

# A Comparison of Selected Legal Ontologies for the Design of Legal Process Optimization Ontology

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**Abstract:** *As a matter of fact more and more industries are adopting information communication technologies and its applications in different functional areas of organization spanning from customer order management to corporate social responsibility (CSR). Among several different technological solutions to overcome issues related to interoperability, development and maintenance of complete and shareable ontologies are gaining popularity and wider acceptance with promising results among software communities (viz. designer and developer). Meanwhile, these days' people show wider interest on how to utilize the ontology in the legal domain. These legal ontologies are greatly useful when designing a legal knowledge system. The major part of the research is to optimize the case flow process (viz case filing, hearing, postponing, case transfer and the judgment) in the district courts of Sri Lanka. In this paper, our intention is to survey on selected four legal ontologies (shows pioneer steps to system and domain theory development) towards to construct the concept of optimization and organization of the process structure (case filing) and the workflow of the district courts in Sri Lanka. In fact the surveying and comparing the different ontologies towards the particular goal is essential to generate a new ontology either with totally new sub concepts or enhance and fill the gap of the current concept when it is essential to the community. Ultimately ontologies enhance flexibility and agility to the working environment. Our intended future work is to make an ontology framework which can be reused in other legal subdomains too.*

**Keywords:** Ontology, Legal Domain, Conceptualization, Comparison, Process Model, Optimization.

## 1. Introduction

More industries are adopting information communication technologies and its applications in different functional areas of organization spanning from customer order management to corporate social responsibility (CSR) in order to make sure of smooth functioning and maximize the value (viz. profit, service, resource) of their product.

Steady growth and sustainability of an enterprise is guaranteed by uninterrupted and clear communication in order to make the processes and transactions comfortably. The complexity of the processes may ruin the whole enterprise system without any profitable value to the stakeholders. Not only the domains like medicine, engineering, computing and etc., but also service providing domain such legal also suffers broadly in complexity of the processes (viz. internal and external), since the complexity is much higher than they expect. Unlike other domains the legal domain experiences more complex processes since, inherited complexity of the legal cases, multiple-actor collaboration, hard and fast laws, courts procedures (viz. tendering, filing, hearing, postponing, case moving and judgment), more hard rules (viz. general and courts specific) on stakeholders or actors in the courts system. In legal domain, some studies had been taken over previous on legal knowledge systems in order to retrieve the information including legal term/vocabulary clustering and querying. It clearly expresses that, complexity of processes in the legal system still remains. In a nutshell, our main intention is to survey and compare selected four legal ontologies, which had been introduced in the legal domain in order to know how far the previous studies accommodated the concept of legal process optimization and use the findings to contribute our future

work (propose an ontology process optimization model as a part of the studies in order to reduce the complexity of the processes (viz. case filing, cancelling or withdrawing, hearing, transforming, and verdict) in the district court system)).

Among several different technological solutions to overcome issues related to interoperability, development and maintenance of complete and shareable and reusable ontologies are gaining popularity and wider acceptance with promising results. We have organized this paper by; describing ontology in general and specific legal ontology (section 2), a brief description of four ontologies including the concepts (section 3), state some special criteria to compare the ontologies toward the process optimizing concept (section 4), comparison and discussion of those ontologies (section 5), concluding remarks with suggestions for the future research work (section 6).

## 2. The Definition of Ontology in General

There are many definitions proposed for the ontology in different domains. We would like to state some definition related to the legal domain including more or less closer. Ontologies are conceptual models of a specific domain [1]. Gruber defines the ontology in a more specific way "specification of a conceptualization and a more specifically, as a description of concepts and relations that exist for an individual or community of individual" [2]. Another ontology definition is "A shared understanding of some domain of interest" [3]. Ontology is stated as a meta-level description of the model under construction [4]. In abstract, ontology is a model of reality of the world and the concepts in the ontology must reflect this reality. Ontology is broadly used for sharing

common understanding of the structure of information among people or software agents[2], enabling reuse of domain knowledge [5], making domain assumption explicitly or in other word domain theory development, separating domain knowledge from the operational knowledge, analyze the domain knowledge [6], system development and system documentation Furthermore, the ontology is playing vital role on different domains (viz. medical, engineering, mathematical, IT, financial, and social).

### 3. Short Survey on Selected Popular Legal Ontologies

Several studies have been done in order to formulate a good ontology in different conceptual schemes so far. It is clear by referring many literatures in legal domain; most of the studies have been focused to develop ontology for knowledge acquisition (viz. knowledge transfer, queries, and domain knowledge development), system development and domain theory development. The third one is still crawling stage compare with earlier two. We would like to survey and compare four legal ontologies in this section and the main focus is how far these ontologies can support the process optimization concept which will be later developed. The followings are four popular ontologies in legal domain knowledge system development.

