A Critical Analysis of Legal Requirements Engineering from the Perspective of Legal Practice

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***Abstract*—This paper reviews existing approaches to representing legal knowledge for legal requirements engineering. Legal requirement methodologies are rarely developed together with legal practitioners, with the result that often approaches are based on a simplified view of law which prevents their acceptance by legal practitioners. In this paper, we analyse how legal practitioners build legal knowledge and possibilities for existing approaches in RELaw to mirror legal practice.**

***Index Terms*—Requirements Engineering; Legal Compliance; Comparative Law**

I. Introduction

Computer Science has many different disciplines, with different aims and methodologies. Many disciplines share the need to develop technologies and deliver applications where the law has an impact on what they should and shouldn't do in content and presentation. It often becomes necessary to codify norms in computable form relevant to software and the application domains, so that new generation IT systems can comply with norms in an automated or semi-automated way. Explicit computational representation of norms has been developed for requirements engineering, compliance management, privacy enforcing systems, e-business based on e-contracts, Intellectual Property Rights management of online multimedia contents, licensing audiovisual materials, multi-agent systems, open linked data, ownership of data and service level agreements on the cloud, among others.

The importance of legal compliance is acknowledged more and more in Requirements Engineering (RE), as attested by many recent papers such as Ghavanati et al. [15] , Siena et al. [33], Gordon et al. [18], and the success of the RELaw (Requirements Engineering and Law) workshop[1].

Massey et al. [25] state that legal requirements engineering developed as a distinct research area for the following reasons:

- Compliance improves when legal requirements are handled alongside other requirements in software engineering, and where legal requirements are closely mapped to governing legal texts. Moreover, traceability is essential to establishing legal due diligence.
- Standard RE techniques such as Use Cases provide insufficient context to adequately capture and prioritize legal requirements. Even sophisticated testing techniques cannot detect legal conflicts and ambiguities.

Our brief survey of approaches to legal requirements engineering (see Section III) found the following common features:

- A modelling methodology whereby a modelling expert is required to extract requirements from legal texts and model them in the representation language. Pattern-based knowledge extraction is carried out manually or with some technological assistance. The modelling is carried out manually by a modelling expert.
- A modelling language to represent legal requirements. The representation languages are intended to verify compliance of the system, to identify conflicting requirements, and to prioritize legal requirements.

Despite many progresses and innovations, the community has identified a number of unresolved issues:

- A legal modelling expert needs to be very familiar with the law to produce accurate legal models (Maxwell et al. [27]).
- The dynamism of law necessitates continuous adaptation of modelled legal requirements (Gordon et al. [18]). To ensure traceability and adaptability, RE systems must consider the evolution of norms and concepts depending on changes to the legal source.
- Formal models often fail to resolve ambiguities in natural language representations and simply result in unambiguously wrong specifications (Kamsties et al. [21]).
- While the RE community acknowledges that legal interpretation is a fundamental part of legal practice, this issue remains confined to future work sections, even in the most recent literature (Breaux et al. [7]). Laws portray exemplary cases and do not have the ambition

[1] http://gaius.isri.cmu.edu/relaw/2013/index.html

of covering all possible future situations, which though they may be unforseen, still need to be covered by the Law. Lawyers have to interpret the law to adapt to new situations, in accordance with the goals the legislation was developed to achieve. In this context, ambiguity is not always regarded as a problem in legal practice.

In addition to the above open questions and problems, there are more fundamental problems raised by legal practitioners when presented with existing solutions in RE.

