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Supporting Knowledge-Intensive Work in Public Administration Processes

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Knowledge management efforts focus much on the strategic applications of knowledge-related initiatives and not so much on their implications at the level of concrete business processes. On the other hand, business process management efforts have not concentrated on leveraging knowledge. In this paper we attempt to fill that gap by developing a tool for proactive, context-sensitive delivery of knowledge. We focus on the modelling of knowledge-intensive business processes and we develop a framework for modelling this type of processes that explicitly considers knowledge-related tasks and knowledge objects. We present a tool that is an implementation of our theoretical meta-model and realises proactive, context-sensitive delivery of knowledge, integrated with the workflow enactment. As an example, we sketch one case study, the process for granting full old-age pension as it is performed in the Greek Social Security Institution, discussing the benefits derived from applying our tool. Finally, we draw the main conclusions of our work and discuss further research directions. Copyright © 2003 John Wiley & Sons, Ltd.

1 INTRODUCTION

In most knowledge management efforts, an emphasis is given to the strategic applications of knowledge-related initiatives and a focus on creating the right culture and organizational structure that facilitates knowledge sharing and enables knowledge leveraging (see e.g. Davenport and Prusak, 1998). However, the approaches that focus on knowledge management at the business-process level are limited (see e.g. Wiig, 1995) who claims that 'knowledge-related perspectives need to be part of BPR'.

On the other hand, most business process management efforts have not focused much on leveraging knowledge. This is indeed critical, considering that knowledge is treated more and more as a principal success factor—or the major driving force behind business success. Moreover, although business process modelling tools and/or workflow management systems support in an adequate manner the modelling and enactment of business processes, they lack any support for knowledge-related activities.

From the above, it becomes clear that an approach that explicitly integrates knowledge management activities into the business process environment is missing.

In the present paper we attempt to fill that gap by developing and testing an IT tool for proactive, context-sensitive delivery of knowledge in such processes. Our work builds on the artificial intelligence approach to organizational memories

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(Abecker *et al*., 2000; Reimer *et al*., 2000) and extends the work of other researchers in the field of integrating organizational memories with workflow management (Staab *et al*., 2000; Van Kaathoven *et al*., 1999). The main extension is the explicit treatment of the knowledge intensive, weakly-structured character of some decision-oriented processes in public organizations (Abecker and Mentzas, 2001). Our modelling tool extends the formalisms used in most existing business-process modelling tools (Yu and Wright, 1997) supporting in an integrated manner the modelling of knowledge-intensive business processes and domain-knowledge structures.

The paper presents the application of our tool to a knowledge-intensive business process of the largest Greek Social Security organization. We have selected the process of granting full old-age pension to insured people, which is, to some extent, a straightforward and well-defined business process. Nevertheless it contains critical knowledge and document-intensive steps for obtaining a decision (see Wenger (1998) for similar forms-based knowledge-intensive processes). In the case we examine, the steps of the process are often done under uncertainty, they are influenced by many legal regulations, and they are vital for the correct result of the process.

The paper is structured in the following manner. Section 2 outlines the requirements for an IT system that supports knowledge-intensive business processes and provides a survey of research undertaken in the same area, while Section 3 illustrates the developed modules of our tool. Section 4 pinpoints the relationship of our solution to public administration processes and describes its application to a specific social security business process discussing the derived benefits. Finally, Section 5 outlines the conclusions of our work and discusses some directions for further research.

2 SUPPORTING KNOWLEDGE INTENSIVE PROCESSES

2.1 Requirements for IT systems

The starting point of our work is that an analysis of knowledge work (Buckingham, 1998; Davenport *et al*., 1996) shows that knowledge-intensive business processes tend to be characterized by dynamic changes of goals, a fluid information environment, unexpected constraints, and highly individual and *ad hoc* communication and collaboration patterns. Moreover, knowledge generation and application plays an important role. Such business processes have to be analysed from a knowledge management perspective and knowledge management activities should be integrated into daily work. IT support of this type of work seems difficult to achieve but is nevertheless desirable.

Workflow-management tools that are usually used for supporting automation in office work present limitations that restrict their usability in the environment described above. Traditional workflow-management systems facilitate the modelling and execution of complex processes but they exhibit major limitations when confronting adaptability issues and support for knowledge-related tasks. The reason for this is that current workflow approaches are not flexible enough to adapt to changing processes while these are being executed. Moreover, the knowledge needed for executing the processes is not explicitly described in the workflow model.

A tool that supports knowledge-intensive processes should extend the complexity supported by workflow-management systems with context-sensitive information management. This means that we should be able to provide the user with contextually selected, task- and user-specific background knowledge. In detail, we should be able to couple the workflow tool with other systems in such a way, that it will be possible to access the required knowledge in an optimal manner. Ideally, the notion of context provided by the workflow system—which 'knows' what the user is currently expected to do, what he did before and what he will do after this task—should be employed in order to optimally incorporate the external tools, e.g. by accessing an information retrieval (IR) system already with the correct search request, or starting a collaboration tool already with a connection to the person who is known (e.g. from the yellow pages system) to be knowledgeable in the topic in question. In this way, users engaged in their daily work routines have not to spend much time and effort in knowledge and information management activities additional to their operative ones. Instead, the system will realize autonomous KM services at the desktop.

