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EXTRACTING NORMATIVE CONTENT FROM LEGAL TEXTS

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Abstract

Interoperability is a crucial issue, as large scale applications mainly depend on the possibility of mapping and connecting different models and structures. In the context of public services organization, achieving interoperability among public sector information means, on the one hand (back office), enabling dialogue among public offices, sharing data, standardising structures and models, connecting data producers and final users. On the other hand (front office), it means, providing better services and making citizens communicate and understand administrative and legal content. Due to the social dimension of legal information, semantic interoperability in the regulative domain is of crucial relevance, but of great complexity. Connecting regulative data requires the alignment of the structural layers, by adopting Semantic Web Standards, enabling data and meta-data to be identified, combined and retrieved, but also interconnection at conceptual level, allowing deeper communication of legal knowledge across domains and languages.

The subject of this article concerns the conceptual modelling of legal information in systems for the organisation of digital services by administration and businesses and for assessing their normative compliance. This is a field in growing evolution and of great interest both from the market and public perspective, where several projects, tools and languages have been implemented, but the "knowledge bottleneck" in extracting and representing normative content from legal texts has not yet found a suitable solution, able to make the process of formalisation computationally tractable and reliable.

The methodological aim is to show how the ontology-based approach, constructed around the basic notion of 'obligation', could support the formalisation of rules from texts and, at the same time, provide the reference model where to ground the mapping process between rules extracted from a normative statement and the business model specifications.

Keywords: knowledge extraction, ontology population, legal concepts, services process organization

1 INTRODUCTION

All the work done within the Semantic Web Community in term of languages, resources and tools provide a rich source of solutions for producing semantically enriched and interconnected information; the migration of the Web of documents into a Web of data, as well as the increasing success of initiatives as Linked Open Data are clear evidence of the added value of integration and shared access. At the same time, in the field of public information, several initiatives have been promoted by Public bodies (especially by USA and U.K. governments) towards making their data open, public available and interconnected; government policies are addressed to several goals: the definition of a deep and detailed standardisation framework, in order to provide public and private data producers with a rich set of *meta data standard* for identifying and describing PSI[1], a wide increase of the amount of data published (for instance, in USA: *www.**data.gov**/)* and the implementation of tools for *data interoperability assessment,* in order to provide private producers with means for evaluating the compliance of their products and services (in UK: the e-Government Interoperability Framework http://www.egifcompliance.org/).

Under the stimulus of the European Institutions, there is a growing awareness in public sector that interoperability of data and information is a pre-requisite, not only for promoting the economic value of information (i.e., in the commercial exploitation of public sector information-PSI[2]), but also with the aim of strengthening the democratic participation of the citizen in institutional activities and of improving access and availability of public information services[3].

Within the scope of Public Sector Information, the *legal domain* is a crucial one, being the core component in the interrelations between citizens and public bodies. Legal information enter into play according to a double perspective: first of all, legal barriers still exist that prevent the re-use of public sector information: numerous obstacles lie in the way of individuals, associations and companies keen to locate, procure and re-use PSI, in order to comply with the implementation and application of existing law and to overcome legislative changes. Public bodies are, for their part, confronted with an ever increasing set of demands upon their infrastructure. Even where they have a positive attitude and policy towards PSI re-use, they too are confronted by handling legal landscape that is complex, varied, inter-linked, overlapping and above all dynamic.

The second aspect, is the value of legal data as an asset in itself " Legal information is a typical exponent of the area where traditionally the government did not see a role for itself, limiting its activities to the core public task and leaving the value adding and distribution to the private sector. However, under the influence of the enhanced possibilities of information technology, that perception is changing rapidly and, interestingly, governments all over Europe are in the process of taking on board additional tasks within the value chain"[4].

A further aspect rely on the social dimension of legal information. Achieving interoperability among public sector information means, on the one hand (*back office*), enabling dialogue among public offices, sharing data, standardising structures and models, connecting data producers and final users.

