

Knowledge Organization Systems in the Law Domain: Benefits and Challenges

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Abstract

The digital age has transformed the way legal information is created, accessed, and used. Legal resources are now created and disseminated in a wide variety of digital formats, including text, audio, and video. Additionally, the proliferation of legal information in the digital age has made it increasingly challenging to organize and retrieve legal information efficiently and effectively. Knowledge organization systems (KOS) have emerged as a critical tool for organizing and retrieving legal information in the digital age. Legal information organization impacts the daily life of every citizen and represents one of the opportunities of legal culture to meet the challenges of the digital age. This includes organizing information related to legislation, case law and legal scholarship. However, developing KOS in the legal domain presents several challenges. This paper aims at identifying the challenges of KOS in the legal domain, such as the complexity and dynamism, the lack of standardization, and the diversity of legal cultures and languages. In particular it describes the development of specific ontologies about legal fundamental legal concepts. This approach aims at improving the quality of legal provisions by monitoring new regulations' impacts on the legal system.

Keywords

Legal language, legal representation, organization of legal information

1. Introduction

The legal domain is a complex and dynamic area of knowledge, where the interpretation of legal texts requires a high level of precision and accuracy. Legal information, such as statutes, regulations, case law, and contracts, are typically written in a formal language that is difficult to understand for non-experts. Moreover, legal concepts and terms often have multiple meanings and can vary depending on the context and jurisdiction. Therefore, legal researchers, practitioners, policymakers and even citizens need efficient ways to access, organize, and analyze legal information. Knowledge Organization Systems (KOS) provide a structured way to represent legal concepts, relationships, and rules, which can facilitate access to legal information and improve legal reasoning.

2. Development of KOS in the law domain

KOS are knowledge representation frameworks that use ontologies, taxonomies, and other semantic models to organize and classify knowledge. KOS have been widely used in various domains, to support knowledge management and decision-making. In the legal domain, KOS have been developed to represent legal concepts, relations, and rules [5], such as, for example, the concepts of contracts, and property rights. KOS can be constructed by domain experts using manual or semi-

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automatic methods [2] [3] [4] such as ontology engineering tools, natural language processing techniques, or crowdsourcing. In particular in the legal domain the intellectual work is fundamental as law does not only represent a complex set of rules, but also a world of interpretations of the same legal concept.

KOS can have multiple benefits in the legal domain. First, KOS can improve legal research and retrieval of legal sources [1]. By using KOS, users can navigate legal databases more efficiently and locate relevant resources more easily. KOS can also support legal classification by providing a standardized vocabulary and classification scheme for legal documents and can facilitate legal reasoning and decision-making by providing a structured representation of legal concepts and relationships [6]. Moreover, KOS can help to identify inconsistencies, gaps, or contradictions in legal arguments [12] and provide a more transparent and consistent interpretation of legal texts [13]. Finally, KOS can support the development of legal expert systems, such as intelligent legal assistants, by providing a knowledgebase of legal concepts and rules, which can be used for legal drafting, as well as for training legal practitioners [4].

3. State of the art of legal KOS

A certain number of thesauri, taxonomies, classification schemas, ontologies in different legal areas and for different purposes have been used in various applications: i.e. Eurovoc [13], the European Legal Taxonomy Syllabus [1], the Core Legal Ontology -CLO [2], the Lexical ontologies for legal information sharing- LOIS [3]. All these instruments respond to diverse functions: a) structuring of information; b) reasoning and problem solving; c) information retrieval; d) semantic integration. However, the multi-level complexity of law and the research on this field suggest that there is no single way to address the development of legal semantic indexing tools, but rather we need to use and follow a plurality of approaches, both on theoretical and on pragmatic grounds [4].

4. The Model of Provisions

Of special interest in the legal domain is the development of specific ontologies dealing with legal fundamental concepts, as LKIF [5]. In this respect a specific type of KOS conceived to represent fundamental legal concepts is the Provision Model [6] which offers a classification of legal provision types (e.g. Right, Duty, Power, Liability, Sanction, Procedure) and related properties (e.g. Right Bearer, Right Action), including logical relations between legal concepts (like Hohfeldian relations). The Provision Model represents units of the regulation as structures encompassing indication of a provision type and a set of properties assuming values from a vocabulary or thesaurus, representing semantic content of the regulation. The Provision Model has been used in the literature to provide advanced legal information retrieval and reasoning services based on the semantics of legal rules, but primarily, it has been targeted at implementing model-driven legislative drafting facilities, as well as providing a tool for semantic annotation of legislative texts.

