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B. van Buggenhout

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More information about the JURIX foundation and its activities can be obtained by contacting the JURIX secretariat:

Mr. C.N.J. de Vey Mestdagh
University of Groningen, Faculty of Law
Oude Kijk in 't Jatstraat 26
P.O. Box 716
9700 AS Groningen
Tel: +31 50 3635790/5433
Fax: +31 50 3635603
Email: sesam@rechten.rug.nl

 http://jurix.bsk.utwente.nl/

USING KNOWLEDGE BASED MICRO SIMULATION IN ANALYSING THE APPLICATION OF LEGISLATION

Jörgen Svensson

Summary

The method of knowledge based micro simulation (KBMS) was developed to help determine (ex-ante) the socio-economic consequences of social security legislation. This paper discusses the possibilities of the KBMS method in the proces of ex-post evaluation of legislation, namely in monitoring the application of legislation by the (local) administrative organisations. The two possibilities that are discussed are:

- *the monitoring of actual compliance with legislation by the administrative organisations:*
- *the monitoring of the changes of the relative empirical importance of different (sub)sections of a law in administrative practice.*

The proposed method of monitoring can deliver important information for the proces of revising and redrafting existing legislation.

1. Introduction

The discussion about the use of knowledge based systems in the context of analysing legislation is generally focused on the aspect of ex-ante evaluation: the analysis of new legislation proposals before they are actually introduced. In this context knowledge based systems may be used in testing the consistency of legislation, in determining the effects of legislative changes for certain critical cases, and in predicting socio-economic macro-effects [Debrock et al., 1991]; [Bench-Capon, 1992]; [den Haan, 1992]; [Svensson et al., 1992]. The research in this direction has already lead to very promising results. Still a lot more work has to be done before we can fully make use of all the possibilities in this field.

In this paper I propose that knowledge based models of legislation can also be applied in the ex-post analysis of legislation, namely in analysing the actual application of legislation after it is put into effect. I will show that such an ex-post evaluation of legislation can give most relevant input when considering legislative changes.

The method of knowledge based micro simulation (KBMS) was developed by us for the Dutch Ministry of Social Affairs and Employment. It was originally intended as a tool for the ex-ante evaluation of legislation.

In this paper I will show how KBMS may be used to *monitor the actual application* of legislation in administrative practice. In the following paragraphs I will specifically address the use of knowledge based micro simulation with regard to two aspects of the application of legislation. These aspects, for which a need for monitoring clearly exists, are:

- The actual compliance with legislation by administrative organisations: The question if, and to what degree, existing legislation is indeed applied in practice;
- The changing of the relative empirical importance of different (sub)sections in legislation, especially the question of the frequency with which different (sub)-sections of a law are applied in practice.

Before I go into these aspects I will shortly address the history of the method of knowledge based micro simulation.

2. The method of knowledge based micro simulation: history

In previous research at the department of public administration at the University of Twente, we found that it is possible to make accurate models of legislation using a

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knowledge based systems approach [Nieuwenhuis, 1989]. In my PhD-research I investigated the use of such models in the process of gathering data and predicting the consequences of new legislation-proposals [Svensson, 1993]. It was found that it is possible to incorporate knowledge based models of legislation in a micro simulation approach. Using this micro simulation approach, a knowledge based model can be applied to a (large) sample of cases. The principle of what we call knowledge based micro simulation is shown in figure 1.

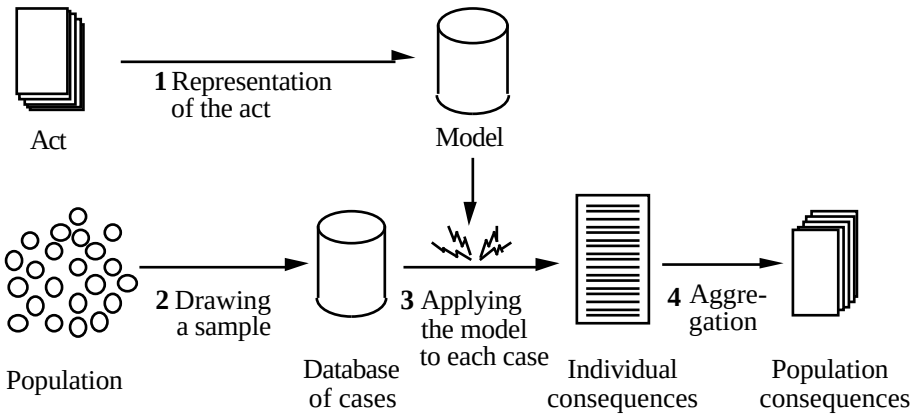

Figure 1: The principle of knowledge based micro simulation

In knowledge based micro simulation a knowledge based model of the legislation in question is applied to a sample of cases (case characteristics). Through this application the consequences of the legislation become known for each individual case. These individual consequences can then be aggregated into consequences for the total population.