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1 http://www.cabinetoffice.gov.uk/govtalk.aspx

2 a complete survey is in the MEPSIR study [Dekkers et al. 2006], commissioned and awarded by the European Commission (DG INFSO) in the context of the implementation of the EU PSI Directive 2003/98/ on the re-use of public sector information (PSI).

3 COMMISSION RECOMMENDATION of 2 July 2008 on cross-border interoperability of electronic health record systems (2008/594/EC),art. 8.: " Semantic interoperability is an essential factor in achieving the benefits of electronic health records to improve the quality and safety of patient care, public health, clinical research, and health service management. The Member procuring eHealth services to enable interoperability of States should: [...] c) agree on standards for semantic interoperability to represent the relevant health information for a particular application through data structures archetypes and templates, and subsets of terminology systems and ontologies; (d) consider the need for a sustainable reference system of concepts (ontology)as a basis for mapping multilingual lexicons that take into account the difference between professional healthcare languages, lay terminologies and traditional coding schemes"

4 http://ec.europa.eu/information_society/policy/psi/docs/pdfs/mepsir/executive_summary.pdf, p.18

On the other hand (*front office*), it means, providing better services and making citizens and legal practitioners communicate and understand legal content.

As a consequence, in the legal domain the level of semantic interoperability must cover the structural layer, by adopting Semantic Web Standards, enabling data to be identified, aligned and retrieved, but also it must be established at conceptual level, enabling deeper communication of legal knowledge across domains and languages. As EU Parliament pointed out[5], "... the European Community is a community based on the rule of law and that Community law remains a dead letter if it is not properly applied in the Member States, including by national judges, who are therefore the keystone of the European Union judicial system and who play a central and indispensable role in the establishment of a single European legal order. [...] Parliament considers that language is the main tool of practitioners of justice. [....]; noting that complete and up-to-date information on Community law is not available in a systematic and proper manner to many national judges, Parliament calls on the Member States to renew efforts in this area as a true European judicial area in which effective judicial cooperation can take place requires not only knowledge of European law, but also mutual general knowledge of the legal systems of the other Member States. It welcomes the Commission's intention to support the improved availability of national databases on national court rulings concerning Community law and is of the opinion that all national judges should have access to databases containing pending references for preliminary rulings from all Member States."

From the technical side, the main methodological challenge is how to classify, express, and communicate the regulative content in a standard format; traditionally, in Standard Frameworks for PSI, the description of content refers to Dublin Core elements ('content' dataset) or to structured vocabularies, as in UK, GCL (Government Category List), or IPSV (Integrated Public Sector Vocabulary). Due to the complexity of information embedded in legal documents, the classification of content according to taxonomic categories would not be sufficient to express neither the prescriptive meaning, nor the semantic distinctions in different contexts and across different legal systems. Legal terminology used in the various legal systems, both European and non-European, expresses not only the legal concepts which operate there, but also reflects the deep differences existing between the various systems and the differing interpretative perspectives of legal practitioners in each system. This is due to the coexistence, in legal language, of two autonomous but structurally similar systems: both law and language are endowed with *rules* that underlie the construction of the system itself, guide its evolution and guarantee its consistency. Both are conditioned by the social dimension in which they are placed, whereby they dynamically define and fix their object in relation to a continually evolving social context.

2 THE ONTOLOGY BASED-APPROACH

In large scale integration of PSI [Alani et al. 2007] and in advanced computer applications (e.g., in e-commerce or in Digital Rights Management) the ontology-based approach has been proposed as capable of offering good solutions; in legal domain it permits cross-lingual mapping, as it allows for the representation of legal concepts in formal frameworks, thus expressing, in a coherent way, the links among the conceptual characterisation, the lexical manifestations of its components and the universes of discourse (or reality) that are their proper referents [Agnoloni et al. 2008]. Firstly, the representation made by ontologies enables migration from the *term* to the *concept* and enables the meaning of the concept to be disambiguated setting it in a specific domain or context. Moreover, conceptual models clarify and explain the implicit assumptions underlining legal knowledge; in this way, understanding, sharing, and re-using knowledge bases is supported in a consistent way and the dynamic evolution of the meaning of legal concepts can be monitored[6].