The aim of this approach is to improve the quality of legal texts and ensure the maintenance of legal information by monitoring the impacts of new regulations on the legal system (including the consistency and completeness of new provisions within the same text or different texts within the same legal order, as well as between different legal orders), as well as to provide advanced legal information retrieval based not just on documents, but also on legal rules.

According to the legal theory point of view, the legal order can be seen as a legal discourse composed by linguistic entities or *speech acts* [7] with descriptive or prescriptive functions.

Every linguistic entity in a legislative text can be seen as a set of signs organized in terms of a set of signs organized in words and sentences for creating a normative statement, typically called 'Provision' [8] [9].

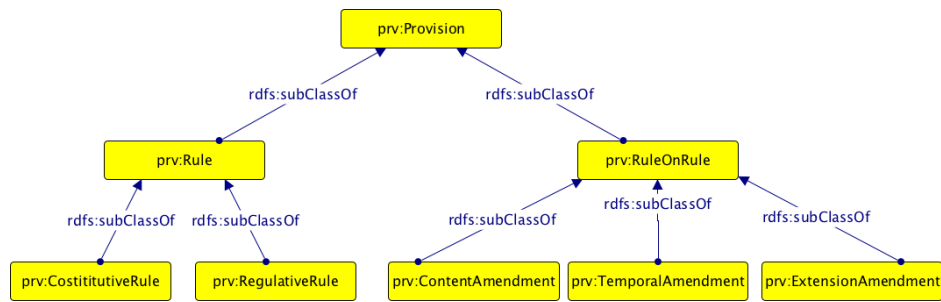


Figure 1: The Provision Model top classes (“prv:” is the namespace for provisions)

Provisions have been classified in [9] in terms of provision types, organised into two main groups (Fig. 1): *Rules* and *Rules on Rules*. *Rules* can be *Constitutive Rules* as *Definition* introducing entities, or *Regulative Rules* as the concepts *Duty* and *Right* (or in a more deontic oriented terms *Obligation* and *Permission*), as well as *Power* etc., regulating subject roles and activities. *Rules on Rules* are different kinds of amendments: *Temporal*, *Extension* or *Content amendments*. Each provision type is characterized by specific *properties* (for example the *Bearer* or the *Counterpart* of a *Right*), reflecting the lawmaker directions.

Provision types and properties can be considered as a sort of metadata model able to analytically describe fragments of legislative texts, hence the name of *Provision Model* [9]. In this vision, norms represent the way how provisions are applied; as such they represent the product of an interpretative process [11]. A provision, as pure textual object, represents the building block of the legal order (new provisions can enter or leave the legal order itself).

Advanced legal information retrieval, able to implement reasoning on deontic notions, is a type of reasoning managing textual information, thus pertaining to *provisions*. A typical example is a system able to implement Hohfeldian reasoning, in which a user submits a query to a legal document collection in order to find the rights of a bearer A towards a counterpart B. Following an Hohfeldian reasoning, the system should be able to retrieve also the provisions expressed as duties of the bearer B towards the counterpart A, because such duty can also be seen as A’s right. An OWL 2 DL approach using the Provision Model for this type of reasoning is illustrated in [6] and [10].

4.1. Modeling provisions and Hohfeldian relations

In [6] it is shown how Hohfeldian relations on deontic and potestative notions can be managed within a description logic computational framework. We recall here the main aspects of the approach to show how *Provisions* can be used to implement an advanced legal provisions retrieval system, endowed with legal reasoning facilities, using a decidable fragment of OWL 2 (in particular OWL 2 DL), therefore exploiting existing decidable reasoners.

In this recall, we show the approach for deontic notions and their relations, sketched in the schema of Fig. 2.²

² More details on this modeling approach and its application to potestative notions (*Power*, *Liability*, *Disability* *Immunity*), can be found in [6] and [10]

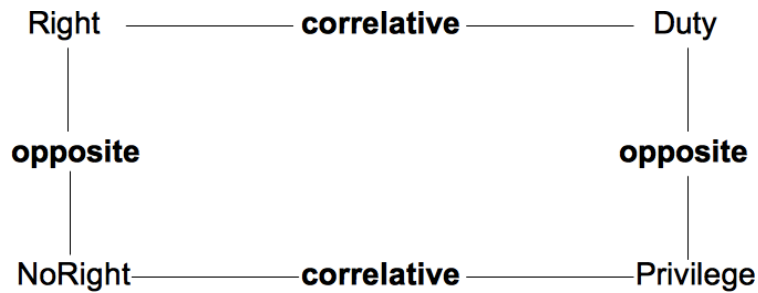


Figure 2: Hohfeldian relations on deontic concepts

In order to implement an advanced legal provisions retrieval system, it is necessary to describe the relations between provisions at the level of the Provision Model. For example, the Hohfeldian relation between *Duty* and *Right* can be effectively represented by observing that a *Right*, in correlative correspondence with a *Duty*, is actually not explicitly expressed in the text, but represents an implicit provision, basically a different view of the *Duty* itself, where the values of the related bearer and counterpart properties are swapped.

