Feasibility Study for a Legal Knowledge System in the County of Herford

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Abstract. In this paper we present a feasibility study we conducted in a German county in order to assess the potential of a legal knowledge system in the domain of family law. The goals of this project were to describe the actual work processes, to propose optimized processes if needed and to develop a prototype. Our study was based on interviews, on two test cases submitted to clerks and on an online questionnaire. We identified potential problems both in terms of productivity and quality of administrative decisions and demonstrated that it wais possible to optimize work processes using a knowledge management solution consisting of a legal rule-based system and a knowledge-sharing component.

1 Introduction

In the 1970s, interdisciplinary research between lawyers and computer scientists began on ways to model the law and support legal reasoning [4], based on a deeper understanding of the law and legal processes. The field of legal knowledge systems has been constantly growing since. It is now possible to build models of legislation [5] and to use markup languages such as the MetaLex application of XML in order to create complex relationships between sections of legal code and to enable the use of sophisticated, collaborative hypertext systems for helping to browse, review and compare versions of draft legislation [2].

To get a good picture on best practices for development and operation of legal knowledge systems, we recommend a recent report by the Australian government that analyses advantages and disadvantages of this technology [1]. It furthermore contains the results of a large survey showing current and planned applications of legal knowledge systems by public agencies in Australia. However the field known as Artificial Intelligence and Law is much more than an applications area, it is also concerned with topics such as reasoning, knowledge representation, learning or decision-making [9].

Between October 2004 and January 2005 we made a feasibility study in the German County of Herford in Nordrhein-Westfalen in order to assess the potential of a legal knowledge system in the domain of family law. This system should allow clerks

to manage more efficiently the recovering of social benefits paid to elderly persons. In short, the state supports elderly persons that are without financial resources and, under given conditions, it has a right to ask some of this money back from the relatives (mostly the children) of these elderly people. The offices we worked with are in charge of deciding whether a child has to support financially his/her parents, and if yes, how much money is to be paid.

The goals of this feasibility study were:

- To describe the actual work processes
- To evaluate the consistency and the quality of the actual work processes
- To propose optimized work processes
- To develop a prototype for a legal knowledge system.

Our team[1] created a model of the relevant laws and regulations used in order to make such parent support decisions. We also led interviews with the clerks in order to identify their work processes and to describe how they acquire and share knowledge, as the regulations in that domain change quite often and the workers have to rely on up-to-date legal sources. Furthermore, we developed two test cases that were submitted to twenty clerks, from which ten responded. Finally we created an online questionnaire in order to find out how the respondents solved the test cases, what information and knowledge they needed and where they found it if they had to specifically research it. That was a very interesting experimentation field as the work processes were weakly formalized and as the knowledge was completely decentralized and disseminated, and not directly explicit in many cases. Indeed, the clerks have to interpret regulations in order to make a decision, and formalizing this process can be quite difficult.

2 Actual and Optimized Processes

In order to describe the actual work processes we used a conceptual framework called MIMIK (Method and Instruments for Modeling Integrated Knowledge) [6]. It consists of 8 types of diagrams, most of them being inspired or directly taken from existing modeling techniques and particularly UML [3]. The goals of MIMIK are to identify:

- Strategic goals of an organization
- Actors and roles
- Knowledge resources
- Processes

[1] This project was led in cooperation by FOKUS, the County of Herford and the Fachhochschule für Öffentliche Verwaltung Nordrhein-Westfalen (FhöV). The FOKUS team was made of Thomas Gordon, Dirk Arendt, Olivier Glassey and Jonas Pattberg. The County was represented by Paul Bischof, Marion Ziemens and Michael Borgstedt; Monika Müller acted as legal expert on behalf of the FhöV, along with independent consultant Rainer Fisher.

- Interactions between these elements.

As in UML or other modeling tools, it is not necessary to use all models in order to provide a good representation of reality. In order to model the domain with the clerks and the legal experts, we worked mostly with text scenarios and developed simple graphical models. However this simple visualization technique allowed us to validate the models we created and to show clearly the optimized processes we proposed. On the basis of validated abstract diagrams, it becomes possible to develop detailed models at the operational level. We will show some of these models as we go along the paper and illustrate them with examples from the Herford feasibility study.

