

ACTIVE KNOWLEDGE DELIVERY IN SEMI-STRUCTURED ADMINISTRATIVE PROCESSES

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Abstract. *In this paper, we present the technical approach of the DECOR project to realize proactive, context-sensitive delivery of knowledge within semi-structured, knowledge-intensive processes. We describe some main ideas of the DECOR project and discuss their particular relevance for administrative processes in e-Government. As an example we sketch one of our DECOR case studies, the process for granting full old age pension as it is performed in the Greek Social Security Institution IKA.*

1. Introduction and Overview

Knowledge management has recently been identified as a crucial issue for the delivery of electronic services by public organisations (see, e.g., [25]). A subject that has not yet been sufficiently tackled is the treatment of loosely structured administrative business processes which are not seldom in the public sector (cp., e.g., the process perspective in [13]). The present paper describes some aspects of the ongoing multi-European research effort DECOR (Delivery of Context-sensitive Organizational Knowledge, [8]). DECOR develops and tests integrated methods and tools for proactive, context-sensitive delivery of knowledge in such semi-structured processes. Our work builds on the artificial intelligence approach to organizational memories ([3],[18]) and extends the work of other researchers in the field of integrating organizational memories with workflow management (see, e.g., [22],[23]). The main extension is the explicit treatment of the knowledge-intensive, semi-structured character of some decision-oriented processes in public organisations. Shortly, these two characteristics can be described as follows:

1. Knowledge-intensive: The processes considered are often complex in general, with many, but conceptually simple, document-centred activities; at the heart of these processes are few central decision steps which require personal judgment based on experience, a comprehensive knowledge about the given as well as about older, similar cases, access to much specific information in files and forms, manifold legal regulations and standard operating procedures, etc. This is where intelligent techniques for knowledge management come into play (cp. [18]).
2. Semi-structured: The processes under consideration normally consist of many steps performed by many people in different roles, often several departments are involved, sometimes at different locations, etc. Though legal regulations prescribe the departments to be involved, the specific sequence of processing steps may vary for specific instances due to particular eventualities, exceptions, or complications. Even if the business process is determined completely, complex, not formally modeled decision processes may be embedded in black boxes (see above), or the process may change during its enactment (which appears typically in procedures like urban planning with an extremely long duration [9]). In such cases, flexible and adaptable workflow approaches are required (see, e.g., [14],[19]).

In this paper, we shortly describe the DECOR technical approach and try to point out its relationships to the particularities of e-government processes in e-Government. The paper is organized as follows: in the following Section 2, we sketch the overall ideas of DECOR; then, in Section 3, we elaborate in some more detail on three specific ideas underlying the project and argue why we think this approach is particularly useful and necessary in e-Government processes; in Section 4 we describe in some detail one of our case studies in the DECOR project; finally, we conclude in Section 5 with some remarks about the status of our work.

2. Overview of the DECOR Approach

Our starting point is the observation that explicit knowledge relevant for a specific workflow task or decision is normally spread over many different kinds of documents, forms, legislative texts, etc. Furthermore, links and relationships between documents are often not explicitly represented in software systems for information retrieval and access, although existing and possibly useful (e.g., links between laws, commentaries, and authoritative precedents, links between contradictory interpretations of regulations, or links between specific regulations, general principles, and popularly understandable commentaries and