- Most approaches have a "textualist"[2] view of the law: they identify norms with single statements in a single regulation. Each article is assumed to contain one self-contained norm. There is some recognition of the holistic nature of law, where meaning emerges from a network of legal texts as the authors recognize exceptions and refinement relations via cross-references [6]. However, norms arise not only from one piece of legislation but from multiple sources: regulations, case law, doctrinal work and unofficially judicial practice. Extracting norms from texts and tracing them back to their sources, while useful, is not enough.
- Formal approaches, even if they could allow consistency checking and automated reasoning between different requirements, fall short of being acceptable to legal practitioners, because they poorly reflect the dynamics of legal reasoning in practice, which uses all the richness of natural language.
- Different approaches in RE use different (often conflicting) classifications of basic deontic modalities. These classifications range from simple obligations and rights (Siena et al. [33]) to the famous Hohfeldian [35] modalities in Ghavanati [13]. The meaning of these modalities vary with different authors. The variability in the formal use of deontic terms reflects the variability in the use of these terms in legal texts (as pointed out by Hohfeld [35]), rather than solving the ambiguities. Another problem is that the classifications are usually incomplete; for example the notion of legal power is frequently ignored in the RE literature and misclassified as right or permission.
- The RE community fail to include efforts carried on in other communities such as Deontic Logic (Gabbay et al. [12]) or AI&Law who have modelling legal knowledge and legal reasoning at their core, with few exceptions such as Siena et al. [33]. Of course, such fragmentation is frequent in Computer Science and there are other communities such as privacy and compliance that are also concerned with legal issues and are self-referential in finding solutions. In the case of the RE community, the reluctance may be partly explained by their notable advancements compared to other areas, including AI&Law, due to their concern with practical needs. Innovative and useful technologies from the RE community include prioritisation of legal requirements (Massey et al. [26]), identifying and resolving conflicts (Maxwell et al. [28]), and text mining of policy documents (Massey et al. [24]).
- More worrying, perhaps, is that in most papers the role of Law is addressed without the involvement of legal practitioners, resulting in naive views of the Law. This make the resulting systems difficult for legal practitioners to accept and use in evidence in case of dispute about the compliance of software.

[2]http://yalelawjournal.org/the-yale-law-journal-pocket-part/legislation/judges-in-jeopardy!:-could-ibm%E2%80%99s-watson-beat-courts-at-their-own-game?/

The fragmentation in branches of computer science and the technological gap in handling the dynamics presented by legal frameworks is indicative of an IT-Law misalignment. While requirements engineers may not be called upon to directly provide interpretation of the laws they model, their interpretation impacts heavily on how software are designed to be compliant with the law. In the long term, it is not sufficient to simply consult lawyers intermittently during the extraction and formalization of requirements. In the long term, we need both engineers and lawyers to evolve into Legal Knowledge Engineers who are able to understand the dynamic functionalities of legal requirements and their formalization. The same can be said of compliance officers who are currently predominantly lawyers. We need a harmonizing methodology grounded in the reality of a juristic conceptualization of the law that a) promotes a sufficient level of acceptability among legal practitioners to facilitate relevant applications that would transfer academic research to legal industry and b) promotes dialogue to enable IT professionals to appreciate the complexities of the judicial process.

In this paper we address the above issues with the following research questions:

- What is the methodology employed by legal practitioners to build legal knowledge?
- How do existing approaches in RELaw comply with this methodology?

II. Representing Norms

Most technologies for representing norms are based on identifying norms from legislative text and representing them as formal rules. State-of-the-art systems have sophisticated rule reasoning systems with priorities, exceptions, etc. Such technologies are viewed with disinterest and scepticism by legal practitioners, both for their relative simplicity and, above all, for being distant from legal professionals' view of the law. The problem is that these Computer Science technologies for the Law are based on a formalist assumption of Law that was abandoned by legal philosophers and practitioners more than 50 years ago. Contemporary legal practitioners believe that norms are more than the text of legislation. Norms are living entities that emerge from a plurality of sources and adapt continuously, not only to legislative changes, but also to the way in which they are interpreted in different contexts by judges and legal scholars. Their meanings are sometimes different to that originally intended, due to social, cultural and technical changes. Mutual misunderstanding between the Law and Computer Science disciplines has resulted in missed

opportunities to develop systems to support legal practitioners' work. The head of the CODEX centre for Legal Informatics in Stanford, a leading figure in this field, admits in his manifesto on Computational law states that, despite many years of research, "these ideas have not achieved their full potential' (Love & Genesereth [22]).

The rule-based view at the heart of existing methodologies for computational law rests on the following assumptions:

1) The law consists of rules.
2) Legal rules can be meaningful and coherent.
3) Legal rules can be applied to particular facts.
4) Some actions accord with meaningful legal rules; other actions do not.

These assumptions originate from legal philosophers who sought to give a theoretical foundation to Law. The law in practice is a different story.

Comparative law has emerged as a thorough approach to investigating and describing laws and legal systems and how legal concepts interact with the social and political environment. The resulting analysis helps explain the meaning of legal terms as used by practitioners. One of the most influential comparative lawyers is Rodolfo Sacco. Starting from the premise that norms are not "legal flowers without stem or root" (Sacco [32], page 27), he identified key factors that influence how laws are interpreted in different jurisdictions.