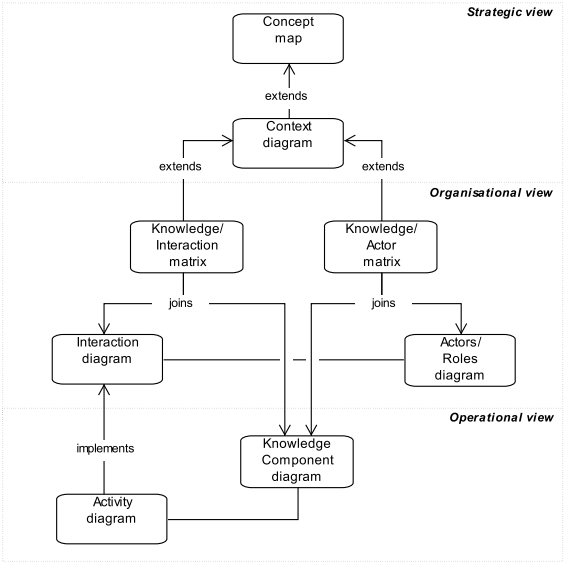

Figure 1. Metamodel of the MIMIK framework and formal relations between diagrams: knowledge-interaction matrices formally link knowledge components to the interactions that implement a use case; knowledge-actor matrices create a formal relation between knowledge components and real actors within an organization

Concept maps are the top-level diagrams and show the strategic goals of an organization in terms of functions or processes (Fig. 2). Let us mention that the metamodel of our framework is in itself a concept map. These concept maps can be decomposed in several levels, a terminal node of this type of diagram is implemented by a context diagram.

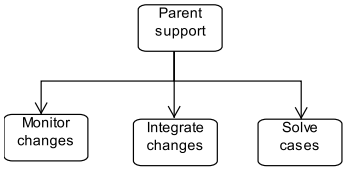

Figure 2. Concept map showing strategic processes for "Elternunterhalt" (parent support): monitoring the changes in law and regulations, integrating these changes into the daily work of the organization and handling the actual parent support cases

Context diagrams (Fig. 3) are almost exactly the same as use cases in UML, but we added the concept of knowledge packet. A knowledge packet is an abstract representation of a set of knowledge components. These components encapsulate documents, databases, files, implicit knowledge and so on. They provide metadescriptions for "knowledge units" and are implemented with RDF (Resource Description Framework), a W3C standard for defining metadata and encoding machine-readable semantics. RDF is based on XML and uses graph theory. However in MIMIK diagrams, knowledge packets and knowledge components are only represented with a graphical stereotype and allow us to show what type of knowledge is necessary in order to complete a process and which knowledge is relevant in a given context.

Figure 3. Context diagram showing how clerks monitor changes from various legal sources

For the first mission (Fig. 3) we found out that the clerks who answered the online questionnaire used legal texts and databases extensively, including case law:

- The majority of the clerks (75%) uses legal texts weekly, the other 25% use them once a month or less.
- They all read various specialized publications in the domain of social welfare. 65% of the respondents read these several times per month.
- They all (except one) take part in training seminars about once a year.
- 40% of their work time is dedicated to doing legal research for particular cases, reading legal journals and publications and calculating the amounts of money the relatives have to pay.

However, each clerk is doing it his/her own way and using different sources (up to 20 different legal sources). Furthermore, there is absolutely no structured or formalized sharing and integration of this knowledge. For example, different units at the communal and district levels develop their own forms and spreadsheets tables in order to acquire data from the potential social beneficiaries and to calculate the amounts of money their relatives might have to pay. In some cases, clerks only share knowledge

with their colleagues during informal discussions on the phone or at the coffee break and only a handful of them use email to share their specific domain knowledge. The only "formal" knowledge acquisition activity consists of an annual continuing education seminar.

We believe that these tasks could really be optimized with the use of knowledge management technology. Furthermore the IT infrastructure is already in place: although most workers only use word processing tools, they all use email and most of them also have Internet access. Our idea for process optimization (Fig. 4) was to select one or several clerks that would have the formal responsibility to monitor the changes in the legal sources and to publish these changes using the prototype that we will present in the next section.

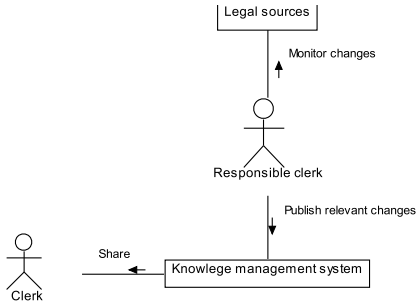

Figure 4. Collaboration diagram showing optimized processes for monitoring and publishing changes

On the other hand the actual work processes describing how the cases are treated and decisions are made were rather formal, although implicit. With the help of clerks we were able to define how they conducted interviews: Fig. 5 shows the general approach they use, but we also developed detailed interaction and activity diagrams.

