Integrating Legal-URN and Eunomos: Towards a Comprehensive Compliance Management Solution

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Abstract. Business process compliance with regulations has been a topic of many research areas in Computer Science such as Requirements Engineering (RE), Artificial Intelligence (AI), Logic and Natural Language Processing (NLP). This work aims to provide a systematic way of establishing and managing compliance to assist decision-making and reporting. Despite many notable advances, few systems deal adequately with legal interpretation and modeling norms in an expressive way that is well-integrated with business modeling practices. In this paper, we bring together two leading systems, LEGAL-URN and Eunomos, for a comprehensive compliance management solution.

Keywords: Compliance, Legal Interpretation, Requirements Engineering.

1 Introduction

Organizations are motivated to comply with legislation since failure to do so leads to undesirable consequences such as lawsuits, loss of reputation and financial penalties. With the rapid increase and evolution of regulations and policies relevant to business processes, it becomes difficult for organizations to constantly keep their goals, policies and business processes compliant with applicable legislation.

The legal documents that dictate how a corporation must behave are usually complex. This complexity originates from the cross-referential nature of legal documents; the inherent (some say intentional [28]) vagueness of legal documents to cover different scenarios; and the ever-changing nature of the law due

to legislative amendments and interpretation by other legal authorities. Applying generic laws to the business processes of different organizations is fraught with difficulties, creating the need to rely on expert advice from lawyers and regulators.

The dynamic nature of laws and business creates problems in large organizations, where different stakeholders may introduce goals that conflict with existing ones or with each other. These goals may even unknowingly conflict with the law. Consider also that being fully compliant with legislation may not be feasible or in the organization's best interests. In such cases, organizations may wish to consider alternative solutions based on top-level goals or strict literal reading and aim for minimum compliance with the law while accepting the penalty.

Much effort has been invested in Computer Science to solve some of the issues mentioned, specifically in Requirements Engineering (RE), Artificial Intelligence (AI), Logic and Natural Language Processing (NLP). Two leading systems, from AI & Law and RE respectively, are Eunomos [9] and LEGAL-URN [16]. Both are suitable for compliance monitoring, but each looks at the problem from a different perspective. Eunomos is a legal knowledge and document management system focused on identifying 1) norms 2) related norms 3) legislative modifications 4) different interpretations of the same norms. Menslegis[1], a commercial version of this system, is targeted towards the banking sector in Italy. LEGAL-URN enables business analysts or software engineers to factor in legal requirements as part of their strategic planning by modeling legal norms in the same way as goal and business process management notations, albeit with deontic extensions. LEGAL-URN has been tested in the healthcare domain in Ontario, Canada by modeling four Ontario regulations for healthcare and analyzing the compliance of the business processes of a research hospital in Ontario to these regulations. The result of this case study has been published in [16] in detail.

This paper aims to analyze how to integrate the state of the art from AI & Law and RE for complete traceability from legal sources to business process models, representing regulatory conversations at each level, thereby allowing informed analysis and design of compliant business processes. The rest of the paper is as follows: Section 2 provides a background in contemporary issues in regulatory compliance. Section 3 introduces the case study, Section 4 describes Eunomos, Section 5 the URN-Framework, Section 6 how to integrate the two systems, Section 7 Related Work, and Conclusion ends the paper.

2   Regulatory Compliance

The law evolves with the involvement of different authorities. Organizations may take into account interpretations of legislation from many different sources - case law, subsidiary laws, ministerial decrees, government authority, legal scholars, self-regulatory bodies, industry bodies, internal regulator and external regulators. Stakeholders may use a variety of legal reasoning techniques, as identified by Bobbit [8] and described by Bartrum [5]: *Historical*, relying on the purpose

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[1] http://www.nomotika.it/EN/MensLegis/Flyer

behind the written law; *Textual*, relying on the actual text; *Structural*, taking into account relations between bodies issuing the law; *Doctrinal*, applying rules generated by precedent; *Ethical*, tied to the ethos of the community; and *Prudential*, aiming to avoid absurd outcomes.

The most important conversation [7] about regulatory compliance is between companies and external auditors. Interpretation of how norms apply takes place at two stages: first, by the auditee in designing business processes, and secondly, by the auditor when assessing the compliance. During the first stage, auditees sometimes do not initially have a clear view of what constitutes compliance to a particular norm, as the legal community works through the issues on a case-by-case basis. There are certain areas, such as IT security, where there is high mutual trust and transparency between auditors and auditees, so that an honest dialogue can take place about proper interpretation [11]. Case studies in the financial sector have shown the importance of regulatory conversations to provide valid models agreed by all. These models can be used later to support decisions taken on operational aspects of compliant business systems [34].

Letterman [45] highlights the challenges of interpretation from a different angle, the trend towards laws that prescribe the achievement of goals while leaving it to the organization to concretize these goals into finer and more concrete goals and targets. Such concretization occurs in two stages, firstly, analysing abstract goals and subdividing them into their component parts, and secondly, development of criteria to indicate to what extent this goals should be realized. At all levels, the emphasis remains on what should be achieved rather than how it should be done.

Cunningham [13] argues that all laws contain a mixture of principle-based and rule-based legal provisions. Moreover, rule-like rules can be treated like principles or vice versa depending on their application and interaction with other provisions. Often, there are rules and principles about the same issues - this can, but does not necessarily, address the problem of legal loopholes.

3   Case Study

Our case study comes from the European Union's Markets in Financial Instruments Directive (MiFID). Among many articles subject to different interpretations is Article 13(6) of Directive 2004/39/EC which states: *"An investment firm shall arrange for records to be kept of all services and transactions undertaken by it which shall be sufficient to enable the competent authority to monitor compliance with the requirements under this Directive, and in particular to ascertain that the investment firm has complied with all obligations with respect to clients or potential clients."*

In a consultation paper [30], The Committee of European Securities Regulators (CESR) proposed that for the purpose of Implementing Directive 2006/73/EC, Article 51(3) (which concretised Article 13(6) of Directive 2004/39/EC), investment advice should be regarded as a type of financial service. The proposal received approval from consumer groups but was rejected by some banking organizations.

The European Savings and Retail Banking Group (ESBG) [23] complained that "It will be extremely difficult for entities to organize and keep records of this type, as the information to be included in such records may be provided through different channels which will be difficult to compile". It added that "If the relationship is ruled by an agreement, this agreement will be recorded in the clients agreements record, and therefore it will not be necessary to keep this additional record." In other words, no additional records should be taken. Regulators may refer to records on investment advice for trading "by agreement" (i.e. for a negotiated deal) as the advice will already be in the agreement. However, where advice is given merely regarding "what is on offer", the advice need not be recorded (presumably due to the extra workload and associated costs).

From a legal point of view, it is possible to argue either way. A teleological or principle-based interpretation would regard investment advice as services, even if financial organizations would not define it as such, to ensure effective compliance monitoring. A literal or rule-based interpretation would avoid its inclusion. Where legal uncertainty exists, organizations need a mechanism to analyze different interpretations in the context of their own business processes.

4 Eunomos

The Eunomos Legal Management System is a web-based interface for managing knowledge about laws and legal concepts in different sectors and different jurisdictions. Legislation from official web portals can be downloaded via web spiders or uploaded by a web interface to the Eunomos database, where they are then stored in legislative XML [2], making it easy to reference individual articles or paragraphs from the text of the law. References are extracted to build a network of internal and external citations. When viewing legislation, the Cosine Similarity technique is used to provide a sorted list of the most similar legislation in the database. This can be useful for finding legislations implicitly modified by later ones. Eunomos has an interface to make comments about legislation and all its paragraphs and articles. This feature is especially useful for annotating elements that have been implicitly modified. The system also includes an alert messaging system to identify knowledge engineers of new legislation, so that they can begin to analyze the impact of the legislative changes.

An important feature of Eunomos is its lightweight legal ontology. Specialist terms within legislation are hyperlinked to jurisdiction-specific multilingual ontologies based on European Legal Taxonomy Syllabus [35]. 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,

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[2] Currently in accordance with the Norme in Rete standard using the ITTIG CNR parser (http://www.ittig.cnr.it), with a view to developing an Akoma Ntoso parser (the emerging international standard) as part of the EU Cases project.

or `transposed_into`, or `group_by` for generic definitions created by gathering 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' ([9]) with the following relations:

– Deontic clause: obligation, prohibition, permission, exception.
– Active role: the addressee of the norm (e.g., director, employee).
– Passive role: the beneficiary of the norm (e.g., customer).
– Description: the prescription reworded as necessary to aid comprehension
– Norm Identifier: hyperlink to relevant provision in the source document
– Violation: the crime or tort resulting from violation (often defined in other legislation such as a Penal Code).
– Sanction: the sanction resulting from violation (e.g., a fine of 1 *quote*, where emphquote is defined in other legislation).

A similar mechanism to that described in Ajani et al. [1] for ontological terms is used to model change over time in Eunomos for prescriptions. Legislation is amended continually, and, thus, prescriptions need to be changed to align with the new text. The modification link is maintained in the Eunomos knowledge-base based on the identifiers of the NormaInRete standard.
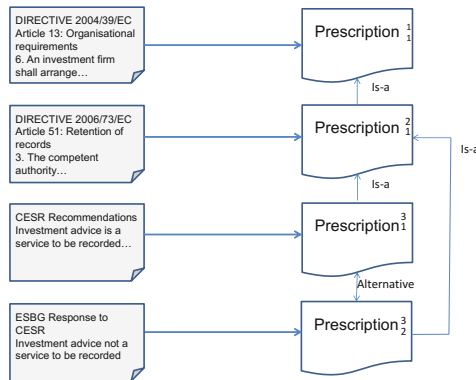

Fig. 1. Conceptual Model of Eunomos to Support Interpretation

The Eunomos system is a very rich legal knowledge management system that allows users to access laws and understand their meaning with user-friendly, well-structured ontologies. A key distinguishing aspect of Eunomos is that the premise that laws and legal terminology are inherently context-sensitive and replaceable is built into the system. However, the system addresses only the normative side. To better support compliance management, the natural next step is to map norms to business processes in an integrated environment.

Figure 1 illustrates how Eunomos relates regulations and prescriptions. Article 51(3) of Directive 2006/73/EC is interpreted in more than one way by CESR and ESBG: $Prescription_3^1$ and $Prescription_3^2$ respectively are alternative interpretations - as represented by the relation in the ontology. Although Eunomos is a lightweight ontology to be used by lawyers, and lacks formal semantics, the *alternative* relation is inspired from specifications hierarchies where specifications of a concept can be labeled as disjoint. Interpretations should be specified as being candidate or non-candidate, where in the latter case the company has determined that the interpretation is unlikely, undesirable or irrelevant. Graphically, this is represented by the dotted line. Where there are more than one candidate interpretations, this represents an area of possible conflict, which requires careful analysis and consultation with domain and legal experts to resolve.

5   The Legal-URN Framework

LEGAL-URN supports business process compliance by extending the model-based compliance framework ([17,18]) based on User Requirements Notation (URN) Language [25]. The LEGAL-URN framework has four layers for legal and organizational models, which are shown in the left-hand side of Figure 2:

1. **Official Source Documents** that define the legislation on one side and organizational structures, policies and processes on the other side.
2. **A Hohfeldian Model** which consists of a set of Hohfeldian statements [44] together with structured elements of legal statements.
3. **Goal Models** based on URN's Goal-oriented Requirement Language (GRL), which capture the objectives and requirements of both organization and legislation.
4. **Business Process Models** based on URN's Use Case Maps (UCM), which define the business processes that implement organizational policies on the one hand and represents steps mandated by legislation on the other hand.

Different pieces of the framework are connected with five types of links introduced by LEGAL-URN. To build this framework, first, the relevant regulations, organizational policies and procedures are identified manually. This step is usually done by the legal expert in the organization. Next, the Hohfeldian model for the legal documents is created. For this, first, each legal statement in each legal document is annotated with one of the Hohfeldian correlative classes of rights: *duty-claim*, *privilege-no-claim*, *power-liability*, or *immunity-disability* and next, the legal statement breaks into the elements as followed: Subject, Modal Verb, Clause, Precondition, Exception and Cross-references.

Although the Hohfeldian ontology is not without its critics, essentially based on redundancy ([24]) or lack of elegance for formal modeling ([39]), it is used in LEGAL-URN to help identify the type of modal verb, the type of the legal statement and the priorities between legal statements (through power or disability). The Hohfeldian model is broader than the Hohfeldian ontology with its
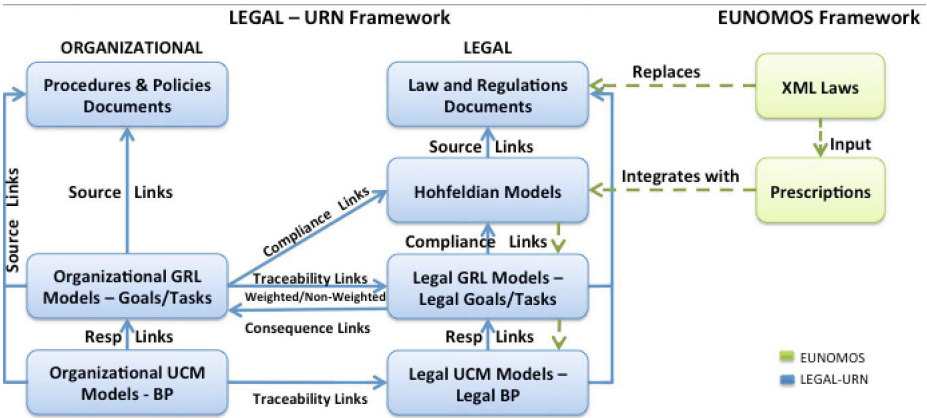
Fig. 2. LEGAL-URN Framework Overview and Eunomos Integration

additional elements introduced above. This layer provides the formalism to goal modeling in GRL and creating the legal extension of GRL called Legal - GRL. That is, subjects in the Hohfeldian model are mapped to Actors in Legal-GRL, clauses are mapped to softgoals, goals and tasks, modalities to permission and obligation stereotypes, and precondition, exception and cross-references are mapped to precondition, exception and cross-reference stereotypes in Legal-GRL. To build the Hohfeldian model, the following rules need to be considered:

- **Rule 1 -** Each legal statement shall be atomic. This means that each legal statement contains one <actor> (the subject), one <modal verb>, one to * <Clause> (<verb> & <actions>), 0 to * optional <crossreference>, 0 to * optional <precondition> and 0 to * optional <exception>.
- **Rule 2 -** If a legal statement contains more than one modal verb, it must be broken down into atomic statements.

In the next step, the Hofeldian classifications (i.e. duty-claim, privilege-noclaim, etc.) are transformed into Permission and Obligations and the Legal-GRL model of regulation and the GRL model of organization are developed. GRL's main concepts come from management and from socio-technical systems and include actors, which have intentional elements (goals, softgoals, tasks, and resources) and indicators, linked through various relationships (AND/OR decompositions, dependencies, and weighted contributions) [12]. The compliance analysis is done in this step.

Figure 3 shows the Hohfeldian models structure and its mapping to Legal-GRL. Modalities in the Hohfeldian model are transformed to *Permission* and *Obligation* softgoals or goals in the Legal-GRL. Power-liability and immunity-disability statements are also of type Permission and Obligation with additional conditions and priorities. More detail of the mapping is explained in [36]. Figure 4 illustrates a Hohfeldian model and Legal-GRL model of the case study.
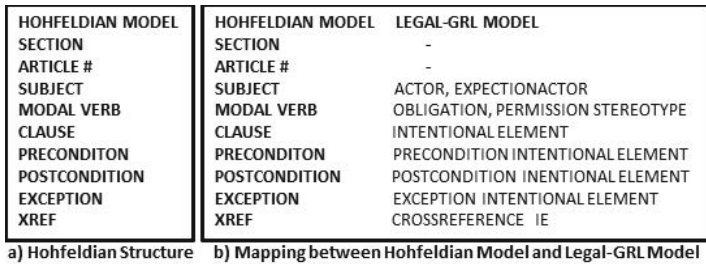
HOHFELDIAN MODEL	HOHFELDIAN MODEL	LEGAL-GRL MODEL
SECTION	SECTION	-
ARTICLE #	ARTICLE #	-
SUBJECT	SUBJECT	ACTOR, EXPECTIONACTOR
MODAL VERB	MODAL VERB	OBLIGATION, PERMISSION STEREOTYPE
CLAUSE	CLAUSE	INTENTIONAL ELEMENT
PRECONDITON	PRECONDITON	PRECONDITION INTENTIONAL ELEMENT
POSTCONDITION	POSTCONDITION	POSTCONDITION INENTIONAL ELEMENT
EXCEPTION	EXCEPTION	EXCEPTION INTENTIONAL ELEMENT
XREF	XREF	CROSSREFERENCE IE

a) Hohfeldian Structure   b) Mapping between Hohfeldian Model and Legal-GRL Model

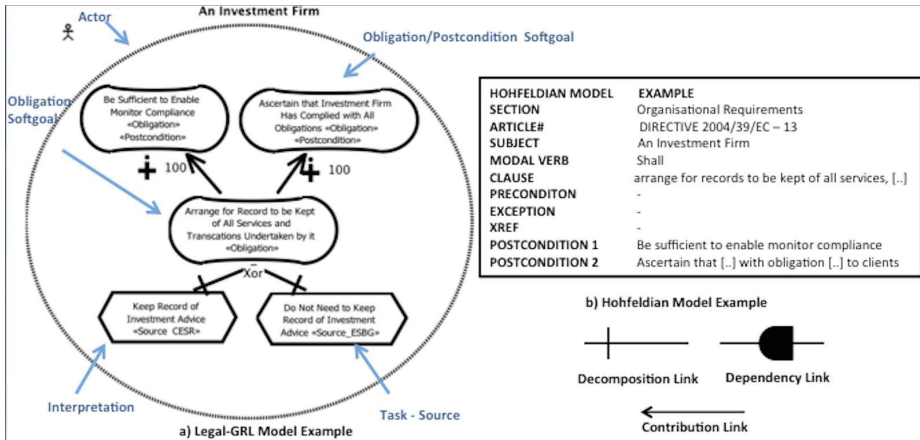**Fig. 3.** Hohfeldian Model Structure and Mapping with Legal-GRL

Fig. 4. Hohfeldian Model Structure and Mapping with Legal-GRL

At the last layer, the business processes of organization and regulations are built in Use Case Maps (UCMs). The benefit of using UCM over other business process modeling notations is that it has the ability to link its elements to GRL elements (as both views are part of URN). In other words, tasks and actors in GRL can be linked to responsibilities and components in UCM maps. Having such business processes for legal clauses helps to capture the sequential aspects of laws and, as a result, this helps to identify violations of the procedural laws. The detail on how to build the UCM models are documented in the literature [43].

LEGAL-URN contains three types of compliance analysis algorithms which are: 1) Quantitative Analysis 2) Qualitative Analysis 3) Hybrid Analysis. These compliance analysis algorithms extend the GRL analysis algorithms of Amyot et al. [2]. These algorithms are all bottom-up which means that the satisfaction value of each of the intentional elements in the model are propagated from the lowest level to the highest level in the model. In the LEGAL-URN compliance analysis, the satisfaction values are propagated from lowest-level of organization to the highest level of intentional elements in both organizational and legal models. Actor satisfaction values are calculated from the satisfaction and

importance of intentional elements embedded in each actor. After analyzing the GRL models quantitatively or qualitatively, these values are propagated to the UCM models of organization through "responsibility" links. As a result, it is possible to identify the non-compliant business processes and modify them.

LEGAL-URN has several unique characteristics to help organizations achieve compliance. One the major benefits of LEGAL-URN is the use of the same modeling notation for both organizations and regulations which helps achieve a shared understanding of the regulations and enable better comparisons. It promotes reuse across organizations in the same sector through annotating non-relevant parts of the legal models with «No» tags, contributing to this reusability. LEGAL-URN adds precision and formalism to legal statements and URN models via Hohfeldian model structures, deontic modalities and stereotypes. It supports business process compliance with multiple regulations with the pairwise comparison algorithm and it has a tool support [3] for modeling, verifying, and analysing compliance, and change management. It is worth mentioning that LEGAL-URN does not aim to replace the lawyer or legal experts but it aims to provide guidelines and tool support for business and data analysts and software engineers to align their business processes and softwares with the regulations before the audits happening.

LEGAL-URN framework has yet some limitations which need to be addressed. The framework does not include a regulations repository. Having such a repository can help automation of the process of identifying relevant regulations and ensuring business processes compliance with relevant regulations. Furthermore, developing the Hohfeldian model is currently manual. With the help of an XML-based version of regulations, this process can be semi-automated. It also lacks legal interpretations [8]. Legal interpretations help identify sets of business process patterns which can be legally compliant. These patterns can be used by organizations to build business processes which satisfy the legal goals and the high-level goals of the organization simultaneously.

6   System Integration

LEGAL-URN and Eunomos are complementary systems for compliance monitoring. Our preliminary investigation suggests that integration is perfectly feasible but would require modifications to both systems. Figure 2 shows the integration of the two systems.

The Eunomos repository of laws - with legislative XML for clickable cross-references, definitions of terms and their inter-relationships in specialist ontologies - would replace the LEGAL-URN "Law and Regulation Documents" level. At the legal provisions level, there is a new representation that integrates Eunomos prescriptions and LEGAL-URN Hohfeldian models. Table 1 shows the mapping of fields and relations between the two representations. Many fields can be mapped directly, some require adaptation, and others are taken from one representation.

The integrated solution classifies provisions according to Hohfeldian modalities rather than Deontic Logic because they allow a more refined characterization

Table 1. Integration of Prescriptions and Hohfeldian Models

Prescriptions	Hohfeldian Model	Integrated Representation
Deontic Clause	Hohfeldian Modality	Hohfeldian Modality
Active role	Subject	Responsible Actor
Passive role	-	Beneficiary
Violation	-	Violation
Sanction	-	Sanction
-	Modal Verb	-
Description	Clause	Clause
-	Precondition	Precondition
-	-	Postcondition
IsA Relation	-	IsA Relation
PartOf Relation	-	PartOf Relation
Exception Relation	Exception	Exception Relation
Norm Identifier	Section + Article	Norm Identifier
-	Cross-reference	Cross-reference
-	-	Stakeholder

of legal provisions with an explicit way to represent the hierarchy of norms. The Active Role, or Subject, are essentially the same, and can be more clearly expressed as the Responsible Actor - who has the responsibility for ensuring the provision is fulfilled. This field is essential at the GRL or UCM level. The Passive Role here is renamed as Beneficiary for clarification. Beneficiaries do not need to be represented at the next levels, unless they also have legal responsibilities that need to be modeled. The question of what is violated and what are the possible sanctions are important considerations in compliance decisions, and are represented at the legal provisions level. In LEGAL-URN, sanctions are modeled as "Consequence" goals which have links from Legal-GRL to organizational models.

The modal verb can provide useful clues for the knowledge engineer to classify legal provisions, but is not required as information about the provision in the final analysis. The Description in Eunomos corresponds to the Clause in the Hohfeldian model - simplifying the syntax and adding information from citations. The Precondition from the Hohfeldian model is maintained as it is useful for describing applicability and sequential information. Postcondition is the correlative. The ontological relations from Eunomos - IsA, PartOf and Exception - are used to show the interaction between legal provisions. Clickable hyperlink norm identifiers are used instead of textual citations (Section and Article fields) to enable easy referencing to legal sources.

The major innovation in the integrated solution is the addition of a stakeholder field which classifies the source of the legal provision as constitutional law, legislation, case law, subsidiary laws, ministerial decrees, legal scholars, self-regulatory bodies, industry bodies, internal regulator or external regulator. Different stakeholders have different levels of authority and/or persuasiveness in different jurisdictions and different domains, which is important to take into account in compliance decisions.

At the Legal-GRL level, different interpretations are associated with relevant stakeholders (derived from the legal provisions) and are modeled as alternative realizations of softgoals, just as there are alternative business processes to realize organizational goals. Different interpretation modalities can be integrated in the Legal-GRL model to simulate the possible modalities of interpreting the regulations that an auditor can adopt. Following from how a Legal-GRL is constructed, explained by Ghanavati et al. [36], the softgoals contained in the model can be associated with the purpose of the law intended by its creators. The different interpretation modalities can then be applied (via capturing them as "Source" tasks), while determining whether an execution is compliant with the Legal-GRL model, to identify whether the executions being analysed are compliant with an interpretation of the law.

7   Related Work

The most comprehensive research project in this area is COMPAS [38], which aims to support the entire compliance life-cycle. The project is inspired by the work of Ghanavati et al. [17] on conformance checking.

Contributions in the AI & Law field more often focus on sub-problems rather than the comprehensive system that the integration of Eunomos and LEGAL-URN provides. Bianchi et al. [6] designed a system to help the readers of legal documents to classify terms and view laws, however this approach lacks Eunomos's legislative XML conversion feature. On the other hand, Lu et al. [29] and Kharbili et al. [14], have sought to develop a sophisticated notation for norms and business process models, with the unfortunate drawback that the models are too general for use in legal settings and the notation difficult for legally trained people. Other relevant work in the area are that of Weiss et al. [42], who sought to separate the domain knowledge from the sequence of activities, and Gong [20], who proposes to use agent technology for mapping legal rules onto business processes. While the structure is simple and elegant in theory, in practice the repositories can get unmanagable as organizational procedural rules are mixed with legal rules. Our solution allows a clearer separation between organizational and legal goals.

Combining ontologies with other techniques to study legal documents is not new. For instance *Carneades*, combining ontologies and rules, studies open source compatibility issues [22]. The LKIF ontology set out to model basic concepts of law identified by citizens, legal professionals and legal scholarsis 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 interconnections a machine needs to be provided with.

Francesconi [15] presents an RDF/OWL implementation of Hohfeldian representations of legal provisions to aid information retrieval and automated reasoning. The representation is similar to the integration of Eunomos prescription and

LEGAL-URN hohfeldian models. The main difference is that our work is aimed at legal compliance and use lightweight ontologies rather than semantic web formalism, because they are easier to understand for legal and business practitioners [35].

The use of Requirements Engineering (RE) techniques for compliance monitoring is well-established - a recent systematic literature review [19] shows that Requirements Engineering (RE) techniques, especially, Goal-Oriented Requirements Engineering (GORE) methods have been used to extract and model legal requirements or build business process compliance frameworks. Among these, Rifaut et al. [33] integrate *i** with the ISO/IEC 15540 standard to measure business process compliance with regulations, Siena et al. [41] introduce a new *i**-based language called *Nòmos* modeling normative statements in terms of 8 classes of rights (Hohfeldian ontology), Breaux et al. [10] develop a process to map natural language domain descriptions to deontic logic descriptions.

Beside GORE approaches, some work in RE aim to integrate regulatory compliance with business processes: Karagiannis [26] uses a meta-modeling platform to integrate Business Process Management (BPM) and Enterprise Risk Management (ERM), Kharbili et al. [27] propose a framework for semantic policy-based compliance management for business processes and Schleicher et al. [37] define a refinement process based on *compliance templates*, consists of abstract business processes iteratively refined according to the requirements.

None of the current systems caters adequately for the ever-changing nature of the law, which can result in an unwieldy rules model. 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. As the systematic literature review [19] mentioned, while the work mentioned above apply RE and GORE techniques to extract and model legal requirements and establish the compliance, they focus on only few aspects of compliance. The LEGAL-URN framework [16], however, covers all these aspects by providing a formal structure for legal statements and guidelines for mapping procedure for creating Legal-GRL and Legal-UCM models, and by developing semi-automatic compliance analysis.

8   Conclusions and Future Work

This paper proposed integrating two complementary compliance management and monitoring approaches (i.e. LEGAL-URN and Eunomos) to achieve a comprehensive business process compliance solution. Eunomos, a legal knowledge and document management system based on AI techniques, focuses on identifying norms, cross-references and semantic similarities, with a clear structure for representing multiple interpretations and normative change.

LEGAL-URN, on the other hand, applies Requirements Engineering techniques to model regulations in the same notation as business process modeling notations as a business-focused means to analyze business process compliance. We demonstrated that an integration at the level of legal provisions allows for complete traceability from legal sources to business process models, representing regulatory conversations at each level, thereby allowing informed analysis and design of compliant business processes.

Legal-URN includes GRL analysis algorithms which can help analyze the impact of different interpretation modalities on organizational business processes and high-level goals. We aim to extend these analysis algorithms to help organizations select a set of business process templates that satisfy concrete rules regulations as well as their high-level goals.

We aim to extend the use of interpretations and comparisons between different regulations in the context of economic globalization. To increase the effectiveness of international regulations, regulatory bodies and researchers are studying different international regulatory contexts such as harmonization, standardization, normalization, reconciliation and mutual recognition for regulations in the financial sector [4]. Laws and regulations are ever-changing. Thus, being more proactive in compliance management and monitoring would better address the complexity of change management. Our system could also integrate techniques that can identify changes in advance for new versions of regulatory text [21].

For a number of years, it has been recognized that the creation and uses of laws and regulations occurs in complex network of stakeholders having different objectives or intentions for regulating complex socio-technical systems (see e.g. [32] for the maritime, aeronautics or nuclear sectors). A main shift that has been made recently and that should be better addressed by our proposal is the focus on evidence-based methods in the legal process [31]. Key Performance Indicators (KPI) are extensively used to link regulations and evidence. KPI should be added to our integration between Legal-URN and Eunomos. In the context of GRL and URN, a proposal has been made in the work of Shamsaei et al. [40] on measuring compliance with goal-based legal provisions with key performance indicators.

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