First, all legal systems have several legal formants, otherwise known as sources of law - codes and statutes, judicial decisions, legal scholarship and political ideologies.

> "The civil lawyer may say that this rule comes, in principle, from the code; the common lawyer may say it comes from a particular statute or from judicial decisions; and yet they both will learn their law initially from the books of legal scholars."
> (Ibid., page 22)

The importance of these legal formants vary considerably in different jurisdictions and different areas of law - case law is more important in France than in Italy, some areas of English law are subject to more statutes than others - although all these legal formants have some influence, whatever the official model of the law might say. The existence of multiple legal formants creates uncertainty, since they are rarely in complete harmony on a point of law. And yet, this does not usually stop the law from functioning. Sacco cites as an example article 39 of the Italian Constitution, which states that "duly registered trade unions. . . may. . . enter into collective labor agreements which are binding upon all". Since there is no legally valid mechanism for trade unions to register, collective labour agreements should not be binding according to the Constitution. Nevertheless, the courts have consistently enforced such agreements, which leads to the conclusion that in Italy, while judicial cases may not be binding on subsequent cases, they can nevertheless have a powerful influence, even though they are not officially a source of law at all.

Legal interpretation is not just influenced by legal formants, but also also invisible factors such as the beliefs or mentality of the interpreters, their social and cultural background. Such factors rarely need to be articulated in a mono-culture. Sacco calls these factors *cryptotypes*. Comparative law helps reveal hidden cryptotypes when a seemingly equivalent rule is interpreted in different ways in different legal jurisdictions, or when an implicit rule is made explicit in another legal system. Sacco cites as an example the issue of whether an heir can transfer property before possessing it. Belgian interpreters of the Civil Code have deemed such transfers invalid, but the French have upheld them. The discrepancy is explained by the fact that while the Code itself does not support such transfers, the old Roman law did, and the custom carried over into French law. A similar situation happened in Italy with the introduction of a new Civil Code in 1942. Legal scholars interpreted the law in accordance with the earlier doctrines of German Pandettists (who in turn always sought to interpret modern laws in accordance with the old Roman laws of Justinian [3]), convinced that the code was incomprehensible otherwise (Ibid., page 345).

Sacco noted that it is quite common to find that not all legal rules are fully articulated. A synecdoche occurs when only part of a phenomenon is indicated when referring to the whole. He gives the example that the legal definition of contract in French law refers to the will of the parties without mentioning the need for the will to be declared or that there needs to be a good reason for the parties to declare their will and for the law to respect it. Filling in the gaps requires knowledge of the legal culture and custom. Unwritten rules are passed on from one generation of jurists to another. Although Sacco claims that identification of legal formants, cryptotypes, synecdoche and connotation were found "almost as a by-product" (Ibid., page 388) in comparing different legal systems, this has led to more profound understanding of how the law functions than the legal philosophies of Kelsen, Hohfeld and others. The reason is that limiting the study of law to a single legal system leads one to ignore features that appear to be too 'obvious' to mention. Such features are not necessarily 'obvious' or common to all legal systems, and their discovery uncovers the unwritten rules and values that underpin the law in different legal systems. The comparative approach can go beyond the letter of the law to find its true meaning:

> "An abstract idea finds concrete expression in a given legal language much as, in biology, a genotype or distinctive set of genes is expressed in the phenotype or outward form of a plant or animal. The jurist of an individual country studies the phenotype. The comparativist must study the genotype of which it is the expression." (Ibid., pages 16-17)

Another important contribution of comparative law is the exploration of the interplay between legal formants, and the

[3] In the nineteenth century, the German Pandettist school sought to create and adapt new norms in response to changing times, or fill the gaps where none existed, in a way that was logically consistent with Justinian's Civil Code, something that Sacco attributed to the 'the medieval cult of Roman law, that the Corpus emphiuris civilis was compiled by a sort of divine mandate' (Ibid., page 346).

awareness that while the law constantly evolves, legal formants rarely move together in sync, so that conflicting valid interpretations are inevitable (Ibid., page 394).

III. Critical Survey of Existing approaches to RELaw

An exhaustive survey of existing approaches to RELaw is beyond the scope and purpose of this paper. Below we mention well-known systems that have been mentioned in the systematic review of Ghanavati et al. [16], Otto & Antón [29], and Clevan & Winter [8].