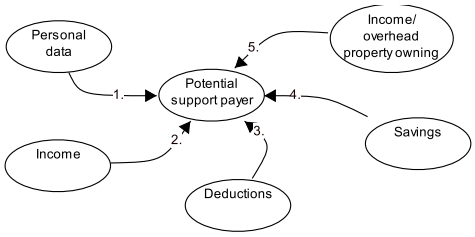

Figure 5. Normal interview sequence, such as described by the clerks

As mentioned in the introduction, one of the goals of this feasibility study was to evaluate the quality and the consistency of the work processes: we developed two test

cases that were solved by 10 clerks. We will not present the detailed results here, only a few key points:

- Between 75% and 79% of the respondents
  - found that the cases were clear, well formulated and realistic
  - said they understood what they were expected to do
  - believed they had all the necessary information in order to solve the cases
  - agreed that they had enough knowledge and support tools to solve the cases
- However 44% of them said they had problems to solve the cases and
  - in case 1, 20% of the solutions were not defensible and the respondents needed an average of 152 minutes to solve it
  - in case 2, 33% of the solutions were not defensible and the respondents needed an average of 162 minutes to solve it.

Many answers given to us by the respondents were different from the solutions provided by experts mentioned in the introduction, but after verification, some of them were legally defensible given often changing regulations and various interpretations of these regulations.

	ML	B 1	B 2	B 3	B 4	B 5
Gesch. Ehefrau	0.00	0.00	0.00	0.00	0.00	0.00
Sohn A	273.00	375.00	348.60	272.00	0.00	375.00
Sohn B	200.00	199.00	170.40	137.50	0.00	138.00
Tochter C	0.00	0.00	81.00	87.50	0.00	0.00
Zeit		60 min	75 min	150 min	120 min	75 min

	B 6	B 7	B 8	B 9	B 10	Demonstrator
Gesch. Ehefrau	0.00	0.00	0.00	0.00	0.00	0.00
Sohn A	375.00	272.00	273.00	272.73	305.00	272.73
Sohn B	183.33	199.00	200.00	0.00	224.00	200.00
Tochter C	0.00	127.00	127.00	127.27	71.00	0.00
Zeit	120 min	120-150 min	150 min	150 min	225 min	

Figure 6. Case study 2: the ML (Musterlösung) column shows the solution of the legal experts, B1 to B10 list the responses of the participants and the Demonstrator column presents the answers provided by our prototype (in Euros)

In order to avoid indefensible results and to speed up the case resolution process, we proposed a legal knowledge system where legal experts and computer scientists would model and program legal rules on the basis of legal sources and where clerks would use this up-to-date and coherent legal knowledge system (Fig. 7).

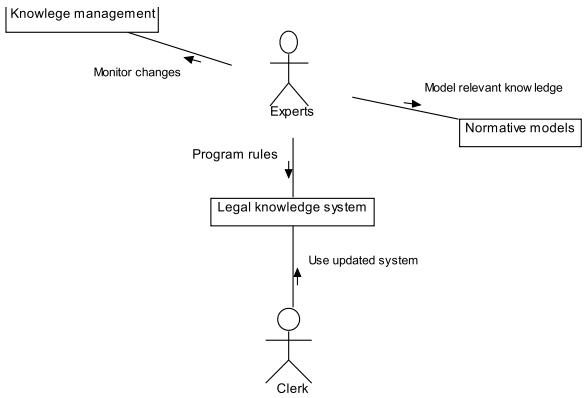

Figure 7. Collaboration diagram for the general architecture of legal knowledge system

Finally, let us mention that the knowledge-based solution we proposed also had organizational consequences, which we will present in another publication. Here we will only describe briefly the prototype we developed.

3 Prototype

This prototype is based on two different tools: a legal rule-based system to support the resolution of the cases and a knowledge-sharing system.

Legal rule-based systems require and use one or more computer models of the relevant legislation. In our case the prototype was written with software called StatuteExpert, a rules engine platform developed by an Australian firm called SoftLaw. Specialized for government, this platform can integrate large bodies of complex legislation, regulations, policy and administrative procedures. Its end-user interface is a simple web browser. In the United Kingdom, the Assert rule-based system was been developed using SoftLaw's technology, to help low income citizens to assess their entitlement to a range of housing benefits from several different government social programs. Nearly 700 pages of legislation have been modelled in the Assert system, in a knowledge base consisting of about 7,000 rules.