In my theses I showed that using this method the consequences of legislation can be automatically computed. Two experiments in the domain of the Dutch General Assistance Act were performed. They showed a high correspondence between the outcomes of the method and the actual decisions made by the municipal offices, which administer this act. The correlation between the model outcomes and the actual decisions was found to be .95 and .78 respectively.

3. Monitoring compliance with legislation in administrative practice

As I wrote in the introduction, this paper is about the use of the method of knowledge based micro simulation for monitoring the practical application of legislation. In this paragraph I will subsequently address the problem of compliance with legislation, the current practice of monitoring compliance and the solution that is offered by KBMS.

3.1 Legislation in practice; deriving conclusions based on characteristics and rules?

Legislation, especially in administrative domains, typically consists of large sets of rules which state in which situations (under which conditions) what conclusions should be drawn (or actions should be taken). These rules are, at least in the Dutch context, often quite specific (e.g. if a person has worked more than ... years of the last ... years and becomes unemployed, s/he is entitled to a unemployment benefit for the duration of ... years; if a persons income is under ... and s/he has a monthly rent of ... s/he is given a benefit of ...).

This kind of legislation is generally conceived at a central level (e.g. the national parliament). The application of this centrally conceived legislation in administrative practice, however, is generally performed by local offices (e.g. municipal social security offices). The administrative clerks at these offices have to use the legislation in deciding individual cases.

Sometimes it may be very practical to think of legislation as a complete set of very rigid guidelines from which no departure is possible, and which is always followed. This view however is seldom correct. In the application of central legislation by local administrations there may be instances in which there are deviations from the exact rules. These deviations may be structural or incidental. Causes of incidental and structural deviations are, for example:

- there may be structural deviation from the actual legislation because:
  - the local authorities may refuse to apply certain rules (e.g. when it is felt that these rules are unjust)[1];
  - the local authorities may deviate from the given rules unintentionally (because the central rules are misunderstood);
- there may be incidental deviations from the actual legislation because:
  - a certain officer refuses to apply a certain rule to a specific case (e.g. because s/he is convinced that applying that rules will lead to an undesired result for that case);
  - a certain officer makes an error in applying the rules (e.g. because s/he forgets to apply a rule or simply because of a computational of error).

It may also happen that decisions have to be taken for cases for which the legislation does not provide solutions (for instance because the legislator has chosen not to regulate certain cases) or for which several contradicting rules apply. In such cases, in which legislation does not provide a clear solution, local administrations may have no choice but to fill the gap and make their own decisions.
It is for these reasons that the application of legislation is in practice more than just applying fixed rules to case characteristics.

3.2. Government wants to know

It is understandable that the central government is interested in the way its legislation is carried out. In this context, knowledge about local deviations from, and additions to, legislation may be most important, especially if these deviations and additions become structural.
Based on information about structural discrepancies between legislation and administrative practice, government might take action. Depending on the observed cause of the discrepancies actions that could be taken are, for instance:

- When it is found that there is a large discrepancy between legislation and practice, and that this is due to unintentional erroneous application of the legislation, there would be a point for either clarifying or simplifying the legislation, or for paying more attention to instruction of civil servants;
- When it is found that there is a large discrepancy due to intentional deviations from the legislation, it would be useful to investigate why the legislation as it stands is not accepted. Depending on the result of such an investigation it could be concluded that either the legislation is indeed not acceptable in certain circumstances (e.g. because the legislator has failed to see some practical aspects) or that the deviation is unjustified and practice should conform to the legislation as it is.

Such analysis, that would lead to adequate actions, could improve both legislation and administrative practice.

3.3. How to find the discrepancies: current practice

Knowledge about existing discrepancies between legislation and practice is important. This means that information has to be collected. How can this be arranged? There seem to be two main solutions:

- Asking the local administrations;
- Reviewing local decisions in this context.

The first method, asking the local administrations, is of course practical and may be very useful. It is clear however, that there are some problems connected with this method. First, there may be the problem of possible unwillingness to inform the government about deviations; to deviate from the legislation is one thing, but to tell the

government that you do it is another. This problem may be especially serious in the case of intentional deviation. Secondly, there is the, in my view more important, problem of the unintentional deviation. Local administrations do not necessarily know that they differ.