One of the most influential approaches is that of Breaux [5], with subsequent developments including Breaux &Antón [6], Gordon & Breaux [17], Gordon & Breaux [18], Breaux & Gordon [7] among others. In Breaux & Antón [6], the authors aim to ensure that the security and privacy requirements of relevant software systems are aligned with regulations. For the authors, "these regulations describe stakeholder rules, called rights and obligations, in complex and sometimes ambiguous legal language. These 'rules' are often precursors to software requirements that must undergo considerable refinement and analysis before they become implementable." To support the software engineering effort of deriving security requirements from regulations, they present a methodology for directly extracting access rights and obligations from the text of regulation:

> "The methodology requires the requirements engineer to analyze each statement in a regulation text and identify the statement as a definition, right, obligation, or constraint." (Breaux & Antón [6])
>
> "FBRAM [methodology] ensures that engineers trace relevant words and phrases from their exact position in the legal text to an unambiguous role in a formal requirement specification...models should syntactically and semantically explicate ambiguity and models should encode cross-references and support their use in resolving exceptions ... Legal models should match the language and structure of legal documents: models should map between logical propositions and corresponding paragraphs in the law..."(Breaux [5])

The textualism is clearly evident - norms (modelled in logical form), are extracted from and connected to a single part of text. The multiplicity of sources is ignored. Links among legal texts are considered only in the case of exceptions.

The authors identify two kinds of deontic modalities:

> "A right is a statement about one or more actions that a stakeholder is permitted to perform. If a stakeholder is expressly not obliged to perform an action, called an antiobligation, then this statement also describes a right. An obligation is a statement about one or more actions that a stakeholder is required to perform. If a stakeholder is expressly not permitted to perform an action, called a refrainment, then this statement also describes an obligation."

This quotation shows that deontic modalities are limited to two. Instead of using the less ambiguous term "permission", the term "right" is preferred, despite Hohfeld [35] famously highlighting the risk of ambiguity one century ago. The terms "antiobligation" and "refrainment" are alien to legal practice. The purported equivalence between permission and absence of obligation has been widely criticized e,g, Boella & van der Torre [4] Another problem, as mentioned in the introduction, is that the notion of power is ignored altogether.

A literal reading of legal text combined with the use of the ambiguous term right can lead to crucial errors such as mistaking lack of power for permission. The text below is saying (in a complicated way) that consent from CE (covered entity) is not required for a restriction to apply in HIPAA privacy regulation. It is talking about the unconditionality of the power of restriction of another agent with respect to the consent of the CE:

> Privacy Rule x164.522(a)(1)(i)-(iii) (ii) A CE is not required to agree to a restriction (R stands for right).

Instead, the authors interpret this text as CE having a right, i.e., a permission:

> R2. A CE is not required to agree to a restriction (x164.522(a)(1)(ii)). (Breaux & Antón [6])

This model is elaborated upon in recent papers. Gordon & Breaux [18] present the Legal Requirements Coverage Model, a preliminary framework for requirements engineers and their legal teams to identify relevant legal requirements and trace changes in requirements coverage. The goal is to provide a repeatable model that IT developers can apply to cope with legal evolution on their system, particularly how to determine relevant legal requirements and when to review a system's compliance. Their methodology determines which conditions determine which portion of the law covers the IT system and which requirements apply. Together with legal counsel, an analyst determines "coverage" i.e. whether a legal requirement covers an organization. This is true when the assertions made by the analyst satisfy the preconditions for a particular requirement. The work is limited to determining the applicable law to improve regulatory harmony while leaving open the best ways to translate legal requirements into software requirements and specifications. Nevertheless, some legal interpretation takes place when mapping legal constraints onto software requirements. The analyst translates a regulatory text into Legal Requirements Specification Language (LRSL), generates logical expressions from the LRSL-encoded law, and applies the coverage model by making assertions about the logical expressions. The analyst extracts requirements into the LRSL using previously validated heuristics. They also apply previously validated extraction patterns to balance rights and obligations and re-topicalize statements from different actor viewpoints. Re-topicalisation means changing either the subject, word or phrase to be the topic of a sentence typically by placing it first. For example, re-topicalising the subject in a stipulation granting rights to one party helps to reveal the obligations or duties of another party. This methodology

does not consider that other interpretive sources may impinge on the accuracy of predetermined heuristics. Moreover, re-topicalizing statements to derive other actor viewpoints is a one-to-one mapping and therefore insufficient.