Our prototype currently includes about 200 rules created from the legal model defined by the project's team. It enables users to decide whether someone is obliged to pay parent support and to decide who has to pay what (for example in the case where several brothers and sisters have to pay different amounts of money depending on their financial situation). This system also offers online help for each question that a user might have during the process of solving a case.

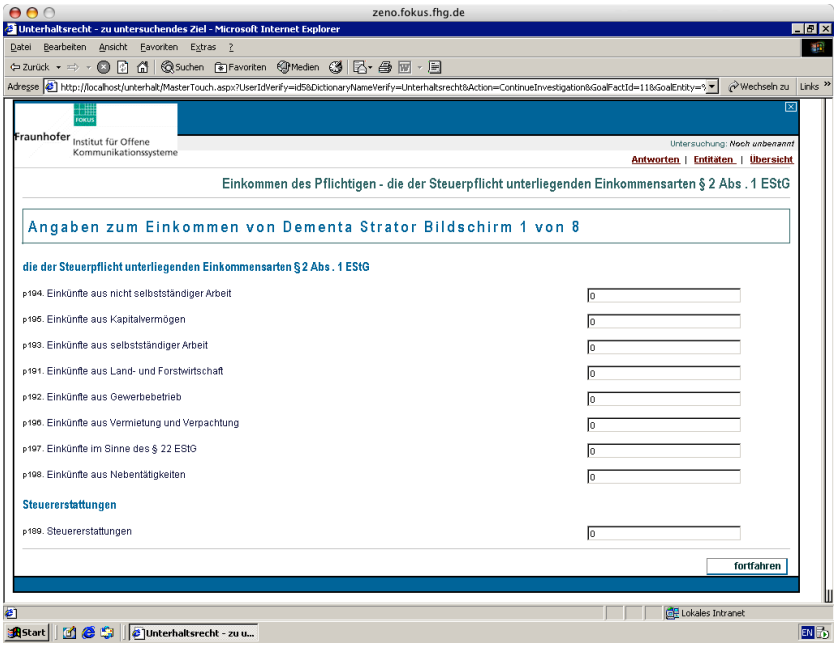

Figure 8. Depending on the answers already given, the system only asks relevant questions to its users

The demonstrator is able to completely and correctly solve both test cases, and we estimated that a clerk using it would need between 30 and 60 minutes to solve each of these cases (as opposed to 152 and 162 minutes on average for the clerks that took part in our survey).

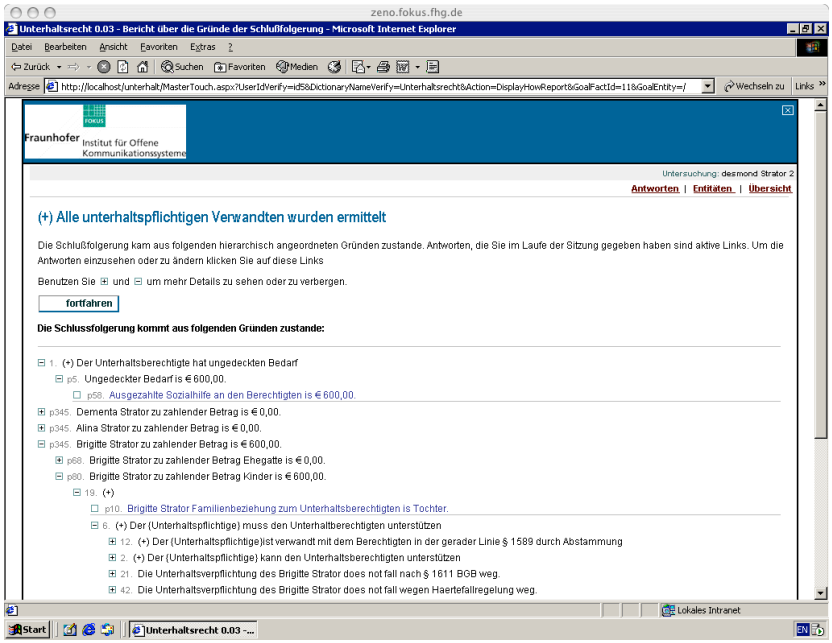

Figure 9. Generation of reports for each decision and explanations based on facts

