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### The document revolution. Work- or document-flow?

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# **THE DOCUMENT REVOLUTION. WORK- OR DOCUMENT-FLOW ? ARCHIVAL DOCUMENTS AS TRIGGERS FOR PROCESS IMPRO- VEMENT**

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## **ABSTRACT.**

*This paper is resulting from a research project at Tilburg University, the Netherlands, in which the fields of organization, information and archival studies have been integrated. We argue that the archivist concept of the record keeping system, in information-intensive organizations, can be used as an instrument for improving the performance of the document-flow in a business process, and, as a result, on the process. Archival documents must not only contain the information related to the result of an activity, but also information both on the circumstances of their creation and organization and business processes. We think this can be realized by using a record keeping system, with as essential elements: context, quality, appraisal, warehousing and logistics. The instrument we have developed as a translation of the conceptual model is the process-specific archival document-file, a meta-file that, after translation, operates as an engine managing document management. The approach that was developed was tested in a case-study in the city of Veldhoven. From the case-study, it became clear that our approach leads to considerable improvements in the flow of documents and thus in the primary processes supported by these documents.*

## **1. INTRODUCTION.**

As Hammer and Champy said, there is not a company in the world whose management would not like an organization to be flexible enough to adjust to changing market conditions and dedicated enough to deliver maximum quality and customer service (Hammer, Champy (1993), p. 7). Rapidly advancing technology creates possibilities undreamed of in earlier years. 'Nobody can drive to the future on cruise control' (Gibson (1997), p. 1). So each corporation wants to create a responsive organization.

In short, three forces are responsible for this drive to responsiveness: customers, competition and change (Hammer, Champy (1993), p. 17-24). Consequence of this drive to responsiveness in information-intensive organizations (Porter, Millar (1985)) is that more demands are made on the performance of time-critical processes and the work- and/or document-flows linked to those processes.

## **2. RESEARCH QUESTION.**

Operational processes in information-intensive organizations are generating and manipulating information, in such a way that the end product, most often an item of information too, will be willingly accepted by the customers of the organization. This means that the work-flow in such an organization is a flow of information items. The drive to responsiveness demands greater performance of this flow, not only in terms of effectiveness and efficiency, but also in terms of legitimacy and accountability (Bearman (1994)). In improving performance these four dimensions have to be considered. Neglect of one of them will raise costs in realising the other dimensions.

Better performance can be realized, as Davenport stated (Davenport (1993), p. 83), by including in the operational process the information 'value chain', that is a definition of the information requirements, and the collection, distribution, receipt, use and storage (or better: record keeping) of the information. One of the most neglected elements within this 'value chain' is record keeping. From a legitimacy and accountability point of view, record keeping influences all the other elements in the chain (McKemmish, Upward (1993); Duranti (1995), Duranti (1997); Andersson (1997)).

It is interesting to see what Davenport calls 'higher-level and more understandable information units' within that 'value chain': not data, but documents. 'Because the flow of documents often defines the flow of a business process, (...), returning to a document-oriented view of information (...) means a return to greater simplicity, less detail, and the ability to accommodate less-structured information' (Davenport (1993), p. 88-89). So the quality of the document-flow will have far-reaching consequences for the process-flow (or work-flow). The theoretical implications of the quality requirements, collection, distribution, receipt, use and record keeping of documents connected to business processes are studied in records management (Robek et al. (1995); Goodman (1994); Kennedy, Schauder (1994)).

An important records management theory concerns the record keeping system. The ICA defines this as 'an information system developed for the purpose of storing and retrieving records, organized to control the specific function of creating, storing, and accessing records, to safeguard their authenticity and reliability' (ICA (1997)). In order to achieve legitimacy and accountability, documents should be 'authentic' and 'reliable'. Therefore they must not only contain the information related to the result of the activity that is documented. They must also contain information on the circumstances of their creation and on the organization and business process. We think this can be realized by taking care of the most indispensable parts of records management: context, quality, appraisal, warehousing and logistics of documents.

The question which we want to answer in this paper is whether the concept of the record keeping system within information-intensive organizations can be used as an instrument to improve the quality of the document-flow in a process, and, as a result, the quality of the process.

### **3. DEFINITIONS.**

*'Document'*: irrespective of form, a (reproducible) collection of interrelated data, carried as a unity, reproduced or communicated by means of a storage medium.

*'Archival document'* (or 'record'): all 'documents' which are by their nature intended to be processed by the organization, person or group of persons, which have received or created these documents on account of activities or accomplishment of assignments, and which, because of their context, are of importance for the organization for their informational and evidential value.

*'Legitimacy'*: the possibility of demonstrating that procedures have been executed in accordance with laws, rules and good practice.

*'Accountability'*: the possibility of accounting for actions and the way these actions have been performed.