More formal approaches to modelling the law aspire to model both the applicability and satisfiability of norms. In this regard, Ingolfo et al. [20] extend their previous work on the Nomos 2 framework for representing legal knowledge in requirements engineering, to 1) include antecedents and consequents of clauses in models of law, and 2) use this information to evaluate the applicability and satisfiability of clauses for given sets of requirements, and thereby the compliance of these requirements. They subsequently present a syntax for modelling preconditions and post-conditions of legal norms and their relationships into early representations of the requirements problem and solution space. They describe how to traverse norm models to evaluate the applicability and satisfiabilty of norms for given sets of requirements, and thereby the compliance of these requirements. This shows a limited understanding of the law as it does not consider the role of interpretation in its models. Although the model adopts ontologies to specialise norm concepts, they only assume two specializations from the ontology i.e. a duty and a right.

Finally, we consider increasingly popular goal-oriented for modelling legal requirements or building compliance frameworks. Ghavanati et al. [14], [13] extend their goal-oriented compliance model with a systematic approach coupled with tool support for: managing compliance; identifying relevant regulations and consequently extracting legal requirements; analysing, resolving and prioritizing potential instances of non-compliance; identifying and resolving conflicting goals between stakeholders and within legal documents; ensuring integration of relevant legal requirements to the business processes; resolving cross- references; and ensuring compliance with multiple regulations (national and international) at the same time. The result is a conceptual meta-model that extends User Requirements Notation (URN) to the legal domain i.e. Legal-URN that system engineers can systematically extract legal requirements from regulations. This methodology aims to bridge the gap between abstract norms and concrete business processes. URN is superior in this regard for it explicitly combines goals with scenarios in a single graphical language. The goals are modelled with the Goal Oriented Language (GRL) while Use Case Maps (UCM) are used to model the business processes. Despite being one of the most innovative models, with an explicit level to represent legal knowledge besides the proper legal requirements representation model (Legal GRL model), the approach also does not consider interpretative sources of law and thereby suffers from textualism as is prevalent in the RE literature in general.

IV. Related Work in AI & Law

The most similar systems in AI & Law are those that deal with compliance in a general sense. They suffer from the same problem of textualism, as well as an over-ambitious preoccupation with formal reasoning which ignores the issues of usability and multiple interpretations.

For example, Lu et al. [23] and El Kharbili et al. [9] sought to develop a notation to represent norms and annotate business process models. However, while technically sound, the labellings are difficult to create and the notation difficult to read for legally trained people. Moreover, BPMN-type process models are too general for use in legal settings.

There are software suites used by corporations and government agencies to handle knowledge management for complex administrative processes. Crucially, this approach is declarative rather than procedural: if-then rules specify what should be the case, not how it is to be achieved. The slogan is to ”separate the know (domain knowledge) from the flow (sequence of activities)” (van der Pol [34]). In practice, knowledge repositories get large and unwieldy, and people use the software to model specific business rules rather than generic legal knowledge.

The most comprehensive research project that we know of in this area is the COMPAS project, which aims to support the entire compliance life-cycle. Much of this work is inspired by the success of conformance checking: verifying whether a business process description conforms to some specific set of compliance requirements (Rozinat and van der Aalst [31]). The COMPAS project architecture maintains a Compliance Requirements Repository, separate from the rules that implement them, but the project does not state how this repository should be filled.

Carneades, combining ontologies and rules, studies open source compatibility issues (Gordon [19]). The LKIF ontology set out to model basic concepts of law identified by citizens, legal professionals and legal scholars is with a reasoning mechanism. However, the system finds its limits on EU Directive 2006/126 on driving licences, a relatively straightforward regulation. One of the biggest challenge for creating ontologies for machine reasoning, as opposed to merely for human understanding, is the sheer amount of basic knowledge and inter- connections a machine needs to be provided with.

Francesconi [11] presents an RDF/OWL implementation of Hohfeldian representations of legal provisions to aid information retrieval and automated reasoning. The work is based on semantic web formalism, which are difficult for legal and business practitioners to understand.

None of the above systems caters adequately for the ever-changing nature of the law, which can result in unwieldy rules models. Norms and the interpretation of norms need to have a status, active or inactive, and to be linked to explanations and sources for clarification as needed. By focussing more on AI than law, the systems developed are unusable to legal practitioners, which is problem given the dynamic nature of the law, and the need for continuous input from legal experts if the systems are to maintain the required level of accuracy.