> A few years ago I gave a presentation about an expert system in the social security domain to employees of an administrative organisation. The expert system could apply legal rules, that were drawn from a Dutch social security law. In the process of building this system, I had been assisted in interpreting the legislation by a domain expert. This domain expert worked at the Ministry of Social Affairs and Employment and had been involved in the drafting of the legislation in question. When I was demonstrating the part of the expert system which determined the entitlement to the benefit, one of the workers of the administrative organisation argued that a certain demand the system was testing, was not in the legislation. His colleagues supported him in this.
> The domain expert from the ministry, who was present, reacted quite amazed. He told them that the demand was in the legislation, and that this always had been so; the rule that was meant to state this had been misinterpreted at the local level. The workers at the administrative organisation were also puzzled. They never knew that they were not working in correspondence with the legislation.

The second method, reviewing the administrative decisions, is therefore a necessary addition. By comparing the decisions made in practice with the decisions that should be taken according to the legislation, it would be possible to determine where legislation and practice deviate. There is however a major problem connected to this approach: before you can start to compare, *you need to know what the decisions according to the legislation are.*
This monitoring by reviewing administrative decisions is currently performed by hand. People with a vast knowledge of the field and the existing legislation visit the local offices and study the decisions made by the workers, by investigating files of beneficiaries. Among other things, they try to determine if for each case the decisions have been made in correspondence with the legislation. However, due to the fact that people with this expertise are rare (and expensive!) and due to the labour-intensive nature of this kind of analysis, relatively few cases can be reviewed in this way.
Due to these problems with the current practice, there is only a limited insight into the aspect of discrepancies between legislation and administrative practice.

3.4. Using KBMS to find discrepancies between legislation and practice
It is my view that our method of knowledge based micro simulation can help in solving this problem of monitoring discrepancies between legislation and practice. In the paragraph about knowledge based micro simulation I already mentioned the two experiments in which I compared predictions by a knowledge based model with actual decisions by municipal administrations. These experiments gave some insight in the correspondence between legislation and practice.
In view of our current problem of monitoring discrepancies between legislation and practice, the basic ideas behind those experiments should be carried further. In this context, the KBMS method may be used for two specific purposes:
- finding deviations,
- finding underlying factors.

Finding deviations; needles in the haystack
The central problem of the current monitoring practice I already discussed; deviating decisions are quite hard to find. The bulk of all administrative decisions seems to be in compliance with the legislation [Svensson, 1993]. Moreover, it may be quite difficult to recognise the cases that deviate. Therefore, finding deviating cases is a very difficult and labour-intensive task, that requires experts scrutinising large numbers of cases.
KBMS can clearly help in the process of finding deviating cases. When we collect all relevant case characteristics for a large sample of cases, together with the decisions taken on those cases, these cases can be run through a knowledge based model of the

actual legislation, to produce the legislation outcome. These legislation-outcomes then only have to be compared with the actual decisions to find the discrepancies we look for.
When an adequate model of the legislation is available, the process of gathering information, performing the simulations, and comparing simulation results with the actual decisions is a simple task, that requires little knowledge about the domain. This task can easily be performed by non-experts, thus making it possible to scan much more cases than is currently possible. Experts can then concentrate on the real interesting work of analysing the cases in which deviations occur, trying to determine the underlying causes (see figure 2).