## **4. RESEARCH METHODOLOGY AND CONCEPTUAL MODEL.**

### **4.1. Research methodology.**

The method we used in researching the problem consisted of an extensive review of the organization, information and archival literature. We focussed on methods to improve the management of archival documents in business processes. Based on this review, we developed a conceptual model in which an hypothetical 'record keeping system' is an important element.

With the help of this conceptual model, we developed an approach. We checked the conceptual model by implementing the approach in several case-studies, using the method of analytic generalization (Yin (1990), p. 30-31). In each of these cases, we used the techniques of action research and experimental evaluation (Eden c.s. (1996); Rossi (1989)).

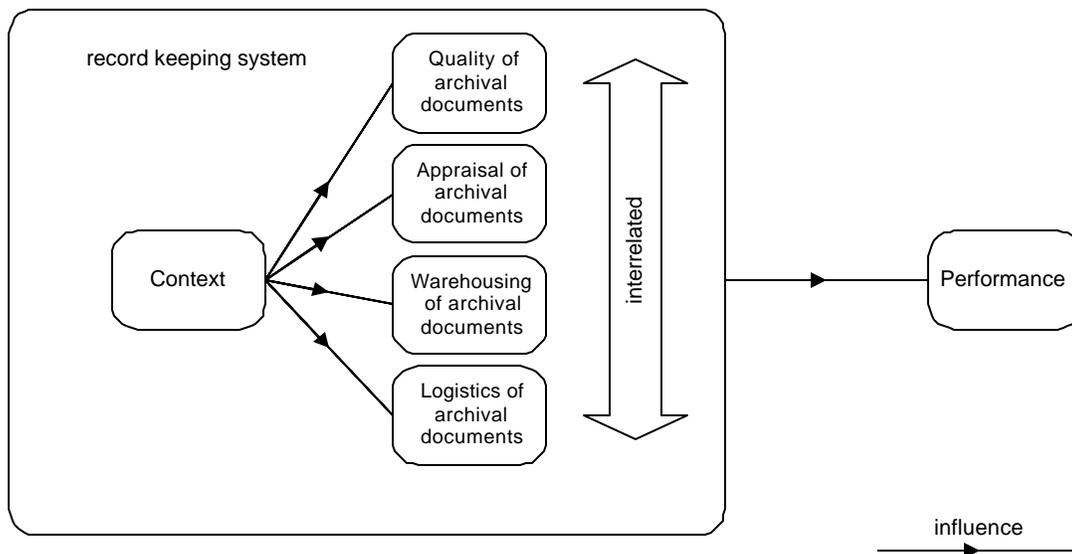
### **4.2. Conceptual model.**

The conceptual model we developed is a simple one. Our basic assumption is that a record keeping system influences the performance of the document-flow within a process; see Figure 1.



**Figure 1. The conceptual model: the general view.**

It is necessary to decompose this view of the model. In Figure 1, the record keeping system is presented as a 'black box'. When this 'black box' is opened, the essential elements of records management will appear: context, quality, appraisal, warehousing and logistics. Within the record keeping system, these elements are interrelated. Each of them affects the document-flow; see Figure 2.



**Figure 2. The conceptual model: decomposed view.**

## **5. THE ELEMENTS OF THE CONCEPTUAL MODEL.**

### **5.1. Context.**

The notion 'context' means 'connection', 'coherence', 'environment' or 'surroundings'. According to Lewicki, context is 'a combination of intraorganizational variables and some notion of organization environment' (Lewicki (1977)). Within records management, 'context' is an essential part of a record keeping system. For understanding archival documents and for using them as evidence, it will be necessary to record business processes and activities, the way the information household is organized, the way internal and external information flows are organized, the way archival documents are stored and classified, and the rules dictating all of this (ICA (1997), p. 27), at any given moment in the lifecycle of the organization or the flow of a business process. 'Context' creates an interrelationship between archival documents. In short, we can define 'context' as the state of affairs in which a system operates for each moment in the lifecycle of the system at which archival documents are created (Pettigrew (1984)). The elements of the contextual model, i.e., quality, appraisal, warehousing and logistics, are all influenced by this contextual information.

### **5.2. Quality.**

All archival documents within a business process are process-bound. To use them *at any moment* after they have been created means that they will have to meet certain quality requirements. These requirements are completely independent of the information systems used.

These requirements are:

- integrity, which means that it must be impossible to wrongly add or delete data in archival documents;
- authenticity, which means that the archival document must have the right form and the right contents, irrespective of the compression used;
- controllability, which means that the document and the data it contains can be tested on reliability;
- historicity, which means that the data as they are at the moment the archival document is created are retained for as long as is necessary, so that it will be possible to maintain integrity, authenticity and controllability.

The requirements have to be met to guarantee that each archival document is correct and complete in spite of all handling that could be necessary (e.g., conversion, compression).