Another starting point is the observation that explicit knowledge relevant for a specific task or decision is normally spread over many different kinds of documents, forms, legislative texts, etc. Project teams in knowledge-intensive business processes are used to dealing with huge amounts of information. Lessons learned in previous engagements, insights from prior projects, notes for subsequent process steps are scattered among manifold 'knowledge containers', from the personal memory, over paper, to different electronic systems. Even if there are mechanisms to explicitly capture

and store bits and pieces of 'best practice', these are seldom used in a coordinated manner and, at best, take into account document content, but not so much document context, i.e. neither the creation situation nor the potential usage situation. On the other hand, business processes are a context-giving, structuring element prevalent in a company, often even formally modelled for some purpose such that it would make sense to exploit the usage of business processes to organize knowledge archives. The goal would be to enable context-sensitive storage, more purposeful access to information, and better integration with the process-oriented, day-to-day work of the employee with the knowledge system. The next section outlines the related research efforts that are trying to address the requirements already mentioned.

2.2 Survey of related literature

In many KM systems there is no explicit notion of business processes while there is some kind of knowledge-related processes support. On the other hand, in many business process-management tools or workflow-management systems the modelling and the enactment of business process are well supported. However, these systems lack the support for knowledge-related processes.

The importance of the combination of business processes with knowledge management tasks is underscored by the knowledge-value-chain approach proposed by Weggeman (1998). His knowledge value chain is a continuously repeated process which is composed of six knowledge-management tasks at the operational level: identify the required knowledge, document the available knowledge, develop, share, apply and evaluate knowledge. These tasks are linked to the strategic level (mission, vision, goals, strategy) and the business process named primary process such as order handling, for instance. Nevertheless, his approach does not provide a well-developed method of how to integrate the knowledge-management activities mentioned into the primary process either.

The links between the design of business processes and knowledge management are also stressed by Heisig (2000). He presents an approach to analyse the business process from a knowledge-management perspective and tries to integrate knowledge management activities into daily business. Starting from the selection of the business area and business process, every task—which is considered to be a knowledge processing task—is assessed through its function and contribution to the core activities of knowledge management (i.e. generate, store, distribute, apply knowledge) resulting in a knowledge activity profile which shows the level of support provided by the operational task towards the core process of knowledge management. The business process is improved by closing identified gaps and by sequencing the core task of knowledge management.

The model-based knowledge-management approach proposed by Allweyer (1998) adds a new perspective to the modelling of existing business processes, especially of knowledge-intensive processes. Knowledge-management activities are considered as an integral part of existing business processes. The four-level architecture of business-process management is adopted for knowledge management and the method is renamed knowledge-process redesign. The approach aims to the description of required and used knowledge as well as generated and documented knowledge. Knowledge is understood as information in context with value for the owner of this information which allows him/her to act. The approach claims to support the structuring of knowledge into categories and the construction of a knowledge map to locate who knows what inside the organization. Easy-to-understand pictograms are proposed to help users describe the use of documented and tacit knowledge within their business processes. The approach does not make explicit how to integrate the knowledge-management activities into business processes and does not provide any criteria to analyse and improve the knowledge processing within the business process.

The idea of interrelating knowledge management processes (KMPs) and business processes is a main topic of the EU project PROMOTE (Karagiannis and Telesko, 2000). Their method consists of five steps: (1) strategic decisions/the awareness phase; (2) KMP analysis; (3) KMP and OM modelling; (4) specification and implementation; and (5) evaluation and continuous optimization. In PROMOTE, a knowledge builder is developed allowing users to model KMPs describing the knowledge flow in the business process. Business process models are used to define when to access the OM and KMP processes are used to define how to access the OM. However, KM activities and BP tasks are not explicitly integrated in the modelling phase.

The usage of ontologies in order to provide task support in a business process is a topic of the task-based process management project (Macintosh, 1999). The TBPM system provides intelligent support for the management of complex, dynamic processes through the use of artificial intelligence techniques to represent, and reason with, knowledge about the domain in which a workflow

system is deployed. A key component of the TBPM system is a plan library, which maintains a database of process structures, relating each structure to the types of tasks for which it is a suitable method. Each plan specifies a set of tasks, together with the ordering constraints and object flows between them. Thus, a plan represents one possible way of achieving a given type of task by breaking it down into a particular structure of subtasks. Central to the knowledge-based approach of TBPM is the development of a number of interrelated ontologies for structuring knowledge of the domain and processes of interest.

Ontologies have also proved to be the right answer to structuring and modelling problems by providing a formal conceptualization of a particular domain that is shared by a group of people in an organization (O'Leary, 1998).

From the above it becomes clear that there are similar approaches that cover parts of the requirements for supporting knowledge-intensive business processes as outlined before. However, what we propose is still missing: a tool that explicitly integrates knowledge-related tasks into the business process and proactively delivers to the user context-sensitive knowledge from a process-oriented structured archive. In the following section we present our proposed solution that addresses these issues.

