definitions do not give the full meaning of legal concepts. To determine the assumptions and impact of a given concept, an interpretation process of legal provisions and judicature must be carried out. The process of identifying the meaning of legal concepts becomes even more complicated when, in addition to the relations between concepts resulting directly from the provisions, we want to take into account the relationships resulting from the practice of applying the law.

[P3] Values. Consideration of certain values that need to be promoted in the course of applying the law in different contexts and different types of entities may result in the loss of coherence of concepts which must be addressed at the stage of designing the applied ontology. For this reason, during the construction of legal ontologies, the participation of a lawyer familiar with the views of the doctrine is important, because they can propose such a description of legal concepts taking into account the conclusions which could potentially arise from the application of the concepts in the construction of a legal norm. The task of a lawyer involved in the construction of an ontology is to establish such a framework for legal concepts, which will result from legally justified and in line with the values of applications.

The limits of the applicability of the method of modelling legal knowledge by means of semantic networks are best determined by pointing out some assumptions that have to be adopted when constructing legal ontologies. These are:

[Z1] Selection of input data (only normative acts or whether case law will also be included).
[Z2] Interpretation of data – the decision on the choice of the analysis method, the decision on how to solve the problem of ambiguity, blurring and the so-called open text. [Z3] Scope of ontology – is an ontology designed to model the knowledge of the whole branch of law (e.g. civil law) or, for example, a specific institution from this branch? [Z4] Alternative theories – a consequence of the choice of a given dogmatic theory is the specific way of interpreting the concepts and relations between them. [Z5] The way of representation defines syntactic and semantic conventions that enable the description of reality. [Z6] The area of application of domain ontology (the context of ontology) – a given ontology may work better in a specific usage scenario (e.g. in the legislative process, when the cohesion of the institution is verified) or worse (e.g. in dogmatic discourse), what decisions are supported – from the decision support tool to the "artificial judge". [Z7] The evaluation criteria, among which are the criterion of clarity, coherence, extensibility, minimal ontological commitment and minimal ontological bias (discussed in Section 1.12). In addition, formal evaluation methods can be indicated by means of automatic reasoner mechanisms, i.e. software that primarily serves to verify inferences and ontological consistency. [Z8] Reusability, i.e. ensuring interaction with other ontologies (question about the universality of decisions regarding the definition of concepts at the ontology creation stage).

Assumptions [Z1] - [Z8] show the limitations of modelling knowledge of the law using semantic networks in the sense that they determine the general issues which must be resolved
to build an applied legal ontology. It must be remembered that these solutions are "inherited" by algorithms that use a given ontology. Therefore, assessing – for example – a decision "issued" by the decision support system of law and based on the ontology, one needs to take into account the assumptions on which the ontology is based. It can also be noted that the method of constructing legal ontologies speaks volumes about the decision-making processes carried out by people. The human mind is constructed differently than a computer algorithm: they cope differently with the problems they face, for example a matter of vagueness, ambiguity, or taking into account values in the process of interpretation. Its effect is not limited, nor is mainly based on the processing of abstract knowledge structures, but uses the unconscious processes (intuition) and imagination (mental simulations). The reflection on the use of semantic networks for modelling legal knowledge makes it possible to highlight these differences and better understand the essence of legal reasoning.

In the face of the above observations, the main theoretical conclusions of the dissertation can be formulated as follows:

[W1] semantic networks are a useful tool which enables the construction of legal ontology, which may be used for structuring knowledge of the law, search this knowledge and design decision support systems for legal problems.

[W2] The main problems associated with the use of Semantic Web knowledge modelling of the law are related to the dynamics of the law (the instability of legislation, judicature, the doctrine), peculiarities of natural language, the way legal definitions are constructed and the axiological dimension of the process of interpreting and applying the law.

[W3] The limits of the applicability of the method of legal knowledge modelling with the use of semantic networks are determined by a set of assumptions that have to be adopted through inclusion in the construction of a relevant legal ontology.

Kraków, 18 czerwca 2018 r. 

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