

# Legal Knowledge Systems

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## INTRODUCTION

There are many conceptions of e-governance (Malkia, Anttiroiko, & Savolainen, 2004; Reiner mann & Lucke, 2002). Our view is that e-governance is about the use of information and communications technology to improve the quality and efficiency of all phases of the life cycle of legislation. In this conception, computer models of legislation play a central role. We use the term “model” in a broad way, to cover every kind of data model of legislation or metadata about legislation, at various levels of abstraction or detail, including full text, hypertext, diagrams and other visualization methods, and legal knowledge-bases using Artificial Intelligence knowledge representation techniques. The appropriate kind of model depends on the particular task to be supported.

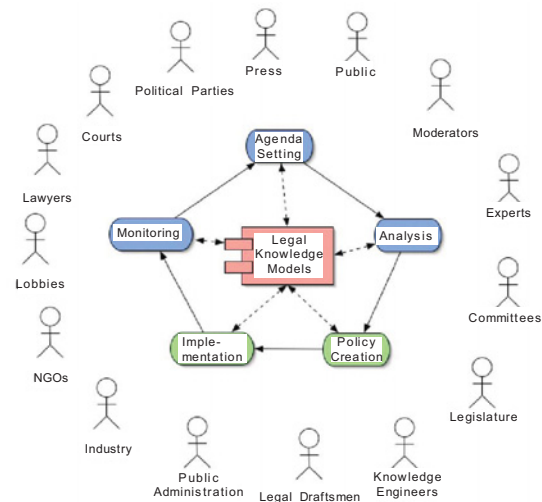
In this article, the focus will be on the use of legal knowledge systems (LKS) to support the implementation phase of the life cycle of legislation. Legal Knowledge Systems are also known as legal knowledge-based systems (LKBS). LKS can greatly improve the correctness, consistency, transparency and, last but not least, the efficiency of the administration of complex legislation.

The rest of this article is organized as follows. The next section explains the relevance of legal knowledge systems for governance. This is followed by a section motivating the use of LKS to support tasks in the implementation phase of the life cycle of legislation and providing a brief introduction to LKS technology. Next, various application scenarios for implementing public policy and legislation using LKS are discussed. Although research on technology for legal knowledge systems continues, it is a mature technology with many impressive applications in regular use by public administration. The article concludes by reiterating its main points and identifying open research issues.

## BACKGROUND

As shown in Figure 1, based on a diagram in Macintosh (2004), governance can be viewed cybernetically as a class of control systems. Many of the kinds of actors involved in governance are illustrated in Figure 1, including the press, political parties and lobbies, non-govern-

Figure 1. The life cycle of legislation



mental organizations (NGOs), the general public and various governmental actors.

All phases of the life cycle of legislation create, use, maintain, or evaluate computer models of legislation and other sources of norms (e.g., regulations, court cases, and best practices). These are called legal knowledge models in the figure. One could distinguish between the full text of the legal sources and metadata, abstractions, or models of these sources, but for the sake of simplicity, a full text database of some legal source is viewed as a kind of computer model.

This model of governance leads to the following definition of e-governance: the use of information and communications technology to improve the quality and efficiency of all phases of the life cycle of legislation. In this conception of e-governance, computer models of legislation and other sources of norms play a central role. The appropriate kind of model depends on the particular task to be supported. In the rest of this article, the focus will be on ways to use a particular class of models, legal knowledge systems (LKS), to support the implementation phase of the life cycle of legislation. There are also important applications of LKS for other phases of the life cycle, in particular to support policy creation and legislative drafting. Conversely, other ICT technologies have a

role to play in the implementation phase, such as business process reengineering and workflow management systems. But these subjects require separate explication.

## INTRODUCTION TO LEGAL KNOWLEDGE SYSTEMS

Computer models of legal rules and regulations for helping public agencies to administer complex legislation are nothing new. A large part of IBM's growth in the 1950s was due to the successful adoption and proliferation of large data processing applications for administering taxes and social benefits in the public sector. From the beginning, computer models of legislation have usually been implemented procedurally: applying knowledge of the law and administrative procedures, a step-by-step procedure is designed and then implemented in computer code for guiding clerks through the process of applying the legislation. The overwhelming majority of software applications for administering legislation are still implemented this way, although modern programming languages, such as Java, are replacing COBOL and new software engineering methods for modeling procedures, such as activity diagrams of the Unified Modeling Language (UML), have largely replaced flow charts.

Procedural models of the law are expensive to build and maintain as the law changes. Since knowledge about the law is tightly intertwined in the procedural approach with knowledge about how to solve a particular legal or administrative task, it is very difficult to reuse models in different applications of the same law to reduce development and maintenance costs. In the 1970s, interdisciplinary research between lawyers and computer scientists began on ways to model the law and support legal reasoning, based on a deeper understanding of the law and legal processes (Buchanon & Headrick, 1970). An active international research community, going by the name of Artificial Intelligence and Law<sup>1</sup>, was founded and grew in the 1980s. This community, as part of the larger field of artificial intelligence (AI), developed methods and technologies for modeling legislation, regulations, and case law and supporting a variety of legal reasoning tasks, using rule-based systems, case-based reasoning systems and other AI methods. See (Rissland, Ashley & Loui, 2003) for a recent overview of the Artificial Intelligence and Law field.

In the mid 1980s, the first prototype legal applications of rule-based systems for public administration began to appear (Sergot et al., 1986). Initially these were often called legal expert systems, because the focus was on modeling the expertise of legal experts. Today the broader term legal knowledge systems (LKS) is usually used. It is

broader in two ways: (1) it includes the use of all possible sources of legal knowledge, especially original, authoritative legal texts, such as legislation and case law, in addition to the commentary or opinion of legal experts; and (2) it includes all ways of modeling legal knowledge using computers, such as case-based reasoning methods or so-called neural networks, in addition to rule-based technology.<sup>2</sup>

The first production applications of legal knowledge systems for public administration began to appear in the late 1980s and early 90s. The Australian company SoftLaw<sup>3</sup>, for example, was founded in 1989. SoftLaw's entire business is based on "the provision of its legislative rule-based technology and related methodologies and services to test, capture, execute, and maintain the complex legislative and policy rules that are used by government and regulatory agencies to administer government programs."

One of SoftLaw's first production applications was a rule-based system for the Australian Department of Veteran's Affairs, to help administer the entitlements of veterans to pensions and other benefits. An independent audit of the agency's performance had shown that decisions were often highly inconsistent, lacked adequate grounds or justification or incorrectly calculated entitlements. These quality issues were the primary motivation to reform the process using legal knowledge systems. In addition to resolving these quality problems, SoftLaw claims the use of LKS led to an 80% productivity increase.<sup>4</sup>

Some more recent projects and applications include a legal knowledge system developed for the Dutch Tax Authority in the context of the European POWER project (van Engers, Gerrits, Boekennoogen, Glassée, & Kordelaar, 2001) and a feasibility study for the German county of Herford on the use of an LKS to support clerks with the assessment of support obligations of family members for their elderly parents (Glassey & Gordon, 2005). SoftLaw collaborated with Northgate Information Solutions to build a Web-based legal knowledge system for the British government, called Assert, which helps citizens to assess their entitlements to a wide-range of housing-related welfare subsidies. In the United States, the Department of Labor has published over 20 legal knowledge systems on their Web site, to help employers and employees to understand their labor law rights and obligations.<sup>5</sup>

Although there are different approaches to building legal knowledge systems, at a certain level of abstraction they all have the same basic architecture and share the same set of features compared to the conventional, procedural approach to building legal decision-support systems (Fiedler, 1985). The basic LKS architecture is shown in Figure 2.

As shown in this figure, an LKS consists of four main components:

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