3 MODELLING AND ENACTING KNOWLEDGE INTENSIVE PROCESSES

In this section we describe the technical solution that meets the requirements mentioned in the previous section. The proposed solution consists of a tool for modelling knowledge-enriched business processes with associated information needs and for modelling domain knowledge structures and a workflow engine that enacts the modelled processes and interacts with intelligent agents that play the role of the information assistant, observing the running process, interpreting the information needs and offering context-sensitive knowledge storage and retrieval.

In the proposed solution we employ formally modelled business processes as an ontology that can be used to specify the creation, or the potential usage context, or both, for a given knowledge item. This leads to the idea of a *process-oriented structured archive*, a meta-information system providing conceptual structures to access the underlying legacy systems.

To achieve the goal of *active knowledge delivery and storage*, we employ a workflow-management system as the host, which is aware of the specific tasks to be performed by the user at a given point in time. *Weakly structured workflow models* represent knowledge-intensive work routines which are usually not so strict and predetermined as, for example, administrative workflows. *Enriched workflow models* describe information flow in the process and information needs for specific tasks. An *information assistant* observes the running workflow and interprets modelled information needs to offer active support from the process-oriented structured archive; further it maintains a notion of information-retrieval context using the additionally modelled information-flow variables, which allows for more precise queries to the archive. Task context can also be used for information storage to describe the creation context of a given knowledge item.

3.1 The business process knowledge modelling tool

In brief, the business process knowledge modelling tool is built upon the DHC CognoVision® tool (Müller and Herterich, 2001) for document and metadata handling and the MS Visio® tool. CognoVision® is a document-based knowledge archive that creates a logical encapsulation of information objects (documents, web pages, etc.), manages metadata and the attributes of these information objects and allows for structured views and intelligent semantic links among the information objects. CognoVision® is the basis in our solution for the development of the process-oriented structured archive, while the integration of CognoVision® with MS Visio® is used for modelling the business processes.

Conceptual framework for modelling knowledge-intensive processes

In order to model knowledge-related tasks and knowledge objects within weakly structured business processes on a conceptual level, we construct a workflow meta-model that emphasizes the coherence between them (Papavassiliou *et al*., 2002). The proposed meta-model is depicted in Figure 1.

A knowledge-intensive business process is defined in a workflow model. The workflow model consists of tasks and their interdependencies. Each of these tasks can be decomposed into (sub)tasks, which in turn can represent a whole workflow.

We distinguish two types of tasks in the workflow model:

- *Normal tasks* (from now on they will be called tasks), which describe the structured work in a business process; and

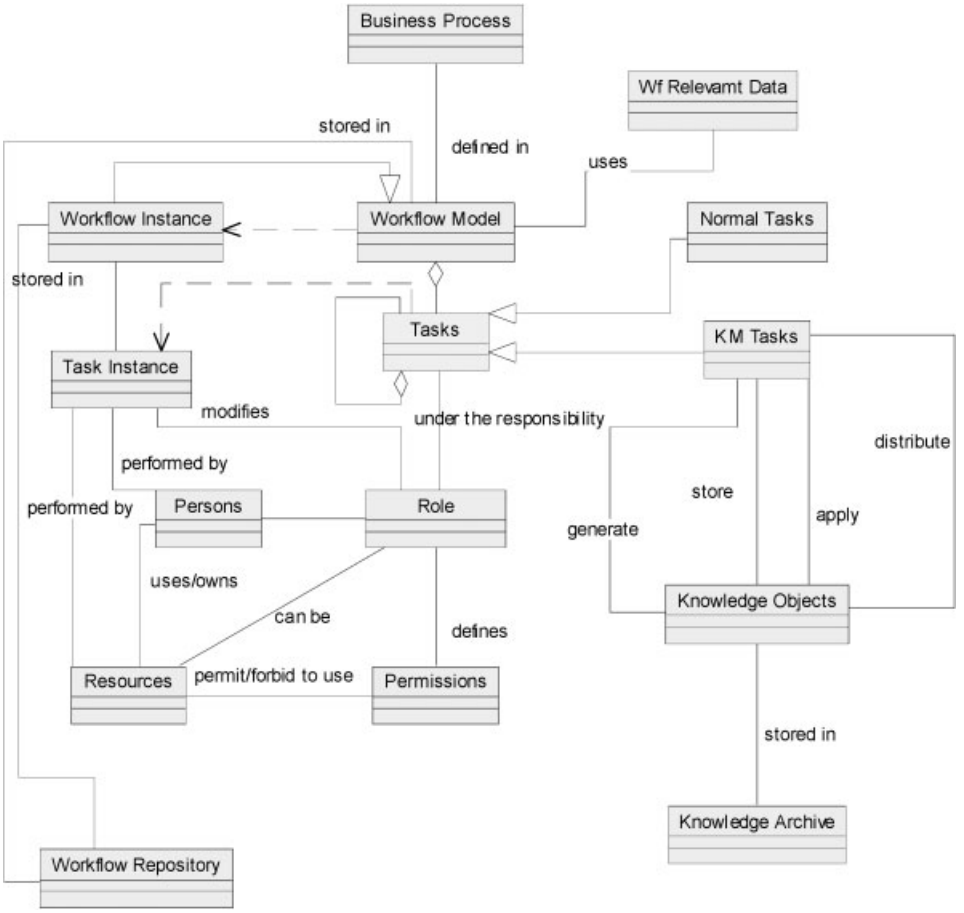

Figure 1 Workflow meta-model using UML notation

- *Knowledge management tasks* (they will be called KM tasks), which describe work associated with the generation, storage, application and distribution of knowledge in the business process.