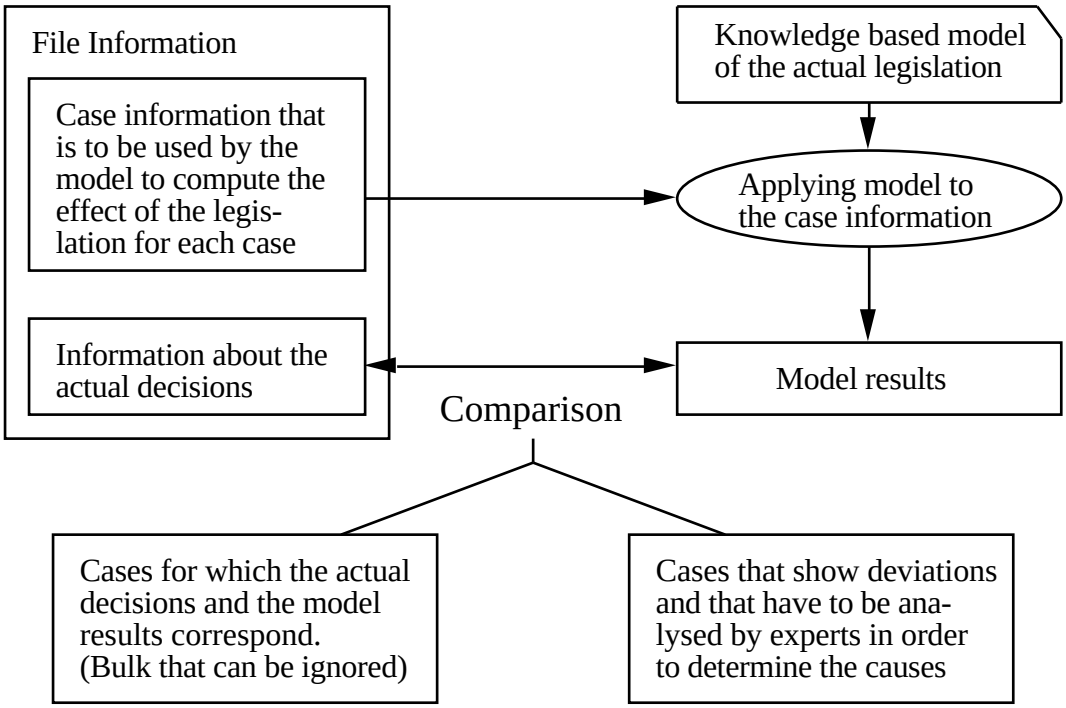

Figure 2 The process of finding deviations using KBMS

From the files of local administrations client information is collected: about basic case characteristics and about the administrative decisions. The case characteristics are used as input for the knowledge based model, which computes the individual consequences by strictly applying the rules. The actual benefit decision, made by the local administration, is then compared with the benefit that was computed by the model. Only the minority of cases that show deviations between legislation and practice have to be examined by experts.

Finding underlying factors
The method of knowledge based micro simulation will also enable us to analyse deviations to find underlying factors.
Because knowledge based micro simulation makes it possible to compare legislation and administrative practice for large numbers of cases, we can now start to analyse deviations and search for factors that explain the deviations that were found. We are also able to compare different sets of cases in order to find patterns in the deviations. We might for instance look for differences in deviations for different types of cases or for different municipalities (see figure 3). In fact we are researching these possibilities at the moment.

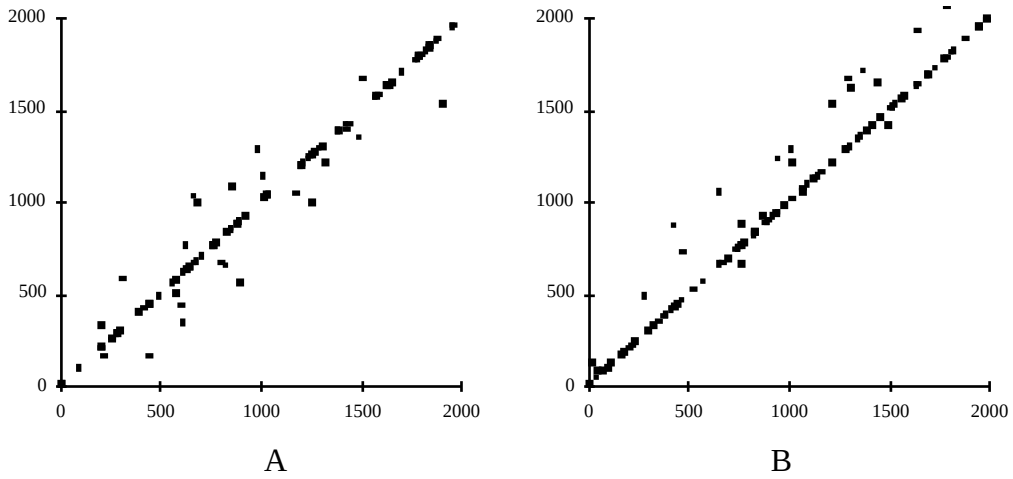

figure 3 Fictitious results: comparison of two municipalities

Fictitious results from the analysis of the administrative practice in two municipality A and B. In both diagrams the decisions on cases by the municipality (axis-Y) are plotted against the results of the knowledge based model (axis-X). It can be seen that in both municipalities there is some deviation from the legislation. In A, however, deviations seem to be random while in B almost all deviations are positive (i.e. the actual benefits given in B are structurally higher than legislation prescribes).

4. Monitoring the frequency of use of (sub)sections

The other aspect that is considered important in the context of monitoring administrative practice is the actual use that is made of the different (sub)sections of an act. KBMS can help to monitor this use of (sub)sections, and especially the changes in this use.

4.1. The use of different (sub)sections

Complex legislation consists of a large number of sections and subsections. Not all of these (sub)sections are applied to all cases: different (sub)sections apply to different cases. The frequency with which a (sub)section is applied is therefore dependent on the actual distribution of different types of cases. This distribution of case types may change in time, changing the relative importance of the different (sub)sections.