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[5] EU parliament resolution EP A6-0224/2008 SP(2008)5307 "The role of the national judge in the European judicial system" The initiative report had been tabled for consideration in plenary by Diana WALLIS (ALDE, UK) on behalf of the Committee on Legal Affairs.

[6] Gangemi, A., Sagri, M.-T., Tiscornia, D., (2005), A Constructive Framework for Legal Ontologies,. Inaw and the Semantic Web (Benjamins, Casanovas, Breuker and Gangemi eds.), Springer Verlag, 2005.

The aim of this article is to show how the ontology-based approach, applied to the representation of the basic notion of 'obligation' could support the extraction of content patterns from legal texts and their conceptualization in shareable models; we also foresee a further specific application task, devoted to the conceptual modelling of legal information in the organisation of digital services by administration and businesses and to the assessment of their *normative compliance.*

In what follows, we will provide: the methodological assumptions and the resources on which we have based our work, the description of the bottom-up (frame-based) methodology for knowledge extraction and the top-down conceptualisation of *obligation* (sect.3). Sect 4. describes how the notion of *public function* is modelled by specialising the deontic notion of obligation and the instantiation of the case study (car tax payment) in the two models that enable us to test how textual content and conceptual knowledge can be mapped. Sect.5 introduces some preliminary considerations on the application in the process for normative compliance checking.

3 EXTRACTING KNOWLEDGE FROM NORMATIVE STATEMENTS

The approach described here originates from practical on-going experiences, carried out in two Italian projects; P.A.eS.I., (Pubblica Amministrazione e Stranieri Immigrati[7]) [Public Administration and Foreign Immigrants] is a portal on immigration procedures, promoted by the Italian government for the development of an on-line support system for immigration procedures. The service aims at and intends to create communications and information exchange among those belonging to the public administration, trade associations and representatives from the professional world so that administrative procedures become transparent and streamlined. The regulative information in PAESI are organized according to an ontology-based modellisation of procedures [Cherubini and Tiscornia 2010], that reflects the normative structure; it enable users to access the information trough the qualification of their status (as immigrant, worker, extraeuropean citizen, etc.) and the topic of interest (permission to stay, access to social benefits, school, health, etc.).

The second experience is the ICT4Law project[8], funded by the Piedmont Region (under the program "Converging Technologies") and aimed at the creation of new tools and support for enterprises by integrating competencies and technological innovations. Here, the definition of (semi) automated procedures for checking normative compliance and risk assessment is considered strategic in speeding-up the technological innovation of productive activities. The implementation of tools able to check the normative compliance in business and service providing processes is a field in growing evolution and of great interest both from the market and public perspective. Several projects, tools and languages have been implemented, but the "knowledge bottleneck" in extracting and representing rules from legal texts has not yet found a suitable solution, able to make the process of formalisation computationally tractable and reliable. Our assumption is that, by mapping linguistic structures to the ontological description of key concepts in the domain, the knowledge extraction process would be facilitated.

The ontologies are considered by definition, descriptive models of a domain that are neutral with respect to the knowledge sources and specific domain, but depend on the task they are expected to perform. In the legal domain a model, designed to meet the practical needs of the user (citizen, enterprise or worker in the industry), reproduces its cognitive attitude, enabling it to follow a bidirectional path to the knowledge that ranges from “specific behaviour” (“what should I do?”) to its normative justification (“on the basis of which norms”). Therefore, ontology building must be based on patterns that mainly reflect the "*competency questions"* belonging to the domain [Gangemi 2007], thus allowing both to be consistent with the domain features and the ontological formats, in order to be isomorphic (and mappable) to the one of web services and the business process, where ontological models already exist. In both projects, the ontologically based model has been built around the basic legal concepts (e.g. formal requirements, duties, liabilities) involved in the process steps, where norms are conceived as constraints to be fulfilled in order to generate legally compliant state of affairs; the

[7] *www.immigrazione.regione.toscana.it*
[8] *www.**ict4law**.org*

model is designed on a higher level of generalisation and, therefore, it is able to be exported into diversified domains (for example, all the sectors of the provision of services by public administrations).