Both tasks and KM tasks of the workflow model are assigned to roles during modelling. Each of these roles has a set of associated permissions regarding the usage of the organization's resources (tools, applications, etc.).

A detailed planning of the work to be done in knowledge-intensive business processes is quite difficult to be achieved in advance. To deal with this observation, in our solution under-specified modelling is allowed. The workflow model can include tasks not completely specified in form of a hierarchically ordered set of black boxes. The specification of such tasks can be completed during run-time with more detailed information.

During enactment time, the workflow model is instantiated. The workflow instance consists of the instances of the tasks and KM tasks. A *task instance* is a copy of the task model plus a reference to it and is under the responsibility of an organizational entity. The actual performer of a task can either be human (employees) or software and they are matched to the roles of the model so that the appropriate actor is selected to perform a specific task.

Modelling modifications can be made to a running task instance. Any possible modification influences only new task instances, but since the changes of the model are getting logged to the workflow audit repository they can be proposed to running instances.

Knowledge-enriched business-process modelling

Our modelling tool incorporates the theoretical aspects of our framework. It is realized as a set of related modelling methods for Microsoft Visio® 2000 integrated with CognoVision®. This integration maps the MS Visio® modelling constructs to structuring elements in CognoVision®. Thus shapes in MS Visio® become information objects in CognoVision® and edges connecting shapes become links. The models developed can later be enacted using the workflow engine. For enacting the models, all the information needed is stored as attributes of these information objects and links. Information needs for specific tasks are modelled

using an agent-description statement which is interpreted by the workflow engine as a call to a specific agent.

The basic modelling constructs that are provided for the design of the business process include:

- *Tasks*: a task represents the structured work in the business process that has to be done to achieve some objectives.
- *Knowledge management tasks*: KM tasks are used to describe the work associated with the generation and application of knowledge in the business process. The execution of a KM task may contribute to the successful performance of a task.
- *Task interfaces*: a task interface is a special kind of task used to connect two different models.
- *Automatic tasks*: an automatic task describes work that can be done without any user interaction.
- *Events*: events are used to trigger the execution of tasks.
- *Connectors*: they are used for modelling complex flows in the business process.
- *Data objects*: they describe variables used in the model to control the flow of the business process when executed by the workflow engine.
- *Knowledge objects*: knowledge objects represent the explicit knowledge required in a specific business process. Knowledge objects facilitate and leverage knowledge creation and sharing activities by providing humans with the information they need. They facilitate the knowledge transfer from person to person or from information to person and are used to search, organize and disseminate knowledge content. Knowledge objects serve as input for tasks and KM tasks in the business process model and they are produced as output of KM tasks.
- *Roles*: tasks and KM tasks are assigned to roles during the modelling of the business process. They describe the entity that can, and is allowed to, perform the specific task.
- *Persons*: persons describe real employee-users of the tool. If the business process model is enacted, persons are playing the roles that have been modelled.

Tasks are connected with events using control-flow elements (sequence, and, or, xor) forming event-driven process chains (EPCs). EPCs are extended by links to other relevant entities. In this way, tasks can be connected: to input and output data to model the data flow in the process; and to knowledge objects to model the information flow. The control flow of the business process is modelled using sequences, splitters and joiners. With the sequence-flow element, it is possible to link two tasks sequentially. More interesting are the split-join constructions that allow a path in the process to split into multiple parallel branches. It can be specified that such parallel branches all have to be executed at the same time (and-split), that only one (xor-split) or some (or-split) of these branches have to be executed.

In order to support in an integrated manner the modelling of those activities in the business process that are associated with the creation and application of knowledge, we extend the EPCs with additional tasks, the knowledge management tasks. The usage of these tasks is twofold.

First, they are used to model the automation of some knowledge-related tasks in the business process, e.g. to offer active retrieval of information necessary for the user in order to perform the tasks at hand. This is achieved by linking the modelled tasks with context-variables. These variables are the communication channel between the business process model and the intelligent agents that will perform the information retrieval when the business process is enacted by the workflow engine.

Second, they are used to extend the business process by adding KM tasks in order to introduce new, or close existing, knowledge-processing loops—for instance, when it is observed that somewhere in the business process some knowledge is generated which can be applied in a later step of the process. An example is the storage and the retrieval of the lessons learned from a task instance.

Besides the business-process model, the user of the tool is able to model a responsibility diagram. This diagram associates the roles that have been assigned to the tasks of the business process with real employees and it can be used as input to the workflow engine in order to assign tasks to real users.

Ontology modelling

The three central concepts that comprise the constructed ontology are *kinds, characteristics* and *relations*. There already . . . exists a straightforward mapping of these concepts to specific elements of the tool: *kinds* are mapped to *structure units, characteristics* are mapped to *definable attributes* and *relations* are mapped to *links*.