In order to develop a prototype for sharing knowledge, we first worked on a general architecture based on RSS. RSS is a family of XML file formats for web syndication. This acronym has several interpretations: Rich Site Summary, RDF Site Summary or Really Simple Syndication. The latter is currently the most commonly used, as RSS provides “items” containing short descriptions of web content together with a link to the full version of the content. This information is provided as an XML file called an RSS feed. In order to access these feeds, users rely on applications called feed readers that check RSS-enabled Web pages and retrieve any updated content that it finds. Websites featuring RSS feeds include The New York Times, The Wall Street Journal, BBC, news.com, Liberation, etc. RSS is not only used as a news aggregator, it is also widely implemented in the weblog community in order to share the latest weblog entries. A weblog (or blog) is a web application with periodic posts on a common webpage. Blogs are used to maintain individual diaries, to follow political campaigns, to broadcast various types of media, to support communities of writers, and so on. It is already a quite popular technology: according to a Pew Internet and American Life Project survey [8], there were 8 millions bloggers in the United States at the beginning of 2005 and 27% of Internet users say they read blogs. Furthermore [7] showed that RSS can be used for public participation platforms, for example to facilitate public consultation, deliberation, participation or “engagement” in policy-making processes such as urban planning. For a good starting point on RSS we recommend [10].

The prototype used existing services to publish knowledge: Blogger.com, a weblog platform owned by Google, Feedburner.com, a free post-processing service that allows publishers to enhance their feeds, and Bloglines.com, an online feed aggregator.

End users can publish new knowledge via a Web interface or a simple email sent to a dedicated address. This requires no specific knowledge (other than being able to send an email), the input text is automatically transformed in an RSS feed by the system. However a "moderator" with basic knowledge of content management systems can validate this new content before it is available to anyone, as Blogger offers the possibility of publishing only validated content. In our Herford example, clerks could notify their colleagues when they have found a new piece of knowledge in legal databases, online law commentaries, or when they have themselves implemented a new form or a new calculation formula. A moderator could then validate or complete this knowledge published by a clerk. All clerks could then rely on this knowledge in their daily work, as it would have been validated by a "domain expert". Furthermore, specific thematic RSS feeds can be defined: users can then choose precisely what knowledge they want to receive.

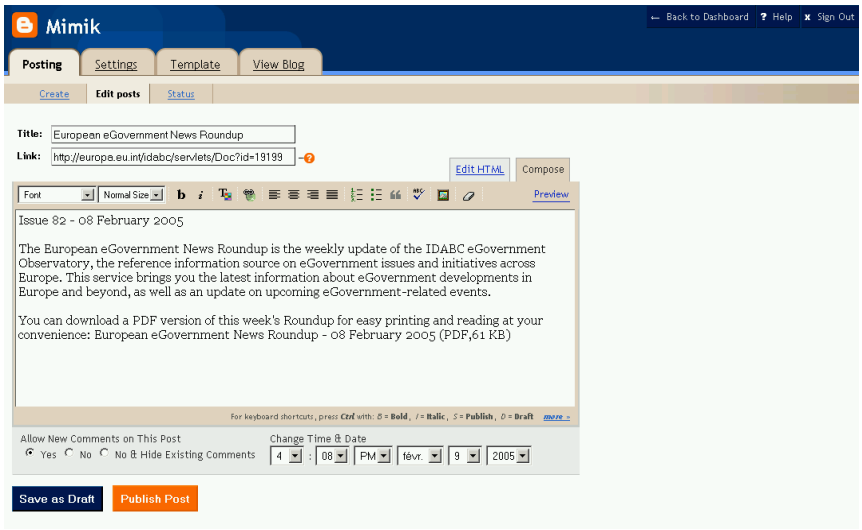

Figure 10. End users can publish new knowledge via the Web interface provided by Blogger

Once new knowledge has been published, it can be used in very flexible ways. Users can simply visit the Web page of the blog, but they can also use Web aggregators such as Bloglines.com or even their own email client. This last point is at the moment still very important, as the Internet and American Life Project survey mentioned above stated that only 5% of Internet users rely on dedicated aggregators to get RSS feeds. RSS aggregators and, to some extend, email clients offer powerful content management capabilities, such as filters to limit access to only relevant content: a user

can for example subscribe only to feeds that aggregate content on social welfare issues and limit this to parent support, they can furthermore implement filters stating that all feed elements not concerning the Land of Nordrhein-Westphalien are to be deleted. This is very useful to avoid information overflow, that is to limit the risk that the users will not read the feeds anymore because they receive to much irrelevant information.