A further requirement is the textual dimension of law, which requires a bottom-up approach in ontology building, where the terminological identification and the context-based meaning can be respected. As already pointed out, in the legal domain, the notion of 'legal source' takes on a special relevance that requires the representation of relations between text/content, or, more precisely, between normative context/norm. The normative text is, due to its formal aspect, structured according to a predefined model, represented by a set of normative contexts identified by the articles and organised in a sequence of logical parts (title, preamble, articles, enacting clause, etc.). Its prescriptive content is expressed by the norms that do not necessarily coincide with the parts of the text but describe a legal situation compliant with the legal system.

3.1 Mapping linguistic constructs and legal concept representation

At linguistic level, text segments can be classified according to their illocutive functions [Searle 1970] in the *ontology of provisions* [Biagioli et al. 2005]; among them, the most relevant classes, from the user's perspectives, are *definitions* and *regulative provisions,* that are usually expressed according to typical linguistic structures, and that roughly correspond to the classical distinction of legal theory between *constitutive* (definitions, institutive and power-conferring norms) and *prescriptive* norms.

From the semantic perspective, the elicitation of linguistic patterns expressing the regulative (deontic) qualification of facts can easily be mapped to the formal representation of prescriptive norms as collection of *duties, powers, permissions* and *sanctions*, as they are represented in core legal ontologies [Rotolo et al. 2006]. In fact, Core conceptualisations of the law include different types of basic legal concepts, as the entities that populate the domain, such as *legal person, norm, responsibility,* and the deontic concepts that are in charge of expressing the normative nature of legal discourse. One of the most complete and detailed framework for such notions is that proposed by the philosopher Hohfeld [Hofheld 1978], who built up the following system of correlatives: *right/duty; privilege/no-right; power/liability; immunity/disability.* Consequently, the Hofehldian framework of Fundamental Legal Concepts seems to be the key element in order to connect the linguistic manifestations of prescriptions with the ontological representation of a set of norms.

We started from a rich background of knowledge, namely, from the availability of formal reformulations of the Fundamental Legal Concepts [Sartor 2006], the availability of their ontological description in the Core ontologies as LKIF-Core and CLO [Gangemi et al.2005, Breuker et al. 2007], the availability of semantic models of the legislative provisions [Biagioli 2008,] and of their formal specification [Francesconi 2009]. In legal texts, the deontic operators are domain independent (any kind of action can be permitted or forbidden) and are expressed by a relatively limited number of linguistic structures. This feature allows us to move our approach into several different legal sub-domains, like procedural norms regulating service provisions and business process. Altough the following analysis will be limited to the "obligation scenario", a wider case-study has been carried out [Agnoloni et al. 2010], aimed at exploring evidence for mapping the whole set of Fundamental Legal Concepts, as formalized in [Sartor 2006], with suitable linguistic structures (i.e. FrameNet Semantic Frames which describe 'deontic' situations).

3.2 The obligation scenario in Framenet

In a previous experience[9] we have adopted alternative approaches to terminology extraction and meaning representation, like the WordNet model [Felbaum 1998]. In WordNet words are organized in *synsets* (i.e., sets of synonyms) in turn linked by hierarchical or taxonomical relations such as

[9] The wordnet model has been adopted in the LOIS Project [Peters et alii. 2003]) where the alignment of the multilingual legal lexicon provides the knowledge on which to ground cross-lingual retrieval of multilingual legal documents.

hyponymy and hyperonymy. According to this view, the meaning of a word is intended as a distinct, atomic semantic object, fully identified by its position in the general semantic network. These kind of tools work well in automatic indexing, classification and cross-lingual retrieval, but are not completely satisfactory in order to represent the inner structure of complex situations, modelled according to very specific competency questions, e.g., "under which *Circumstances*, what *State of affairs* is sanctioned by which *Principle*". Since frame semantic offers the formal framework that can adequately represent events and situations typically expressed in legal documents, the FrameNet model [Ruppenhofer et al. 2006] (hereafter referred to as FN) based on frame semantic has been adopted.