Taking into account this mapping, *structure units* are used to hierarchically structure the information, *definable attributes* to identify the properties of each *structure unit* and finally *links* to represent not only the relations holding between *structure units* but also the way to link to respective information/knowledge sources (e.g. MS Word documents, Adobe Acrobat documents, html files, etc.).

Thus, the process-oriented knowledge archive for the selected business process is created.

3.2 Enacting the business process

The workflow engine that enacts the modelled business process and proactively offers information from the knowledge archive has been implemented as a Client–Server application with a web client provided to the end user with the help of dynamic HTML. The Web-client accesses the server which hosts the CognoVision® tool and the workflow engine. All functionalities are rooted in a relational database management system that guarantees scalability, data security, transaction services, etc.

From the point of view of functional decomposition, the system is composed from a business tier which realizes the application logic of the system, a client and a Web tier which realize the client–server functionalities in the intranet/internet, and an info tier which realizes the data and information management of the system.

The workflow engine interprets the process logic represented in the business process model, goes through the modelled tasks and assigns each task to specific users according to the associations that have been modelled in the responsibility diagram. Whenever an information need is associated with a task as already described during modelling time, the workflow engine invokes an intelligent agent in the background. Given the corresponding context from the workflow task (modelled with data objects) the agent accomplishes an ontology-based information search in the process-oriented structured archive to satisfy the user's information need by presenting the relevant information.

Figure 2 depicts a running task of an active workflow instance where the retrieved information is displayed.

4 PUBLIC ADMINISTRATION AS AN APPLICATION AREA

Our solution fits well in the area of public administration. The following points outline the relationship of the main elements of our tool to public administration processes.

In the area of public administration *workflow approaches* are useful and necessary because often a rough process structure is given and must be followed; many people, documents and maybe locations are involved; enforcing a given process structure through a workflow system may improve quality of services.

The idea of *active knowledge delivery* is especially useful since not all employees dealing with a given topic have the same education and expertise, and decisions involving binding regulations must be

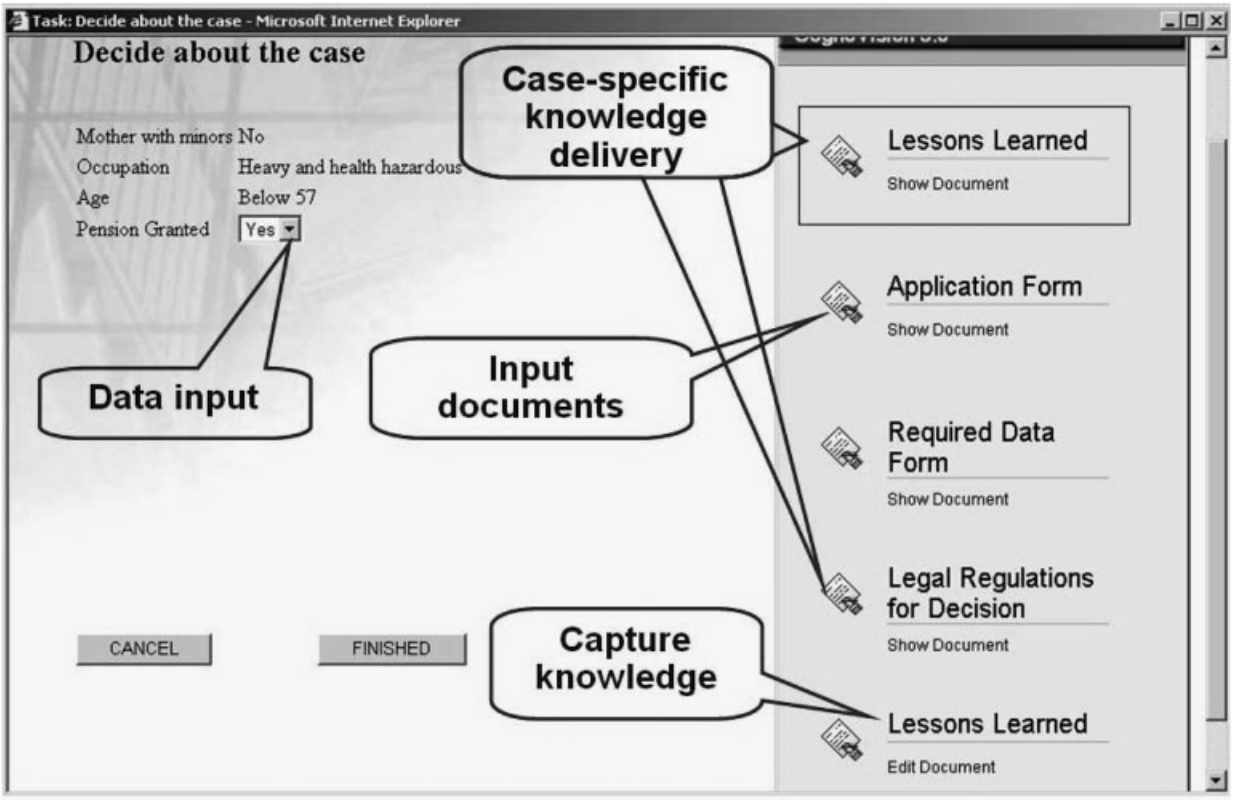

Figure 2 Interface of the workflow enactment

ensured. Active hints to other's decisions are useful to guarantee equal decisions under equal conditions. Further, they support the dissemination of new knowledge, for instance in the case of changed laws, etc. Moreover, it supports legal validity and transparency even in such cases as described in Lenk and Traunmüller's (2000) 'innovative ways of service delivery'.