V. The Way Forward

There is no lack of awareness of the problems of legal analysis in the RE community. Breaux and Antón [6] noted the problems of legal terminology:

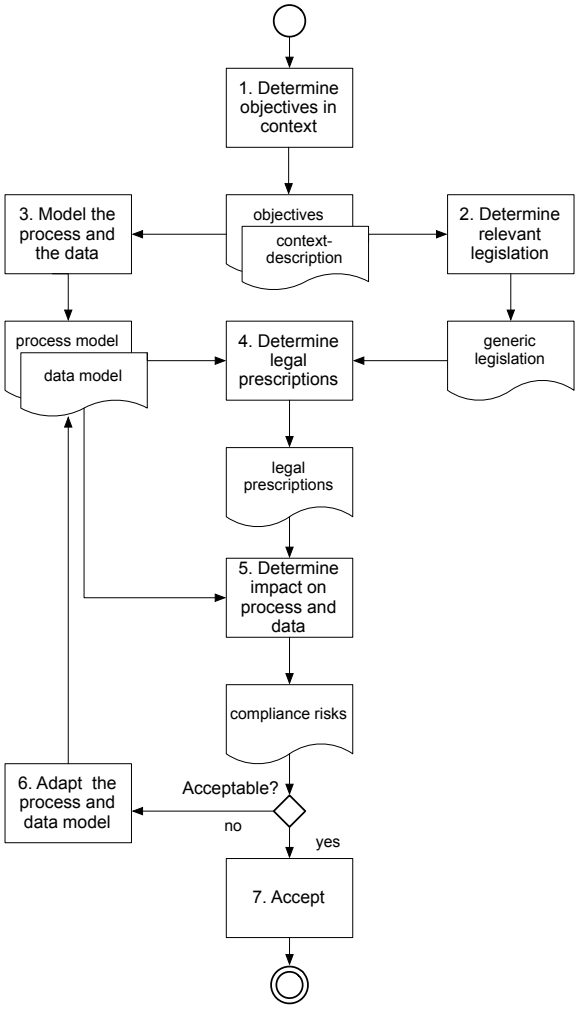

Fig. 1. Business Process Workflow for Regulatory Compliance

> 'Definitions in the US federal and state regulations define terms by enumerating their specializations, which are additional terms that correctly exemplify a concept, or by elaborating the concept]s role in relevant activities. Legal professionals refer to these concept terms as a term of art, defined as "a word or phrase that has a specific precise meaning in a given specialty, apart from its general meaning in ordinary contexts." '

Maxwell et al. [28] recognise the importance of case law, and the interpretation of legal rules by the courts and that cross-references requires time reading and understanding legal texts, before one can begin extracting key concepts or applying the regulations to system design. Siena et al. [33] have acknowledged that legal knowledge does not exist in the void and must be interpreted in the context of the business application. Kamsties et al. [21] denote the perils of using formal methods to remove ambiguities from natural language representations noting that they often simply results in an unambiguously wrong specification. The problem is that RE research do not address these problems in their methodologies.

The first step to addressing this issue is to understand that legal RE in practice is a multi-disciplinary area, which needs dialogue between many experts. Boella et al. [2]'s adaptation of Fokkema et al. [10]'s workflow (see Figure 1) gives an idea of the type of regulatory conversations that need to take place in RE as well as for compliance in general, and the personnel who need to access legal and business information (Table I).

TABLE I
DISTRIBUTION OF TASKS IN FIGURE 1 OVER ROLES

	1.	2.	3.	4.	5.	6.	7.
Legal Office		✓		✓	✓		
Compliance Officer		✓		✓	✓		
BPM Expert			✓		✓	✓	
Operational Manager	✓		✓		✓	✓	
Executive Board	✓		✓		✓		✓

The second step is to increase awareness of the cultural gap between different experts, to facilitate clear communication in the legal RE process. To return to the issues mentioned in the introduction;

- **Legal formants**
  The analysis of what legal provisions mean for legal requirements engineering must be carried out by legal experts who must investigate not only legislation, the interaction between legislative provisions, but also case law, legal doctrine, and regulatory conversations. Less formal sources of law still need to be referenced to provide full traceability.
- **Cryptotypes, or the beliefs of the jurist**
  Legal experts need to explain the values and assumptions behind norms, where they are a given in the legal community, but not well-known in industry.
- **Synedochy, or rules which are not fully articulated**
  Legal experts should be aware that in RE, all requirements must be made explicit. As such, it is the job of the legal expert to supply any 'missing' rule which are commonly understood but not articulated.

Of course, such explanations may very well occur informally in conversations between software analysts and legal experts. What is needed, however, is for these insights to be recorded and shared and used to inform the legal software RE process. All this necessitates expert tool support. Recent years have seen the development of innovative leading systems from the AI & Law community which, even if they do not provide suitable support for compliance or an actual legal RE process, are worth investigating because they support the representation of legal requirements in a way that aligns with the methodology of legal practitioners. These systems have at their core what is arguably the most important contribution of AI & Law - legislative XML.

An interesting project that combines legislative XML, ontologies and formal reasoning is "Fill the gap" by Palmirani et al. [30]. This project proposes a platform where legal documents are modelled using XML standards and the ontology

layer is used as the interconnection technique between the pure text of the document and the embedded legal knowledge, including rules representing the norms expressed by the textual document. The ontology is used for modelling the legal concepts and to represent the properties and the T-Box axioms of the main legal values (e.g., copyright, work, etc.), including geo-spatial (e.g., jurisdiction) and legal temporal dimensions (e.g., enforceability, efficacy, applicability of the norms). The text, annotated in XML using the Akoma Ntoso standard, and the metadata are connected manually to the ontology framework and finally, the rules, formalized in defeasible logic, are connected to the textual provisions and to general and abstract legal concepts modelled in the legal ontology.

Eunomos is a Legal Knowledge and Document Management System for legal researchers and practitioners to manage knowledge about laws and legal concepts in different sectors and different jurisdictions (Boella et al. [1]). Laws are inserted in the database via a web interface or collected by means of web spiders from portals like Normattiva. They are converted into legislative XML, and references are extracted to build a network of links between norms that cite other norms. Each norm is classified semi-automatically, supported by specially trained tools suggesting appropriate categories. Finally, concepts are extracted directly from the text of the law and modelled using a sophisticated legal ontology tool called Legal Taxonomy Syllabus. Polysemy is a significant problem in legal terminology, because legal terms have significantly different meanings across jurisdictions, within contexts and over time. In Legal Taxonomy Syllabus, legislation-specific and generic definitions can co-exist, with generic definitions grouping legislative definitions together with doctrinal interpretation. Given the ever-evolving nature of legal concepts in an increasingly multi-jurisdictional legislative environment, different definitions are linked by relations such as substituted_by, or transposed_into, or group_by for generic definitions created by gathering together different definitions. While constitutive norms are used for definitions of legal concepts, prescriptive norms are represented in Eunomos as special composite concepts in the ontology called prescriptions with the following relations:

- Deontic clause: the type of prescription: obligation, prohibition, permission, power.
- Active role: the addressee of the norm (e.g., director, employee).
- Passive role: the beneficiary of the norm (e.g., customer).
- Relation with other norms: to express if the norm is an exception of another one.
- Description: a description of the norm in natural language.
- Conditions: a description of the applicability conditions in natural language.
- Crime: the type of crime resulting from violation of the prescription, often defined in other legislation such as the Penal Code.
- Sanction: the sanction resulting from violation (e.g., a fine of 1 quote, where *quote* is defined in other legislation).
- References: references in URN format linking to the sources of the norm, both regulations and case law.

Boella et al. [3] describes the integration of Eunomos with Legal-URN in order to allow thorough legal analysis and full traceability for RE. Further work is required to evaluate the effectiveness of this methodology.

VI. Conclusions

In this paper, we have contrasted the methodologies of extracting legal requirements in the RE community from legal practice as observed in comparative law. While many papers acknowledge the problem of ambiguity, cross-references and case law, few provide a mechanism for articulating the unwritten rules that influence legal reasoning. We propose that systems should enable dialogue between legal and industry experts, so that hidden assumptions can be made explicit, thereby enabling more informed judgments about legal requirements. We discuss legal and document management systems developed in AI & Law that, while lacking methodologies for RE, allow the exploration of multiple interpretations in terminology and norms. Boella et al. [3] is one attempt to integrate legal knowledge management and RE system to allow thorough legal analysis and full traceability for RE. Further work is required to evaluate the effectiveness of this methodology.

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