Framenet is a lexical resource for English, based on Fillmore's *Frame Semantics* theory [Fillmore 1976] and supported by corpus-evidence. The goal of the FN project is to document the range of semantic and syntactic combinational possibilities of each word in each of its senses. Words, multiwords, and lexical expressions are Lexical Units (LU) that *evoke* a typical Frame. Typically, each sense of a word belongs to a different Semantic Frame. The type of representation produced by FN is a network of "situation-types" (frames) composed of slots (frame Elements FEs) and organized across inheritance relations between Frames and further frame-to-frame relations. In FN, Frame Elements can also be specified with Semantic Types (i.e., ontological categories) employed to indicate the basic typing of fillers that are expected in the Frame Element. Most of these semantic types can be mapped onto already existing ontologies.

Instead of creating new frames or specializing FrameNet, we have applied to our case study (a set of regulations on consumer protection and car taxation) a set of Framenet frames, expressing the Obligation Scenario, as Fig.1 shows.

Figure 1. the Obligation Scenario in Framenet

What is interesting is the multiple perspectives of expressing this deontic modality. For example, the *Perspective_on* relation provides two different perspectives on the non-lexical (with no frame-evoking lexical units) OBLIGATION_SCENARIO frame. The one offered by the BEING_OBLIGATED frame represents an obligation situation focusing on the 'Responsible_party' which is required to perform some 'Duty'. The following examples have been selected from Italian legislations on "car taxation"[10]:

> [gli autoveicoli adibiti al trasporto del latte, delle carni macellate fresche, delle immondizie e spazzature, ... RESPONSIBLE_PARTY] **sono soggetti** [al pagamento della tassa sulla portata, ridotta del 50% DUTY] (art. 22. legge 21 maggio 1955, *n.* 463) (lit. [vehicles

[10] In these and in the following examples the frame-evoking Lexical Unit is in bold type; the textual span instantiating the Frame Elements is in square brackets and the names of Frame Elements are in capital letter.

used to the transport of milk, of fresh slaughtered meats, of garbage and rubbish,....**are subject** [to the payment of carrying capacity tax, reduced by 50% DUTY])

The other perspective is offered by the the BEING_OBLIGATORY frame which conversely describes the situation from the 'Duty' point of view which needs to be fulfilled by a 'Responsible_party', as the following sentences exemplify:

[La tassa di circolazione regionale DUTY] **è dovuta** [in misura fissa CONDITION] [per anno solare TIME] (lit. [The local circulation tax DUTY] **is due** [in permanent measure CONDITION] [per calendar year TIME])

The *Causative_of* relation by linking the IMPOSING_OBLIGATION and the BEING_OBLIGATED frame puts the focus on the situation offered by the IMPOSING_OBLIGATION Frame where an 'Obligator' imposes on a 'Responsible_party' a 'Duty', according to a 'Principle' which regulates how the 'Responsible_party' should respond to a 'Situation', as the following sentences show:

Visto [l'articolo 8 della legge regionale 23 settembre 2003, n. 23, "Disposizioni in materia di tasse automobilistiche" PRINCIPLE_ANT], [il quale PRINCIPLE_REL] **dispone** [l'assoggettamento alla tassa di circolazione DUTY] [per le autovetture ed i motoveicoli che abbiano compiuto 30 anni dalla costruzione RESPONSIBLE_PARTY] (lit. Considering [article 8 of Regional Law No. 23 of 23rd September 2003, "Provisions on car tax" PRINCIPLE_ANT], [which PRINCIPLE_REL] **provides** [the subjugation to the circulation tax DUTY] [for whatever concerns vehicles and motorcycles that have reached 30 years from their date of construction RESPONSIBLE_PARTY)

Fig. 2. Some of the FE-to-FE relations.