In public administration processes *ontology-based organizational memory systems* are especially important: many existing sources of knowledge, laws, comments to laws, specific regulations, old similar cases, available case-specific documents and information, etc., are prevalent at different places and in different forms and representations, at several degrees of formality, and related by manifold links. In order to make informed, transparent, and accountable decisions, consistent with the past, compliant with the law, and coherent with similar decisions in other places, all this information should be placed into a coherent framework. Having this framework on a formal basis allows sophisticated assessment of relevance in information retrieval (cp. case-based reasoning methods).

The IKA case

Below we present an application of our tool in a specific knowledge-intensive business process. We tested our tool in an organization from the social security sector: the Greek Social Security Institute (IKA), which is the largest insurance institution in Greece. Having as its primary purpose the protection of insured people. IKA offers an extensive range of services to them, like insurance, benefits, pensions and interstate social security. Currently, IKA provides health care to 5 500 000 insured persons including the members of their family and pays out pensions to 1 000 000 pensioners approximately. The institute's income is derived from the contributions of both workers and employers and from governmental funding.

Description of the business process

The business process that was examined and modelled with our tool is the granting of full old-age pension. The significance of the pension process lies in the large number of beneficiaries that currently amounts to 1 000 000 people and increases at an annual rate of 10%. In addition, the pension-granting process requires a deep knowledge of the relevant legislation; first for making the decision whether the insured person is entitled to receive a pension; and second for calculating the amount of pension.

It is quite common that for one specific case more than one legal regulation may be relevant, and it is a matter of knowledge and experience to identify all these regulations and then choose the most appropriate one. For instance, if an applicant is 65 years old and has completed 35 working years then he/she establishes the right to receive a pension according to two different sets of regulations: the 'common' regulations that apply to all applicants reaching a specific age limit (65 years for men and 60 years for women) and the '35 working years' regulations that apply to all applicants having completed 35 working years regardless of their age. If it is the case that the insured member can establish a pension right under more than one regulation, the different pension amounts are calculated and the highest one is chosen.

All knowledge-intensive steps must be legally checkable, they are often done with uncertainty, based on the experience of the relevant regulations the employees have and they are vital for the correct result of the process.

The process begins with the submission of the application form by the insured person and the collection of all the supplementary documentation, which constitutes the retirement folder. The retirement folder comprises the application form and supplementary documentation in paper form such as official documents from the employer(s) of the insured member certifying the number of working days of the applicant. However with our tool we support only the routing of the application form which is the principal document for the specific business process. The retirement folder is submitted by the insured person to any of IKA's branches and then it is forwarded to the one responsible for acting upon it. The pension folder is checked at the department of pensions or the department of payments. If it is not complete, a communication between the department of pensions or the department of payments and the insured member or other departments or even other branches takes place in order to receive the documents that are required for the establishment of the pension right.

The insured person is entitled to a pension when he/she fulfils the prerequisite conditions (e.g. minimum number of working days and age) for the specific type of pension and category to which he/she belongs. The decision regarding the entitlement to a pension is made on the basis of the employment and personal data of the insured person. This decision is based also on the current legal regulations, which are differentiated according to the pension type, the category of the insured person and other factors.

Having established that the minimum prerequisite conditions are met, a decision of approval is issued, which mentions all the information related

to the granting and the calculation of the pension. If the insured person is not entitled to a pension, a decision of rejection is issued.

We developed the model of IKA's 'granting of full old-age pension' business process and enriched it with knowledge management tasks for the knowledge flow in the business process. Figure 3 depicts part of the model as it is presented to the user.

The business process model is presented as HTML pages where the shapes are anchors for links in the knowledge archive. This means that the models can be used for navigating a knowledge network. By clicking on an object of the model the user is presented with attributes for the specific object.

The respective ontology was implemented in the DHC CognoVision® component of the business process knowledge modelling tool (see Figure 4).

Evaluation of the system

In order to evaluate our tool for the 'granting of full old-age pension' business process of IKA, the following evaluation approach was adopted. First of all the tool was installed on an autonomous server PC of the Department of IT Research and Support in the 'Development and Testing of new IT Systems', IKA's division in Athens. An initial testing of the tool was performed by the development team. This initial testing involved running with the IKA pilot five past cases of insured members, i.e. cases which have already been examined by IKA. Thus, having the respective decisions at hand, the system was also tested to see whether it retrieved the relevant regulations. It is clear that the retrieval of similar cases could not be tested because, at that point, there were not enough cases in the knowledge archive.