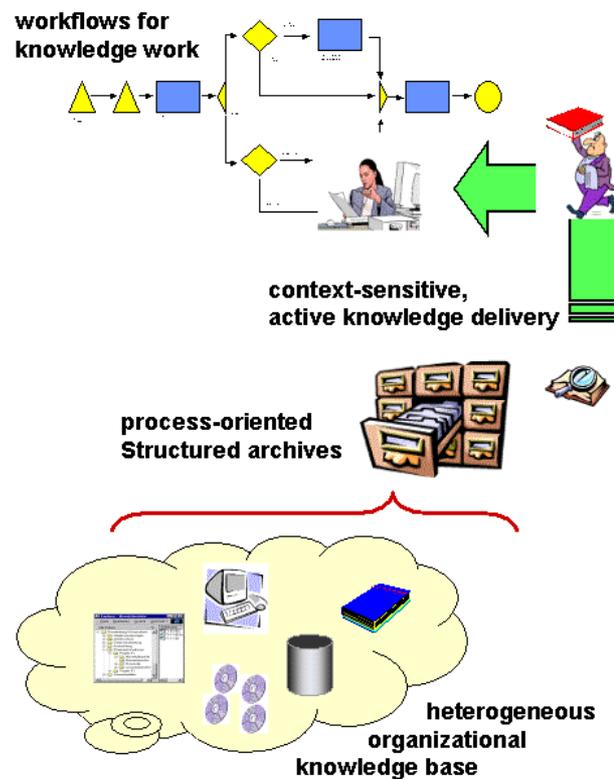


Figure 1: DECOR Overall Scenario - Active Knowledge Delivery at Workflow Runtime

examples, etc.). *Ontology-based information systems* [5],[17] acquire from the community of system users the commonly agreed upon structures (concepts and definitions, relationships, constraints, axioms) which *logically* organise a given domain of expertise or area of work. A formal representation of these generally accepted domain knowledge structures, the *ontology* [12], is the basis for a homogeneous, concept-based (instead of keyword-based) content description of knowledge sources; this can be used for knowledge portals to support manual browsing, and for information retrieval algorithms evaluating queries against an archive system as well [15]. In DECOR, we employ formally modeled *business processes* as one such ontology among others, which 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 (cp. [1]). In such a system, for instance, the basic working steps

to come to a decision could be modeled, and each steps could be linked to information and knowledge sources relevant for this specific task.

Another starting point is the observation that users engaged in their daily work don't want to spend much time in searching for information or for storing experience. What they need is an ***active, context-sensitive knowledge storage and delivery*** service which "knows" what the user is actually doing, and uses this knowledge for autonomous information management services at the desktop. To achieve this goal, DECOR employs a workflow management system as the host system which is aware of the specific tasks performed by each user at a given point in time. We consider *weakly-structured workflow models for representing knowledge-intensive work routines* which are usually not so strict and predetermined as simple administrative workflows. Workflow models are enriched by a description of information flow between tasks and by a specification of task-specific information needs. An ***information assistant*** observes the running workflow and interprets modeled information needs to offer active support from the process-oriented structured archive; further it maintains a notion of information *retrieval context* using the additionally modeled information flow variables which allows for more precise queries to the archive. For example, specific decisions or information fed into the system in a prior process step may influence the information retrieval task in the actual process step; e.g. because they help disambiguating between several alternative process variants with different information needs; because they help determining whether specific regulations or laws apply; because they simply give a specific search concept, keyword or database entry to look for in the information retrieval task; or because they help present retrieved information in an appropriate way depending on the process history or the role or prior knowledge of the specific person in charge. Task context can also be used for information storage to describe the creation context of a given knowledge item. Such an elaborated metadata annotation for stored knowledge items can help assessing its relevance for later, more or less similar retrieval situations.

Altogether, existing knowledge sources are used and extended in a more efficient and more consistent way. Figure 1 illustrates the several system parts playing together at system usage time. The DECOR technical approach realizes a specific instance of the KnowMore architecture for organizational memories [1]. In [4], we describe in some more detail the DECOR toolbox which supports building and maintenance of such systems. In the following subsections, we discuss three main goals of the DECOR approach and try to point out their particular relevance from the e-Government point of view.

3. Relevance of the DECOR Approach for e-Government Scenarios

3.1. DECOR supports knowledge work processes by weakly-structured workflows.

KnowMore and similar projects ([1],[2],[22]) show that workflow models can be augmented to describe information flow between work activities and information needs for specific tasks. Then, an information assistant observes running workflows and actively offers context-sensitive organizational knowledge, thus promoting a better exploitation of existing knowledge sources. DECOR further develops this idea regarding the fact that knowledge-intensive work is often not completely describable a-priori with a strongly-structured workflow ([6],[20]). Instead, DECOR provides open points allowing for later process refinement at runtime, and flexible change possibilities facilitating process adaptation on the fly.

- 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 along given binding regulations must be 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. In the case of "normal citizens" or not deeply specialized operators interacting with a system, the active delivery fosters democracy since it allows to profit from and be part of complex processes without having all required background knowledge in advance. Moreover, it supports legal validity and transparency even in such cases as described in Lenk and Traummüller's "innovative ways of service delivery" [13].
- On the other hand, the idea of weak (loose) workflow structures is also *required*, since normally the legal regulations only provide a process skeleton while specific knowledge-intensive tasks [6] are below the granularity normally modelled (see [9] – this is what Lenk and Traummüller see as a specific characteristic of e-government processes: "They are partly ... structured by legal rules which however, often demand interpretation ..." [13]); or because during long-living administrative process instances rules

may change [9]; or because specific exceptions may occur once for the first time.