Fig.2 shows how FE to FE relations allow the exploitation of shared Frame Elements, for instance, the *Causative_of* relation, which links the Super_frame IMPOSING_OBLIGATION and the Sub_frame BEING_OBLIGATED, results in a relationship between the 'Duty' imposed on a 'Responsible_party' within an IMPOSING_OBLIGATION situation and the 'Duty' which the 'Responsible_party' must perform within the BEING_OBLIGATED situation. It should be noted that the *Causative_of* relation is conceptually close to the domain-oriented (ontological) relationship between public bodies and citizens, as shown in sect. 4. Namely, similar to the fact that when a 'Principle' *imposes an obligation* on a 'Responsible_party' he/she is *obligated* to perform an action, when a public body *imposes* a duty on citizens they are *obligated* to perform such a duty.

3.3 The ontological representation of deontic concepts

The mapping between the lexical meaning of norms, structured according to the frame-based model, and the conceptual content is realized by means of existing legal ontologies. A variety of core legal

ontologies is already available in the literature. Among them, we mainly refer to the CLO ontology [Gangemi et al. 2005], an extension of the DOLCE foundational ontology [www.loa-cnr.it/DOLCE.html]. In CLO norms are Descriptions, intensional specifications of ideal states of affairs represented in the same domain as their extensional realisations (Situation); a situation (a legal fact) is compliant with the legal perspective (or *ontological commitment*) when a set of entities participating in the fact can be classified according to the set of concept in a legal description. The Fundamental Legal Concepts (*right, obligation, power, liability*, etc...) are the reification of deontically qualified descriptions of facts. It is therefore possible to define in details the components of typical pattern representing the relation between norm and state of affair in the world [Gangemi 2007] : "The Norm$Case CODeP: norms use tasks, roles, and parameters; legal cases conform to norms when actions, objects and values are classified by tasks, roles, and parameters respectively. Moreover, relations between legal roles, tasks and parameters correspond to relations between objects, actions and values. For example, an obligation for a role towards a task should correspond to a participation of an agent (object) in an action; a spatial parameter that is requisite for an object should correspond to an exact location of an object in a spatial value region that is classified by that parameter...".

4 THE DEONTIC CHARACTERISATION OF SERVICE PROVISION

In this section we give a first insight of a practical application of the abstract model presented above. Our intuition is that , while citizens, are mainly interested in knowing their direct duties and rights, the representation of normative positions of public administrations in service providing requires more complex notions. The ontological representation of service processes has been elsewhere proposed [Schild 2007] for evaluating the process compliance with quality standards; our aim is quite different, as our intent is to qualify the deontic position of agents and activities involved in the execution of a (public) service. In the ontological characterisation of services, as reported in [Ferrario et al. 2010] "at the core of any service there is a *commitment* situation in which (the *service provider*) guarantees the execution of some kind of *action(s)* in the interest of somebody who agrees (the *service customer*), at a certain cost and in a certain way. This action is executed by the *service producer,* who may coincide with the *service provider*, may be somebody else delegated by the service provider, or even coincide with the service customer [...] service commitment needs to be distinguished from *service content,* which concerns the kind of action(s) the provider commits to guarantee, and service process, which is a set of business processes implementing the service commitment".

In the classification of services, there is an important distinction between public and private services, which is connected to the delegation of the commitment situation and to the transferability of responsibility in performing the services. This is related to the understanding of services as comprising different levels of responsibility. On the one hand, the obligation of guaranteeing the delivery of the service exists; on the other, the obligation of actually delivering the service by performing a set of actions exists. The difference between public and private services lies on the fact that whereas in the case of private services both obligations are transferable, in the case of public services they are not. The public administration committed to guaranteeing a certain service will always maintain the responsibility of ensuring the delivery of that service towards the citizen (and could be held liable when it was not delivered), even in the case it has delegated the actual delivery of services (actual production of the service) to a third party. Thus, we assume that, in public services, the commitment situation is the expression of a public function, i.e., both the obligation of public bodies to guarantee the service (for instance, to ensure that tax payers perform their duty) in the general interest of citizen, and their related power to enact norms on which the obligation is grounded (as already pointed out, note the similarity with the *causative_of* relation that in Framenet links Imposing_Obligation with Being_obligated).