Following the initial test and after ensuring the proper operation of the tool in terms of workflow execution of the business process, a training workshop with the IKA personnel was organized. During the workshop the system was presented to 10 members of the IKA Department of IT Research and Support.

The next step was the operation of the system by IKA personnel with 30 cases (past cases as well as new ones, i.e. applications of insured members recently submitted to IKA for which no decision

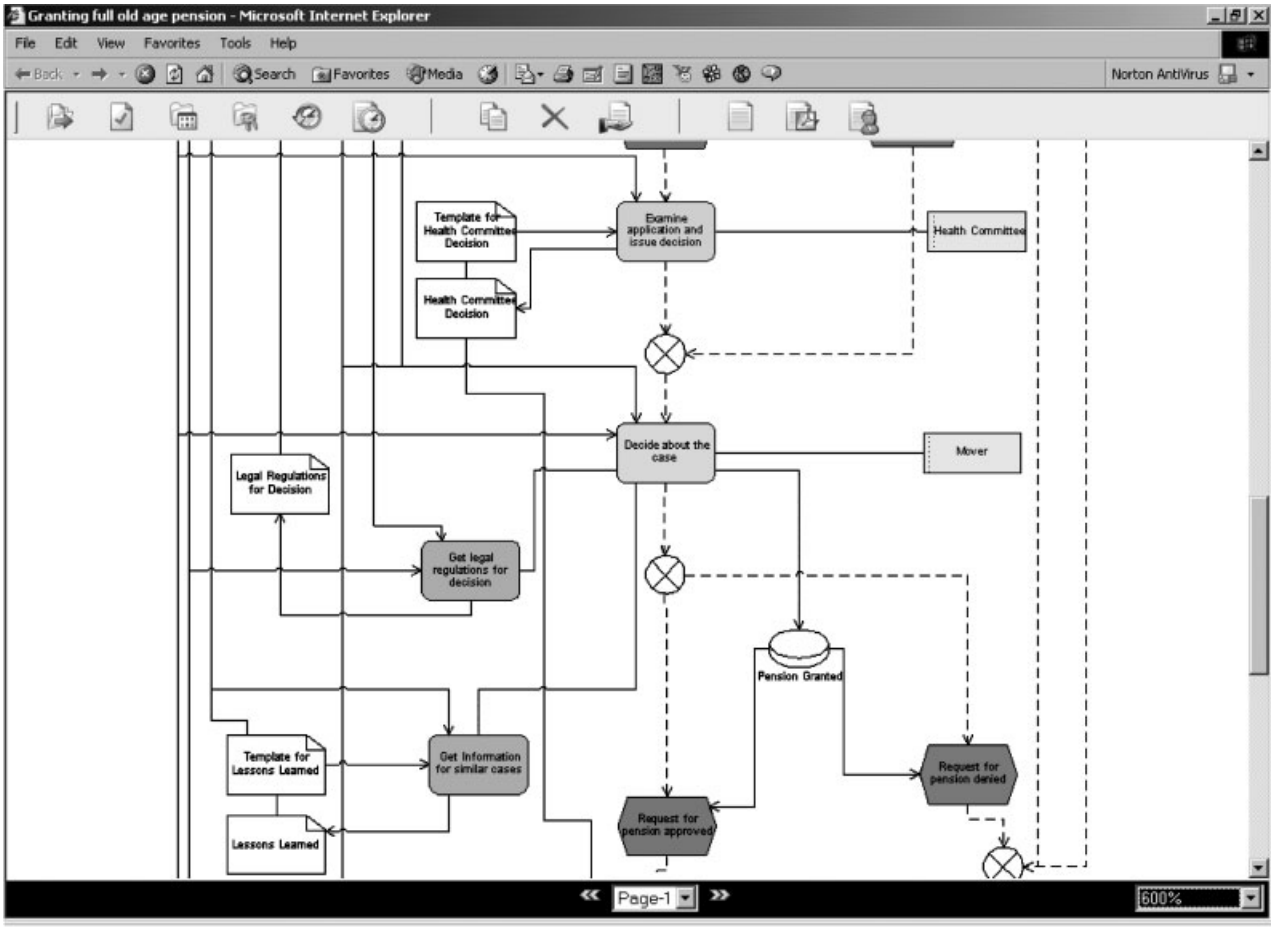

Figure 3 Part of the IKA's business process model

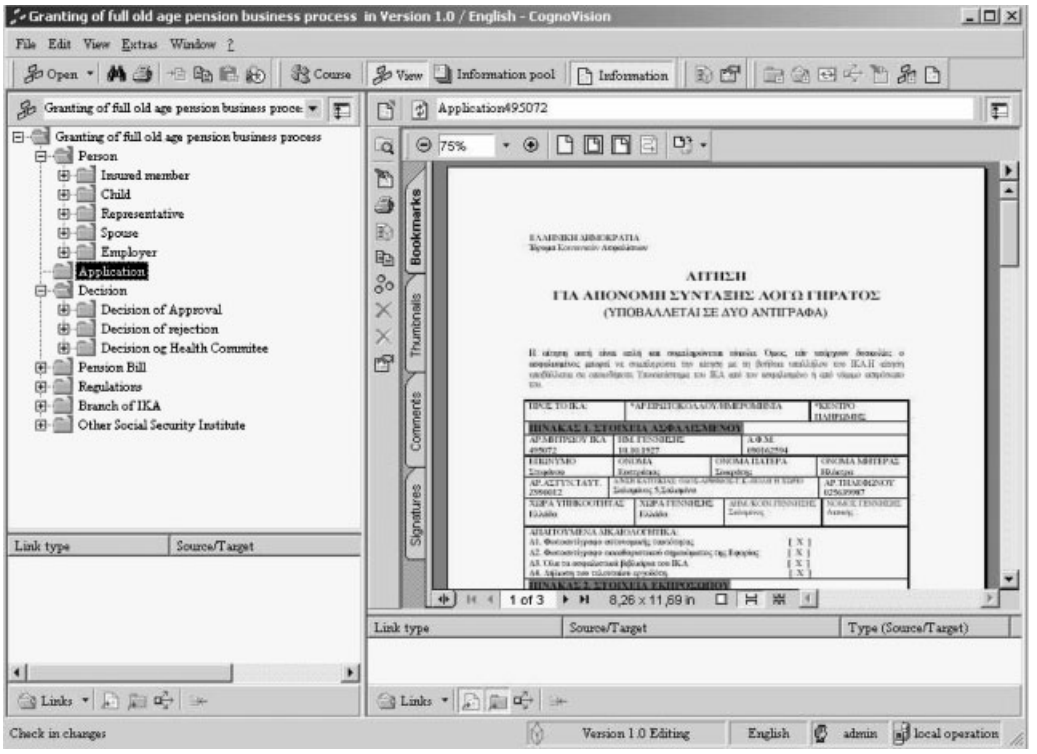

Figure 4 The process-oriented knowledge archive of IKA's 'granting of full old-age pension' business process

has been issued ↑), in order to fill in the archive and create an initial knowledge base with similar cases (lessons learned). The cases were different from all those previously entered in the system and were carefully selected in order to be representative, containing at least one occupation category (e.g. construction workers, pilots, etc.), both sexes and spanning across different age ranges.

This initial evaluation of the IKA pilot was performed over a period of two months. During this time, measurements were taken in order to derive an initial assessment of the speed in executing the business process with the aid of the tool. The results revealed an approximately 50% increase of speed in executing the business process. This was indicated by the total number of decisions issued per day with the use of the tool and without it, respectively 4.6 and 2.4 decisions per day. Another issue of importance for IKA is the percentage of appeals to the decisions by the applicants. Currently 10% of the total number of decisions is appealed against by the respective applicants. However, the majority of the appeals do not deal with the actual nature of the decision, i.e. the applicant appeals against a decision of rejection, but in principal with the pension amount decided. The applicant is usually not satisfied with the pension amount decided by IKA and appeals the decision either because he/she thinks that there has been a miscalculation of the total number of insurance days or because he/she thinks that he/she is entitled to receive a pension according to another set of legal regulations. IKA personnel estimate that the use of the tool will result in a small decrease in the percentage of appeals from 10% to 9% approximately.