Suppose that in the beginning of the sixties two rules were introduced: one rule that was meant to give extra support to married couples that raise children, and one rule that gave extra support to single parents. At the moment of introduction of those rules the first rule would probably be of more importance, than the second (there were relatively few single-parent families then). Now, in the nineties, however, there are more single parents receiving social security benefits than there are married couples with children receiving these benefits.

In the process of steering the social security system it may be very interesting to know about such changes in the applicability of different rules. If rules are applied more frequently, they may lead to higher expenses (or savings) than was expected; and when rules are applied less frequently, their effect will reduce and perhaps even disappear. Knowledge about such changes in effects could be used to determine where changes are needed. This could lead to decisions like fine-tuning the more frequently used rules and removing or simplifying rules that are not in use.

4.2. KBMS as a method for monitoring the frequency of use of (sub)sections
The current problems with monitoring the frequency of use of subsection is comparable with the problem of monitoring deviations between legislation and practice. Again there is the problem that asking administrative clerks about the use of legislation will not be very helpful. Although these clerks are of course aware of global changes in the population of beneficiaries, they generally will not be able to tell exactly how frequently they use the different legal rules, and how important they are in their work. The analysis, by hand, of case files has again the problem of being an expert task of a very labour-intensive nature.

In my thesis I showed how knowledge based micro simulation can be used to determine the frequency with which different sections in the legislation are used. After I apply the model of the legislation to a sample of cases, I can not only aggregate on the end results, but also on the intermediate decisions that are made by the model (e.g. decisions on the eligibility, the basic amount of the benefit and the different additions to and deductions from this amount, based on different sections of the legislation). This aggregation leads to tables as shown in figure 4 (fictitious data).
The results I arrived at in an earlier experiment with real data were considered an eye-opener by workers at the ministry. I could show that some rules, which were considered very crucial in the social-security legislation and about which there had been a lot of discussion in the past, were only of importance in relatively few cases.

	Benefit base			Housing addition		Income deduction	Housing deduction
Section	3	4	5	6	10	11	10
Freq. of use (%)	22.3	72.0	4.0	5	.8	20.0	.1

figure 4 Fictitious results: the frequency of use of sections

Using knowledge based micro simulation it is possible to monitor the frequency of use of different sections in the legislation (the percentage of cases in which the rules in that section are applied). We can see that section 10, concerning a benefit deduction for persons who have no housing costs, is only used in one in thousand cases, while section 4, concerning the benefit base for beneficiaries who are single, is used very often.

5. Conclusion

What I have tried to convey in this paper is that it is important to have insight in the relation between legislation and administrative practice. One aspect of this relation is that in practice there may be deviations form the exact rules given in the legislation; another is the frequency with which the different rules are used.
In both cases it very doubtful that we can get insight in the relation between legislation and practice by just asking the practitioners. These practitioners do not necessarily know the answers themselves. The other currently available method, the analysis of case files, is not practical because it requires a lot of expertise and is very labour-intensive.
Knowledge based micro simulation makes it possible to automatically compute the results of strictly applying (parts) of legislation to case-characteristics. In the first place, these outcomes can be compared with the actual decisions to get more insight in the deviations from the rules that take place in practice. In the second place, the outcomes can give insight in the frequency with which the different (sub)sections are used.
Knowledge based micro simulation is a useful instrument in the process of monitoring the actual application of legislation. It can therefore be extremely useful in the proces of preparing legislative changes.

Pitfall

At the end of this paper I feel the need to address one serious pitfall. It could be thought that KBMS is the method to control things; that finally central government has a tool for determining the compliance of 'its' administrations with 'its' rules. In my view, this is not the case. KBMS is only a good tool *for monitoring*. If it were to be used in a more controlling context, it probably would not work. In the first place it should be noticed that KBMS only covers a part of the whole administrative process, the path from determined case-characteristics to decisions. It leaves out very important practical aspects such as the problems of determining and checking these characteristics.
Secondly if this approach were to be used in the process of increasing central control, local administrations could easily avoid problems by adjusting the basic case characteristics, rather than the decisions. Then, central government would not only have 'wrong' decisions, but also end up with unreliable data.

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Note

1. It must be stressed that in the Dutch context intentional deviations by local administrations from the existing legal rules, may be completely legitimate. In the Dutch National Assistance Act, for instance, a special section is included in which some discretional power is given to the local administrations; in some circumstances they are allowed to deviate from the general rules given in the act.

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