3.2. DECOR services exploit the knowledge contained in a Process-Oriented Organizational Memory.

The active information assistant retrieves knowledge from a meta information system which integrates existing systems by the provision of a middle layer - the knowledge description level - which describes (and sets into relation) existing knowledge items on a uniform, declarative level which is based on *conceptual indices* taken from domain and enterprise ontologies. *Ontologies* ([5],[12]) are formal accounts of the explicit conceptualisations of a given domain of discourse shared among a set of agents. DECOR proposes formal work process models as one such ontological dimension of paramount importance.

- In *governmental processes* ontology-based OM's 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).
- On the other hand, development of ontologies for the public sector is also a *feasible goal*: many topics (especially legal regulations) are formal by nature, thus "easy" to represent; there are people with formal education which can assist in knowledge acquisition. Coming to a shared understanding of things must be possible because otherwise comparable decisions under comparable conditions could never be achieved. Further, the effort spent for modeling ontologies may be a good investment since the same formal model can be reused for many applications, inside and outside the public administration, for many different cases and questions, for retrieval, explanation, reasoning, education purposes etc. [10] start with exactly these arguments to propose an ontology-based system in the Dutch tax administration.

3.3. DECOR develops a methodology for integrated modeling and management of processes and knowledge.

The above described services are only possible after an extensive modeling phase for processes, ontologies, and information sources, accompanied by the installation of appropriate organizational roles, and having in mind a comprehensive life-cycle model for maintaining the described models over a long period of time. Many cultural factors to be dealt with in general knowledge management (not-invented-here syndrom, territory fights between departments, rigid, inflexible work procedures used by many people, etc; see [16],[24]) are at least of equal importance in the governmental sector.

- In the area of e-Government. the DECOR business knowledge method is definitely *required* because, without a deep understanding and sound approach to KM activities, the ever growing complexity of bureaucracy in a networked Europe will soon make impossible informed administrative decisions which properly take into account all relevant, actual information. Further, the increasing speed of change in administrative regulations and processes requires adequate organizational processes to keep pace with the changing world. This is even more the case since (especially in critical decisions) the citizens have access to the same information sources as the officials such that sub-optimal decisions are not longer accepted. A methodologically sound approach is also necessary because the public sector is so big that one needs clearly defined procedures in order to come to comparable (and, technically, interoperable) results.
- On the other hand, such a method is also *feasible* since central authorities exist which may promote well-defined KM initiatives; because many modeling and formalization activities are done already for several purposes like the introduction of workflow systems or process reengineering (but maybe in an uncoordinated manner); and because results pay-off due to their reusability in many applications. Moreover, having a well-understood system plus well-organized procedures in place for contextual information retrieval and active knowledge delivery, can stimulate the speed of knowledge development within the administration: if experience from the direct “customer contacts” is gathered and automatically stored with process-context information, this can greatly enhance later retrieval in similar contexts; if in later, similar contexts old cases are retrieved and presented to the clerk, this one might contact the other author in order to discuss particular problems and maybe further enhance the stored best-practice case.

4. An Application Example

The above discussion may have shown the relevance of the DECOR model for e-Government. During the next few months we will investigate in one of our three pilot case studies the *business process for granting of full old age pension* at IKA. IKA, the Greek Social Security Institute, currently provides 830,000 people with retirement pension. The respective business process is, of course, enacted extremely often each day, all over Greece; it normally deals with much data, often incomplete or inconsistent; many IKA employees are enacting this process, and the result is highly important for the respective citizen. The results must be legally valid and are often subject to fights at the court; the process itself is superficially complex, but many steps are simple by nature. However, at the core of the process are some tasks requiring decisions in a situation where often several, sometimes contradicting regulations apply which must be interpreted and weighted against each other. It is obvious that such a process gives an ideal playground for investigating the use of modern approaches to enhance administrative process performance.

Figure 2 gives an idea of the process for granting full old age pension to people insured with IKA. 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 is submitted by the insured person to any of IKA's branches and then it is forwarded to the one being responsible for acting upon it. The pension folder is being 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 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.

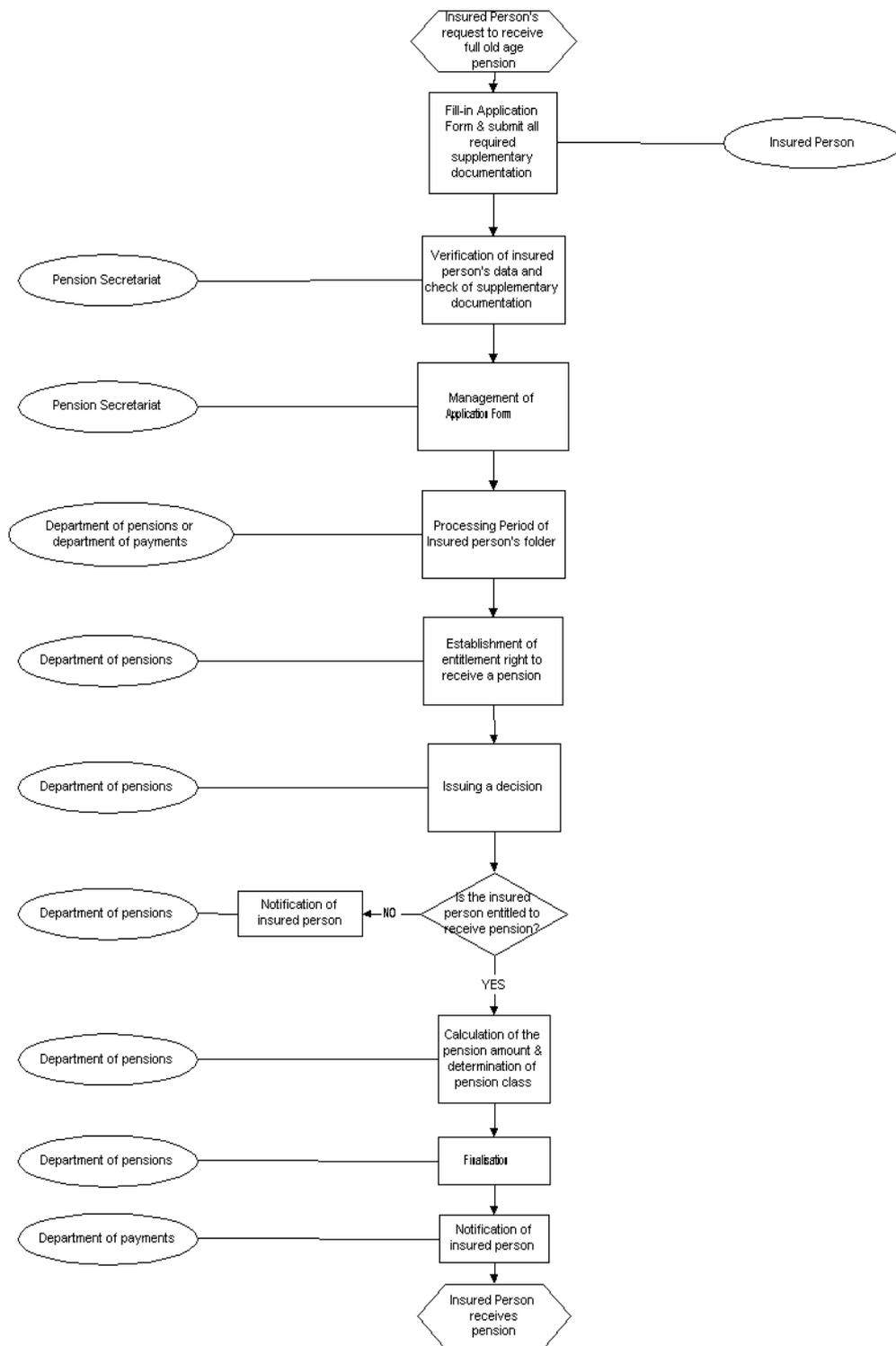


Figure 2: IKA Example Process - Granting Full Old Age Pension

The service area of pensions has been identified as the focus area from the very beginning of the project due to its high degree of importance for IKA and its high knowledge intensiveness. The significance of the pension process lies

in the large number of beneficiaries that currently amounts to 1.000.000 persons and increases at an annual rate of 10%. In addition, the pension processes require 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. 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.

5. Next Steps

Currently, we are building the technical and methodological prerequisites for realizing the DECOR solution in organizations (see [4] for details). Three case studies have been analyzed and planned, one of them is the IKA example presented above. In Summer 2001, the process-oriented structured archives will be installed and filled at user sites. In Autumn 2001, enriched workflow models will be created and enacted. First user experience with the total solution will be available in early 2002.

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