The benefits derived from the use of the tool for IKA can be divided into short-term and long-term ones. Obviously, some of the short-term benefits of the introduction of workflow and electronic documents include smoother process enactment, easier communication and decrease of processing time. In addition, access and navigation to legal documents and comments is greatly facilitated. Concerning long-term benefits, access to older, similar cases will facilitate comparable decisions as well as foster communication with colleagues. Tacit knowledge as the most important knowledge source will be exploited to a large extent and the attachment of personal notes to legal resources and backup material will enable personal views on the knowledge base.

5 CONCLUSIONS AND FURTHER WORK

In this paper we presented the requirements for an IT tool that supports knowledge intensive business processes. In such processes, knowledge generation and application plays an important role and,

therefore, knowledge-management activities should be integrated into daily work. The goal of such a tool would be to enable context-sensitive storage and retrieval of information from a process-oriented structured archive and proactively offer to the user the required knowledge for performing their work.

We also presented an innovative tool that meets the above-mentioned requirements. The proposed solution includes a powerful modelling tool that supports in an integrated manner the modelling of knowledge-intensive business processes and domain knowledge structures and an engine that enacts such processes, interprets the process logic and, given the corresponding context from the workflow, accomplishes an ontology-based information search in the process-oriented structured archive to satisfy the user's information need by presenting the relevant information.

We have tested our tool in an organization from the social security sector, the Greek Social Security Institute (IKA), and specifically in the 'granting of full old-age pension' business process. The results of an initial evaluation indicated a substantial decrease of processing time and a significantly better management of the information pertinent to the business process.

The next steps in our work include the extension of the process enactment environment so as to support the enactment of weakly structured workflow models in full scale. Currently, in terms of enactment we focused on the proactive and context-sensitive knowledge delivery during run-time for certain tasks of the process. In the future, we should be able to support dynamic modelling modifications of the modelled process and append additional modelling of a task specified as a 'black box' during the modelling phase. In order to achieve these goals of weak-workflow support, the necessary agents should be integrated into the process enactment environment and invoked during enactment.

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