### **5.3. Appraisal.**

Appraisal is the process of establishing the 'value' of archival documents, qualifying that 'value' and determining its duration (Duranti (1994); Cook (1992); Kolsrud (1992); Schellenberg (1956)). The objective of appraisal is to identify archival documents according to the time they have to be kept, which is influenced by criteria like legal evidence, fiscal duties, evidence for business transactions and historical reasons. The criteria and the period that archival documents have to be kept are part of the 'context'.

Appraisal has to be applied to all the archival documents in each process, their mutual relation and their form. Depending on the importance of the integrity of the file or archive of which the archival document is a part, it is possible:

- to physically destroy the documents;
- to delete the pointers only; or
- to preserve the destructible archival document until it isn't necessary anymore to preserve the file for reasons of integrity.

The effectiveness and efficiency of process-management imply an appraisal of archival documents, so that the right archival documents can be destroyed at the right time and, if they have to be preserved, kept for the right period. Appraisal affects warehousing in giving management directions for the preservation of archival documents and for the organization of the information infrastructure.

### **5.4. Warehousing.**

Archival documents can have two appearances:

- non-virtual: those documents which (1) exist in a physical shape or (2) occur as a (digital) substitute (not the same storage medium, but with identical data and form). The data relate to each other by way of a fixed connection.
- Virtual: those documents which (1) don't have a physical shape (anymore), but (2) can get this physical shape as copy or print. The data aren't bound to the specific document in which they are used. They can be (or in most cases: are) used in more virtual documents.

Warehousing needs to realize two aims: (1) short- and long-term preservation, based on the 'value' of archival documents attached to them in the process of appraisal; and (2) accessibility and retrieval. Based on this 'value', it is possible to make a deliberate choice in the storage media and systems to be used. It is clear that for archival documents that are to be destroyed at short notice, it is not necessary to use long-lasting, almost indestructible and mostly expensive storage media.

Warehousing must guarantee that the chosen storage media can maintain all the above quality requirements of the archival documents during the period they have to be kept. Standardisation is therefore an necessity (Tombs (1997), p. 210-216; Le Cerf et al. (1997), p. 217-222). A finding aid system must be created containing descriptions of the archival documents, indexes and classification schemes bound to specific business processes. Such a system makes it possible for users to find and consult (but not change) all the archival documents they need.

Warehousing affects all dimensions of performance. In realizing short- and long-term preservation and in maintaining all quality requirements of archival documents, it influences legitimacy and accountability. In realizing accessibility and retrieval, it influences effectiveness and efficiency.

## 5.5. Logistics.

Logistics concerns the way archival documents are distributed in the business process (Bowersox et al. (1986); Lee, Schniederjans (1994)). The aims of logistics are: (1) simplification of the structure of the flow of archival documents and of the process; and (2) management of the document-flow.

'Just-in-time' concepts are important in reaching responsiveness. 'Just-in-time' means production and distribution in the right quantity, in the needed quality and at the right moment. Applying 'just-in-time' to information-intensive organizations means making adjustments in the archival document-flow. The first step is to analyze the existing flow to identify the archival documents which are part of it. Some archival documents that are created don't have any surplus value with respect to the production of the end product. It will be necessary not only to clean up the flow of that sort of archival document, but also to prevent its creation. At the same time, restructuring of the archival document-flow means restructuring the process flow. As Davenport stated, the document-flow defines the process flow.

Logistics affects performance in the dimensions of effectiveness and efficiency. The restructuring of the archival document-flow and of the process influences effectiveness and efficiency and the realization of a responsive organization.

## 6. TRANSLATING THE MODEL INTO AN APPROACH.

### 6.1. The process-specific archival document-file.

In implementing the model, we developed an instrument. This instrument is what we call a process-specific archival document-file, a meta-document file in which all elements of the record keeping system are implemented to guarantee the record keeping functionality of a business process. Changing a business process means changing the file; all process-specific archival document-files are attached to the business process and the archives it has created. The archival meta-documents in that file describe process-bound archival documents, the data that are part of these documents and the document systems used. In fully automated environments, a part of the file will be the IT-engine that manages the document- and process-flow. In all environments, the file operates as a 'working order' in the work-flow, acting as a steering device for the process-bound archival documents, received, created and used in producing the end product of the business process (Georgakopoulos et al. (1995)). It will be captured as a SGML or a STEP file.

### 6.2. The three interrelated levels of a process-specific archival document-file

The process-specific archival document-file consists of three interrelated levels.

The *first level* is what we call the '*contextual aspect*'. It consists of a description of:

- 1.1. the environment in which the organization operates and the influences on the organization, including those legal regulations that are important for the operating activities;
- 1.2. the organization, the way it is structured, the rules fixing the quality requirements and the way they are met, the business processes that exist within that organization and the way they are interrelated;
- 1.3. the specific business process, its structure, the logistics of the document-flow, authorization aspects, the information systems and applications used, the existing process-bound archival documents and the way they are arranged, indexed and stored.

The *second level* is the '*document profile aspect*'. It consists of document profiles for each of the process-bound archival documents appearing in the process. