



Ann Macintosh,

Richard Ellis

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# APPLICATIONS AND INNOVATIONS IN INTELLIGENT SYSTEMS XIII

Proceedings of AI-2005, the Twenty-  
fifth SGAI International Conference  
on Innovative Techniques and  
Applications of Artificial Intelligence



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# **Applications and Innovations in Intelligent Systems XIII**

**Proceedings of AI-2005, the Twenty-fifth SGAI  
International Conference on Innovative Techniques  
and Applications of Artificial Intelligence, Cambridge,  
UK, December 2005**

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## APPLICATION PROGRAMME CHAIR'S INTRODUCTION

A. L. MACINTOSH

Napier University, UK

The papers in this volume are the refereed application papers presented at AI-2005, the Twenty-fifth SGAI International Conference on Innovative Techniques and Applications of Artificial Intelligence, held in Cambridge in December 2005. The conference was organised by SGAI, the British Computer Society Specialist Group on Artificial Intelligence.

This volume contains fifteen refereed papers which present the innovative application of a range of AI techniques in a number of subject domains. This year, the papers are divided into sections on *Applied AI in Information Processing*, *Techniques for Applied AI*, *Industrial Applications* and *Medical Applications*.

This year's prize for the best refereed application paper, which is being sponsored by the Department of Trade and Industry, was won by a paper entitled "Case-Based Reasoning Investigation of Therapy Inefficacy". The authors are Rainer Schmidt of the University of Rostock, Germany, and Olga Vorobieva, from the Sechenow Institute in St.Petersburg, Russia.

This is the thirteenth volume in the *Applications and Innovations* series. The Technical Stream papers are published as a companion volume under the title *Research and Development in Intelligent Systems XXII*.

On behalf of the conference organising committee I should like to thank all those who contributed to the organisation of this year's application programme, in particular the programme committee members, the executive programme committee and our administrator Collette Jackson.

Ann Macintosh

Application Programme Chair, AI-2005

## **ACKNOWLEDGEMENTS**

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## **APPLICATION KEYNOTE ADDRESS**

# **Legal Engineering: A structural approach to Improving Legal Quality<sup>1</sup>**

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## **Abstract**

Knowledge engineers have been working in the legal domain since the rise of their discipline in the mid-eighties of the last century. Traditionally their main focus was capturing and distributing knowledge by means of the knowledge-based systems, thus improving legal access. More and more legal knowledge engineering has become an analytical approach that helps to improve legal quality. An example is the POWER-approach developed in a research programme that is now finished. This programme was run by the Dutch Tax and Customs Administration (DTCA in Dutch: Belastingdienst) and some partners (see e.g. Van Engers et al., 1999, 2000, 2001, 2003 and 2004). The POWER-approach helped to improve quality of (new) legislation and codify the knowledge used in the translation processes in which legislation and regulations are transformed into procedures, computer programs and other designs. We experienced that despite these clear benefits implementation proved to be far from easy. In fact the implementation phase still continues. Adapting research results in public administrations is a tedious process that takes lots and lots of energy and requires continuous management attention. Learning at organisational level proved to be much harder than we thought.

## **1. Introduction**

Getting the right knowledge at the right place at the right time has always been a great challenge for governments since this inflicts the ability to effectuate the legislative power to regulate and control. The Dutch Tax and Customs Administration (DTCA) has developed a method and supporting tools supporting the whole chain of processes from legislation drafting to executing the law by government employees and citizens (see e.g. Van Engers et al., 1999, 2000, 2001,

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<sup>1</sup> Parts of the material described here have been published before (see e.g. Van Engers 2004).

<sup>2</sup> Tom M. van Engers was programme manager of the POWER research programme and coordinator of the IST funded E-Power project.

2003 and 2004). These method and tools resulted from the POWER research program (Program for an Ontology-based Working Environment for Rules and regulations), a research program that was partly sponsored (the E-POWER project) by the European Commission through the IST 5th framework program.

The POWER approach combines two typical knowledge management approaches; the stock or codification approach and the flow or organisational approach. It offers both a method and supporting tools that support a systematic translation of (new) legislation into the administrations' processes.

The motive behind running the POWER program was that drafting and implementing new legislation is a rather time, energy and money consuming process consisting of many inter-connected processes. These processes are very vulnerable to errors. Not only because of the intrinsic complexity of the law, but also because mostly a large number of people is involved in these processes as well as of the complexity of these processes themselves. Varying interests have to be aligned and communication difficulties due to differences in technical jargon have to be overcome in both drafting and implementing changes to legislation. The same holds when completely new legislation has to be implemented.

The POWER-method helps to improve the quality of (new) legislation. It also supports codification of the legal knowledge into procedures, computer programs and other designs. One of the advantages thereof is the reduction of the time-to-market of the implementation of legislation and its increased transparency which will lead to reduced maintenance costs and improved services to citizens.

The POWER-approach was developed in a research programme that is now finished. In this paper I will share some of my experiences with you without explaining the POWER-approach in too much detail.

## **2. Design of regulatory processes**

The knowledge and experience needed to create new laws or adapt existing ones, specify, design and implement procedures and systems in legislative domains is very scarce. A (piece of) law should reflect the intentions of the political responsible minister and should also meet some quality criteria such as clarity and consistency from the perspective of the law-enforcement organization. This is the responsibility of the legislation drafters that are responsible for drafting the new law.

The people responsible for implementing the law (i.e. the administration) have to adapt the procedures, processes and information systems to the new law. Also risk diagnosis, assessment procedures and audit measurements have to be designed and implemented as well. This all has to be done while taking political and social-environmental requirements into account. An example of such requirements is the need for diminishing the administrative costs for citizens and businesses.

Between drafting new legislation and enforcement thereof a chain of processes has to be managed and aligned. Preventing errors as early as possible in this chain can save a lot of time and money. Not only at the design stage but even more during the

law-enforcement stage. Unintended use or even worse abuse is often due to anomalies in the law. Also, the position of the government is much stronger when involved in a dispute if the law is very clear with respect to the object of disagreement.

Many legislation drafting departments at the different ministries already have their own quality insurance techniques. Furthermore in many cases the ministry of Justice has a special role because they are usually responsible for the overall legal quality of a country. Despite all the effort that's been spend on improving legal quality using traditional measurements, such as co-reading (peer reviewing etc.) many anomalies can still be found in recently drafted legislation. The situation is even worse in situations when existing legislation is adapted.

Quality insurance measurements also exist for the other processes in the chain mentioned. Most attempts to achieve quality improvements however focus at just one of the processes involved. In the approach developed in the POWER-research program we consider each of these processes as equally important. We furthermore stress the importance of managing the chain rather than the distinctive processes themselves.

Finding a way to improve legal quality was just one of the three main goals of the POWER research program. The other two goals are reduction of total cost of ownership (TTO) of the (knowledge-based) systems intended for the support of civil servants or citizens and secondly, reduction of time to market (TTM) i.e. the speed with which these (knowledge-based) systems can be created, and consequently the regulatory power can be effectuated.

The POWER-approach supports the finding of anomalies in legal sources. Central in the approach is the central role for formal (and semi formal) knowledge representations. In the POWER-approach different knowledge representation formats are used. How these knowledge representations are used and how they contribute to improving legal quality is extensively described in other papers (see e.g. Van Engers et al., 1999, 2000, 2001, 2003 and 2004). Amongst them are both procedural descriptions called 'scenarios' (which are more or less comparable to UML action diagrams) and POWER-conceptual models (expressed in UML/OCL). Although scenarios (see section 3) lack the benefits of a strict formal model expressed in UML/ OCL (van Engers et al., 2001 [3] and [4]) they are useful to provide both analysts and experts with a good insight in the legal domain represented, especially when the legislation involved is to be used in a categorization or assessment task. Scenarios also proved to be an excellent means of communication with experts and representatives of disciplines involved in the implementation of legislation (see Van Engers et al. 2002 [7]).

The POWER approach combines two typical knowledge management approaches; the stock or codification approach and the flow or organisational approach. It offers both a method and supporting tools that support a systematic translation of (new) legislation into the administrations' processes. POWER offers a systematic approach can help to improve legal quality.

In contrast to other knowledge modelling approaches the POWER-approach is focused on modelling legal sources rather than expert knowledge. Expert

knowledge however is needed to find the correct interpretations but also for efficiency reasons. Starting with representing the (legal) experts' knowledge (using scenarios) helps to find the adequate scope (the legal sources to be analysed). Confronting the expert with differences between the model build out of the experts' knowledge and the knowledge that can be distilled out of the other knowledge sources (specifically the law) causes the legal experts to see things in a different light and has often led to changes in the law.

### **3. Quality improvement**

The quality of the law enforcement depends on the quality of the legislation itself and on the quality of the knowledge systems that are actually used in the client handling processes as well. In previous work (see Van Engers and Boekennoogen 2003) we described some results from a project that was aimed at improving the quality of legislation and the investigation of the consequences of implementing a new law. Others also have proposed approaches for quality improvement both in the legal domain as for knowledge in general (see e.g. Voermans 2000, Preece 1994, Vanthienen 1997 and Spreeuwenberg 2001).

The problem with most verification procedures is that these procedures can only be applied after most of the hard work has already been done, i.e. formalising the knowledge. Since this formalisation process, i.e. translating the legislation into a formal representation (van Engers et al., 2001 [5]) and applying a verification process to it, usually takes some time even when it is supported by tools such as the POWER-workbench, a less subtle and profound approach is needed to satisfy the practical needs of legislation drafters and policy makers need feedback. Especially if in the drafting process, where these drafters deal with the politicians and other influential stakeholders feedback is needed in a much earlier stage. Furthermore it is not always necessary to design a (rule-based) system at all. Specifically for this purpose we developed a less labour and time intensive method derived from the original Power-method that helps to find anomalies. That method is called the Power-light method. We can choose to just applying the Power-light if we don't need a formal model for the purposes mentioned before.

The POWER-approach is used to detect anomalies in legislation, but as a regular part of the design of the regulatory processes not as a separate step. Under time pressure we can use the Power-light method which works quite similar, except for the fact that formalization only takes place in the modellers' mind.

How the POWER-method can be used to detect in legislation defects has already been described in previously published papers (e.g. Van Engers 2004). I refer to those papers for more detailed information about the process and examples. Typical anomalies found are circularities, ambiguous references and missing concepts, gaps in the law and inapplicable regulations.

### **4. Knowledge representation**