1. LLD: Language for Legal Discourse
2. NOR: Norma Formalism [7, 8]
3. LFU: Functional Ontology of Law [9]
4. FBO: Frame Based Ontology [10-12]

#### 3.1 McCarty's LLD

McCarty proposed a language for legal disclosure by considering the basement of any ontology is language. If we narrow down McCarty's concept, the basic components of LLD is constructed in three elements called atomic formulae, rules and modality respectively[13]. The atomic formulae can be described as building relations between basic objects. "A distinction is made between count terms (tangible; company, actor) and mass terms (intangible; value, cash, stock). Rules are formed by connecting atomic formulae with logical connectives. The combination of atomic formulae and rules become as first order logical expression. Modalities are second order expressions. Modality deals with time, event and actions. Here state changes are realized by the events. According to the LLD, actions bridge (relation) the actors and events. In conclusion LLD supports four modality operators namely permitted, forbidden, obligator and enabled. Ultimately the LLD is a language for the ontology but not an ontology even though it shows generic conceptualization of legal domain[11, 14].

#### 3.2 Stamper's NOR

In contrast of McCarty's LLD, Stamper proposed a new concept which was against the use of traditional logic (symbolic representation) especially in legal domain, since the traditional logic suffers from weak connection with real world. Stamper proposed NORMA formalism[7] though him

project LEGOL[15] to fill the gap of McCarty's concept. Stamper stressed that the entities should be described by their behavior instead of individuality or any truth value of it. The NOR is conceptualized with the concept of agent, behavioral invariants and realizations[7, 8]. The agent (viz. person, team, enterprise, social agents and nations) plays major role and by the experience it shows the results to the real world through actions by the help of responsibility. Stamper tries to describe the invariant behavior of entity is constant during cause of any actions. In other words behavioral invariant is a situation which does not affect the entity or its behavior. And the realization is a state change of an agent due to the actions performed[7, 8]. Though NOR put effort to formalize the real world mapping still it suffers from the reality.

#### 3.3 Valente's LFU

Valente proposed first acceptable ontology towards the functional perspective of the legal system as functional ontology of law. It is possible to abstract from the Valente's LFU that, the legal system is a tool, which can influence the social world. Valente strongly dealt with formation knowledge system thus lead him to demonstrate six main legal knowledge areas (viz. normative, world or legal abstract model, responsibility, reactive, meta-legal and creative) in his LFU[9]. We would like to summarize all of his knowledge as follows. Normative knowledge defines a standard of social behavior i.e. behavior of the people in society. World knowledge is descriptions of the legal domain possibly the behavioral description of the system and stakeholders. Thus, Valente declared the world knowledge as a Legal Abstract Model (LAM). The said LAM consists two parts namely; definitional knowledge describes the definitions of legal norms (viz. concept, relations, case, situation and conditions) and causal knowledge describes dynamic part such as behavior of people in society. Responsibility knowledge describes the responsible of the people. Reactive knowledge shows the reaction to be taken in a situation. Meta-legal knowledge is the knowledge of a legal knowledge, most of the time reference knowledge. The creative knowledge in LFU refers the creation of non-existing entity before ever when it is needed[9].

#### 3.4 Van Kralingen's and Visser's FBO

The main focus of FBO is to reduce the task dependencies in the legal knowledge system. The FBO is a mixture of legal ontology and statute-specific ontology. The FBO stands in good position since some part of the knowledge design is still reusable in sub legal domain (knowledge base systems)[11, 12]. According to the legal ontology; it consists of three parts norms, acts and descriptions respectively. As we can see the norms is general rules and it is built with eight components (viz. norm identifier, norm type, a promulgation, scope, conditions & applications, norm subject, legal modality and act identifier). Act represents a behavior which can affect the real world. State changes, events and processes are stated under the acts and which comprised with set of components (viz. act identifier, promulgation, scope, agent, act type, modality of means, modality of manner, temporal aspects, spatial aspects, circumstantial aspects, cause of the action, aim of the action, intentionality of an action and final

state[11]. Concept description is defined as the meaning of the different concepts in the legal domain and the concept description comprised with seven elements (viz. concept to be described, concept type, priority, promulgation, scope, conditions under which a concept is applicable, and enumeration of instances of the concept). As we discussed above generic legal ontology the elements are very much generic to the legal domain in FBO leads those elements can be reused. The statute-specific ontology would be used under a specific subdomain since it describes and suits only within a subdomain. It cannot be used in another subdomain since the knowledge of the subdomain is different than other subdomain[11].

#### 4. Proposal of Criteria to Compare the Legal Ontologies

The development of criteria highly depends on the goal of the comparison. The output of the comparison should lead us to incorporate the results to the new research or future work. As we said earlier in this paper our future work is to develop legal process optimization through the ontology development. But we could notice all the above stated popular ontology models in legal domain focus in the design of legal knowledge system. We would like to propose following criteria to extract useful results for our future intended research.

We can focus to compare the ontologies towards our goal with proposed criteria given below in table 1. Each criterion consists of some properties to be compared.

Table 1: The properties to be compared

Criteria		Properties			
1	Ontology Competence	a)	Concept	b)	Basic elements
		c)	Extensibility		
		d)	Optimization pattern	e)	Role delegation
2	Optimization Concept	f)	Optimizing rule	g)	Possibility of automation
		h)	Out sourcing option		
		i)	Transaction	j)	Role of actors
3	Process concept	k)	Communication	l)	Products or output
		m)	Commitment/Responsibility		
		n)	Total ontology	o)	Task or role
4	Reuse technology	p)	Design pattern	q)	Rules or laws

According to the table 2, we have compared the four ontologies especially in a view of the optimization of the processes for our future work. All four ontologies have own concepts. Except LLD other three ontologies are far more advanced in the concept but not fully to the current needs. We can clearly see from the comparison and survey, the ontologies gradually increase the extensibility and the diversity of the granule level objects. If we discuss about the optimization criteria, over all very much limited. Except LLD other three ontologies show the base level optimization not

#### 5. Comparison of Four Ontologies and Discussion

In this chapter we compare the selected four popular ontologies in legal domain and discuss the outcome of the comparison toward the future work.

Table 2: The properties to be compared

	LLD	NOR	LFU	FBO
A	Preparation of a language since which would be the basic elements to the road of ontology	Limiting the unreachable knowledge to the user through Logic of norms and affordances	influence the social world through the functional aspect	Reducing the task dependency in the legal knowledge system
B	Atomic formulae, rules (first order logics) and modalities	Agents, behavioral invariants, realizations	Six different knowledge areas consists of very man sub level primitives	Generic legal ontology, statue specific ontology
C	Very poor	Limited	Limited but can be	Limited possibility
D	Not mentioned	Optimizing by limiting knowledge	Optimizing by sharing the knowledge level	Optimizing by reducing the task dependability
E	Not mentioned	Not mentioned	very much limited	Poor
F	No specific optimization rule	No specific optimization rule	Very much limited	Available not broadly
G	Not possible toward optimization	Not possible toward optimization	Good possibility	Good possibility
H	Not possible	Not possible	Not possible	Not possible
I	Not mentioned	Available	Available	Available
J	Not Available	Available – limited	Available	Available
K	Not clear	Available	Available	Available
L	Not clear	Available	Available	Available
M	Not clear	Available	Available	Available
N	Not possible	Not possible	Not possible	Not possible
O	Not possible	Not possible	Possible	Possible
P	Not possible	Not possible	Possible	Possible
Q	Not possible	Not possible	Possible	Possible

towards the processes. The role delegation and process outsourcing are completely redundant in all four ontologies.

LFU and FBO show prominently in possibility of automation compared with other two. Overall, concept of process is available all three ontologies except LLD. The whole ontology reuse is still challengeable. All four ontologies are completely not in the level of total ontology reuse. Except LLD other three ontologies give possible evidence for the reuse of task, rules and design. In overall, all four ontologies are not in a great position to reach the process optimization

since the poor design structure of the process. Based on above comparison we would like to suggest the followings which should be added to the legal ontologies in order to get the optimal workflow in future.

1. To be supported to the optimization structures like combining the task, eliminating unwanted task, task automation, parallel workflow, role delegation, split the responsibility, commitment and outsourcing.
2. Sharing and reusing are more important not only legal domain but also any domain including complex domains. Whole ontology (viz. case filing, case hearing and case transfers) reuse is the maximum level of reuse concept but even it is highly desirable if the reuse is limited to method (eg. modeling method allow endless decomposition level thus can stop at any level), pattern (e.g. Cancellation pattern, case transaction pattern), task and etc...
3. The ontology must be powerful enough to show multilevel of abstraction.
4. Well established communication should be accommodated since it is the key factor to the process flow.
5. Each transaction (traceable) must give at least one product either material or immaterial.
6. There should be a room for prioritize the transactions.

## 6. Conclusion and Future Work

The above survey and comparison lead us the awareness of different level of knowledge in legal domain. Armed with this different level of knowledge structure in the legal domain better concept can be developed in future. The process optimization is playing major role in success of ontology apart from the domain. We would like to propose an optimized ontology model for the case filing at the district court in Sri Lanka as a primary and pioneer effort as our future work. This ontology model would become a common model with the facility of especially sharable, reusable, extendible and efficient over different domains.

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