Therefore, the Provision Model can be extended in terms of Duty and Right³ implicit and explicit disjoint subclasses, able to represent a complete covering of the related superclass (ex: *ExplicitRight* and *ImplicitRight* disjoint subclasses represent a complete covering of the *Right* superclass). Properties can also be specified as regards both implicit and explicit provisions, so that *hasImplicitDutyBearer* and *hasExplicitDutyBearer* are sub-properties of *hasDutyBearer*, as well as *hasImplicitRightBearer* and *hasExplicitRightBearer* are sub-properties of *hasRightBearer*.

To represent the Hohfeldian fundamental relations between Duty and Right, firstly an equivalence relation between their explicit and implicit views is established: $\text{ImplicitRight} \alpha \text{ExplicitDuty}$ and $\text{ImplicitDuty} \alpha \text{ExplicitRight}$. In Fig. 3 the established sub-class and equivalence relations between Duty and Right in their explicit and implicit views are summed up.

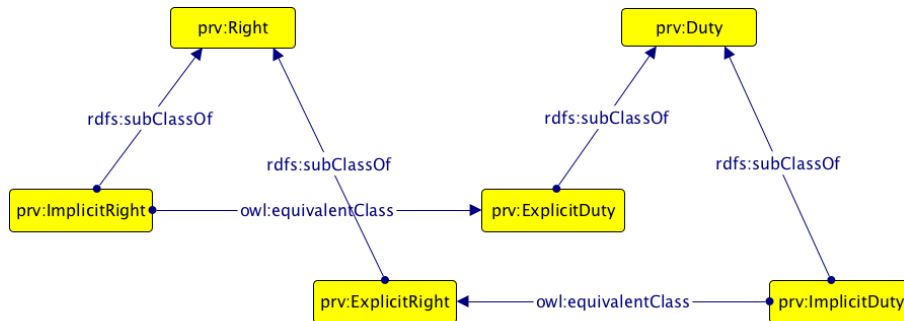


Figure 3: Sub-class and asserted equivalence relations between Duty/Right deontic correlative provisions.

Moreover, equivalence relations between implicit/explicit Duty and Right properties can be established. In Fig. 4 the asserted properties of *ExplicitDuty* and *ImplicitRight* and their mutual equivalence relations are shown ($\text{hasImplicitRightBearer} \alpha \text{hasExplicitDutyCounterpart}$ and $\text{hasImplicitRightCounterpart} \alpha \text{hasExplicitDutyBearer}$).

³ Where “prv:”, namespace for provisions, is hereinafter implied.

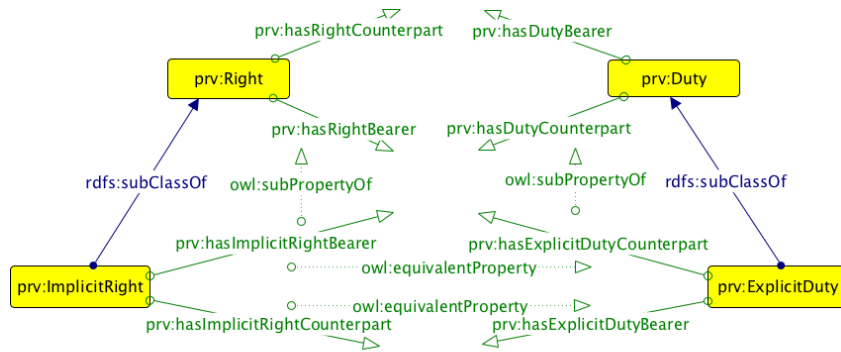


Figure 4: Asserted properties of ExplicitDuty and ImplicitRight and their mutual equivalence relations.

The same holds for the asserted properties of ImplicitDuty and ExplicitRight and their mutual equivalence relations (hasImplicitDutyBearer α hasExplicitRightCounterpart and hasImplicitDutyCounterpart α hasExplicitRightBearer) (Fig. 5).

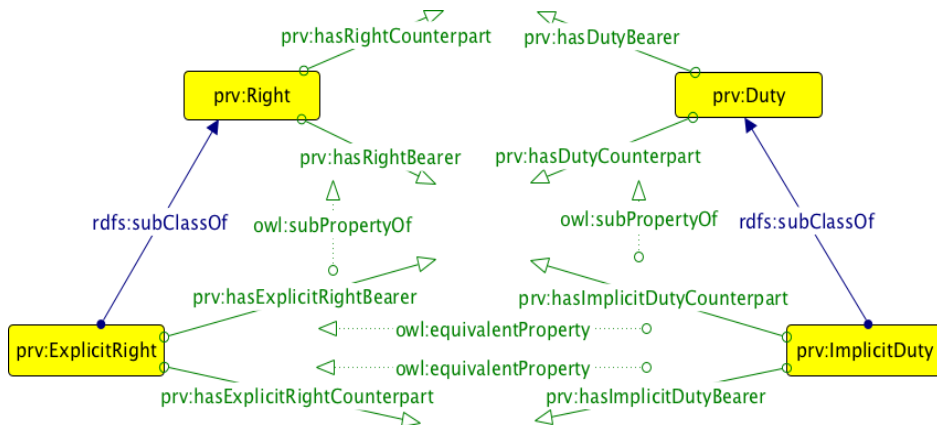


Figure 5: Asserted properties of ImplicitDuty and ExplicitRight and their mutual equivalence relations.

Note that the proposed patterns do not interfere with the relations between Right and Duty, which still hold. In fact, for the couple Right/Duty, an individual of ExplicitDuty is also an individual of Duty, given the axiom `rdfs:subClassOf(ExplicitDuty, Duty)`. Moreover the axiom `owl:equivalentClass(ImplicitRight, ExplicitDuty)` tells us that such individual is also an ImplicitRight, which is also a Right, given the axiom `rdfs:subClassOf(ImplicitRight, Right)`. Since this is done symmetrically for explicit and implicit duties and rights, we can deduce that Right is equivalent to Duty, namely is another reading of the Duty itself, given that the union of the disjoint explicit and implicit subclasses covers completely the related superclass.

4.2. Example of provision for information retrieval and reasoning

In order to show the ability of the Provision Model approach to provide advanced legal information retrieval facilities, based on provisions and related Hohfeldian relations, the following example of a legal rule R1 can be used:

[R1]: *The supplier shall communicate to the consumer all the contractual terms and conditions*

In terms of the Provision Model, this rule can be seen as a provision of type Duty, which can be represented as `ExplicitDuty(Supplier, Consumer)`, where the arguments of the `ExplicitDuty` are the explicit bearer (Supplier) and related explicit counterpart (Consumer), respectively.

Given the following introduced Hohfeldian relations:

`ImplicitRight` α `ExplicitDuty`

`ImplicitRightCounterpart` \equiv `ExplicitDutyBearer`

`ImplicitRightBearer` \equiv `ExplicitDutyCounterpart`

the provision at R1 can also be seen as `ImplicitRight(Consumer, Supplier)`, including related implicit right bearer (Consumer) and implicit right counterpart (Supplier).

Therefore, the provision R1 can be retrieved asking for either the duty of the supplier or the right of the consumer.

Differently from other approaches based on subject matter classification of normative documents by legal ontology concepts, the Provision Model is an ontology approach aiming to provide an analytical semantic annotation of text fragments, representing legal provisions, so that the user can search and retrieve not just documents but also specific norms concerning, for example, a specific addressee, about a particular action, involving a defined counterpart.

5. Challenges and conclusions

The design and use of KOS in the law domain pose several challenges related to the complexity and dynamism of the legal domain. Legal concepts are constantly evolving, and new laws and regulations are constantly being introduced. Moreover, the legal domain is highly context-dependent, and legal concepts can have different meanings depending on the context in which they are used. These factors make it challenging to develop KOS that are comprehensive, up-to-date, and adaptable to changes in the legal domain. A second challenge is represented by the lack of standardization. Also, different legal jurisdictions and cultures with their own legal terminology, concepts, and practices makes it demanding to develop KOS that are applicable across different legal systems and languages. The lack of standardization can lead to ambiguity and inconsistency in legal terminology, which can impact the accuracy and reliability of KOS. Possible solutions can be envisaged in machine learning and natural language processing that can be used to identify patterns and relationships in legal terminology and concepts, which can improve the accuracy and consistency of KOS. Additionally, machine learning and natural language processing techniques can be used to identify and extract relevant legal information from unstructured data sources, such as legal provisions and case law.

The use of KOS in the legal domain proved to be effective in aiding legal professionals about knowledge management, legal reasoning, and decision-making. Much work remains to be done in the development and application of KOS in this field. We argue that future research in this area should focus on (1) the development of domain-specific KOS that can capture the nuances of particular legal domains, (2) the evaluation of the effectiveness of KOS in improving legal reasoning and decision-making, and (3) the development of ethical guidelines for the use of KOS in the legal domain.

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