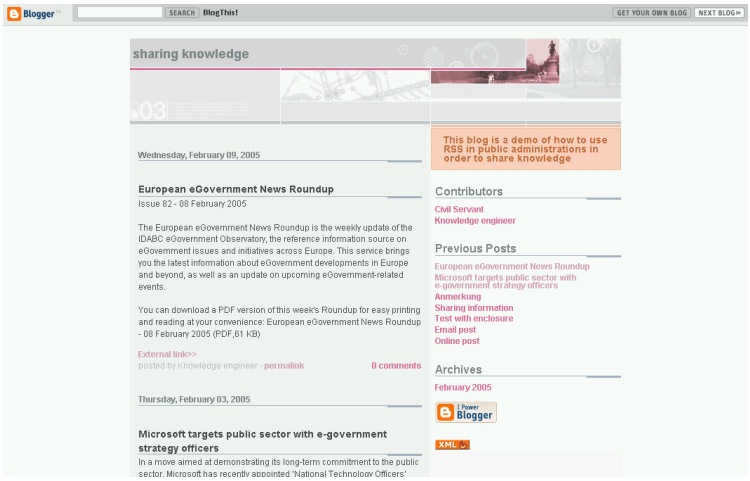

Figure 11. Web page for sharing content

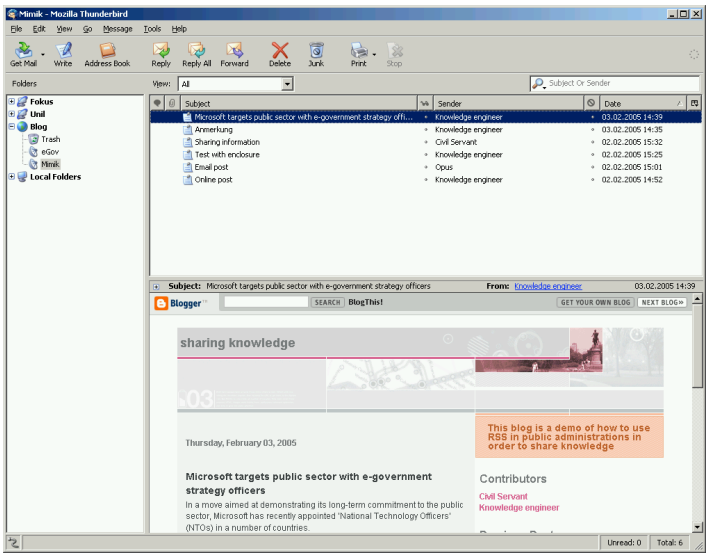

Figure 12: RSS content in Thunderbird email client

RSS feeds support “enclosures”, which allow the addition of any type of multimedia files, similar to an attachment in an email. Thus we added this functionality to our prototype: it can be used to share automatically new documents, new files or any new piece of digitalised information. With an advanced RSS reader, it becomes possible to check periodically (once a day, every week, etc.) selected feeds and to download relevant documents automatically. The user is notified when new information is available. Our prototype is functional and can be accessed at http://mimik-demo.blogspot.com/. It offers flexibility for both publishers and readers, it supports basic moderation, it provides automatic notification when new content is published and moderators have the possibility to create thematically aggregated content. However Blogger’s features in terms of user rights management, content validation and security are quite limited, therefore we are currently testing several dedicated blogging platforms, as well as complete content management system supporting RSS.

4 Conclusion

This study showed that there were potential problems in the domain of parent support in the County of Herford, both in terms of productivity and quality of processes. We also established that it was possible to optimize their work processes, notably by using information and communication technology and introducing a legal knowledge system. Moreover our legal rule-based prototype demonstrated the feasibility of modeling and implementing relevant laws and regulations with an acceptable amount of effort.

However a complete survey would be necessary in order to quantify improved productivity and quality and to evaluate potential cost reductions:

- Detailed cost analysis for actual work processes: how much time is needed on average to solve real cases? How many cases are solved a year and with which resources? What does it cost to Herford administration and what does it represent in terms of revenues?
- Detailed cost estimations for optimized processes: how much would the development of a real system cost? How much would necessary training and maintenance cost?

Fraunhofer FOKUS and the Herford administration are currently planning a follow-up project. Moreover we plan to test RSS technologies for knowledge sharing in public administrations and to investigate issues such as security, privacy, quality and reciprocity of contributions.

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