Therefore, the ontological representation of the *commitment situation* must be expressed in the domain of public services by the formalisation of the notion of public function [Agnoloni et al. 2010]. Since public function (for instance, tax payment) must be performed for the benefit of citizens, the formalisation in terms of power and obligation can be reformulated according to the formalisation of

other-directed obligations suggested by [Sartor 2006]: Obl^{k} $Does_{j}$ A (it is obligatory toward *k*, that *j does* A).

$O_{State}^{[citizens]}$ [Brings ($Obl_{citizens}$(pay.taxes))] Obligation of the S*tate*, in *the interest of citizens*, of creating norms that obligate payment of taxes;

$O_{State}^{[citizens]}$ [Brings ($pay.taxes_{citizens}$)] Obligation, *in the interest of citizens*, of ensuring that taxes are paid;

In the case study concerned with the car taxation, the fiscal function can be translated into an obligation of the State of imposing the obligation of paying taxes on those persons who own a car:

$O_{state}^{[citizens]}$ [Brings ($(owns.car_{x}) \rightarrow Obl\ (pay.taxes_{x})$] Obligation of the State, in the interest of citizens, of bringing about the state of affairs in the world in which if a citizen *x* owns a car, then citizen *x* is obliged to pay taxes;

Moving from the formal specification to the ontological connotation, the *public service scenario* seems to be composed of :

1. a set of agents, playing *legal roles*: in the taxation scenario, citizens are at the same time service customer and tax-payer; public bodies are both agents empowered to impose obligations and service providers committed to ensure that the obligations are fulfilled
2. the class *Action* in the ontology subsumes not only the *service content,* i.e., the set of activities performed in order to execute the service, (e.g., charging, controlling, sanctioning, etc.), but all actions due to fulfil thee obligations: due to the well known limited expressiveness of Description Logic, the operator Bring(Z) is represented by introducing a CoercitiveAction class that reifies such a relationship. The notion of Power and Obligation of a PublicBody can then be expressed through binary relations hasPowerOver and hasObligationTowards some CoercitiveAction of which ObligationToPay is a subclass. In a similar way, the ObligationToPay class reifies the complex relation of Obligation for Citizens to PayTaxes by putting in relation the corresponding classes Citizen and TaxPayment. A fragment of the ontology is reported in Figure 3.

Fig. 3. 'Public function' ontology

4.1 Linking a FrameNet-style knowledge description with the corresponding ontological characterisation

Now we are able to test whether the two models, the formal specification of public function and the related ontology, on one side, and the textual content represented in a FrameNet-style description, on the other, can be mapped.

In fact, it is possible to map each Frame Element, belonging to a given Frame and instantiated in a given sentence, to the corresponding class of the provided ontology. For example, given the following sentence, i.e., "Citizens are **obligated** to pay taxes", evoked by the (*are*) **obligated** Lexical Unit, the FE "Responsible_party" (i.e., *citizens*) belonging to the BEING_OBLIGATED frame can be mapped to the "LegalRole" class and, the "Duty" (*pay taxes*) can be mapped to the "Action" class.

Interestingly enough, the example provided in Figure 4 shows a potentiality of our approach. The FN-style knowledge organisation allows us to consider the basic 'obligation' normative position from a number of different points of view. Accordingly, it should be noted that even though the two considered sentences (i.e., "Citizens are **obligated** to pay taxes" and "Article 18 **provides subjection** to the payment of circulation tax by owners of vehicles") respectively evoke two different frames, i.e., the BEING_OBLIGATED and the IMPOSING_OBLIGATION frame, their Frame Elements can be both mapped to the same corresponding class in the ontology. Thus, both the "Responsible_party" belonging to the BEING_OBLIGATED frame (i.e., *citizens*) and the "Responsible_party" belonging to the IMPOSING_OBLIGATION frame (i.e., *owners of vehicles*) are mapped to the same "LegalRole" class.

Moreover, we foresaw a second level of mapping. It concerns the linking of the lexical filler which instantiates a given Frame Element with a sub-class of the ontology. As shown in Figure 4, the lexical filler *citizens* of the Frame Element "Responsible_party" is mapped to the "Citizen" sub-class of the "LegalRole" class; and, *pay taxes* instantiation of the FE "Duty" is mapped to "TaxPayment" sub-class of the "Action" class.

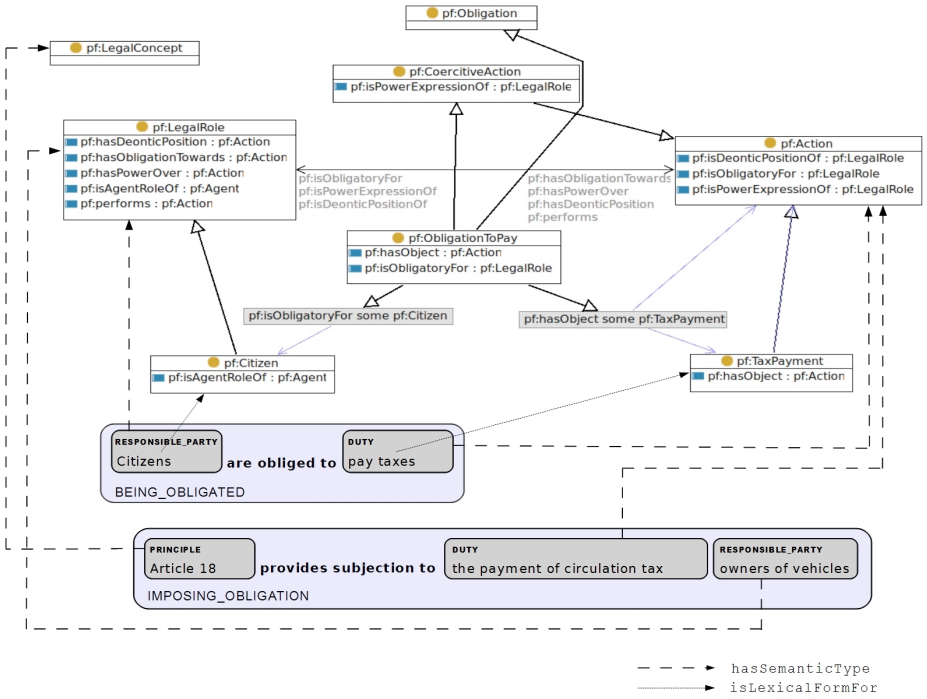

Fig. 4. Mapping Frame Elements to ontology classes.

5 CONCLUSION AND FUTURE WORK: ASSESSING NORMATIVE COMPLIANCE IN SERVICE PROCESSES

In the same way in which we are able to model the service process according to duties to be performed by public bodies and duties/rights to be fulfilled by citizens, we foreseen a further, more sophisticated application of the model for assessing the normative compliance of the process itself. Assessing normative compliance means "ensuring that business operations, processes, and practices are in accordance with a given prescriptive (often legal) document "[Governatori 2009]; more formally, normative compliance can be modelled as a relationships between two formal specifications: the design of a business process model (BPM), modelled as a set of tasks to be executed to fulfil some objectives, structured according to dependency relations; and a set of formal rules, that provide the description of a set of ideal states aimed at achieving a (legally valid) effect.

Beside the adoption of proper languages, standard and inference rules, the overall architecture requires a methodology for model checking. Alignment of formal specifications for business processes and the rule-based representation of the prescriptive content of legal documents should be based on some kind of mapping assumptions, should be mediated by a lexical layer and by a reference ontology, which provide the vocabulary for formalising rules from normative texts and for naming (and describing) the steps in the process.

In this framework, the research presented in this article can provide a semantic model able to mediate between the two representations. At a very preliminary stage, we can assume a mapping process based on a sequence of steps, as:

1 frame detection from normative statements, based on the set of Lexical Units evoking the obligation scenario;

2 classification of text spans according to Frame Elements;

3 population of the ontological classes (Actions, Agents and Roles);

4 instantiation of rules arguments ;

5 mapping instances of Actions and Agents (roles) with the names of states and participants in the Business model.

Practical experimentation of the methodology will be the object of the future development of the project.

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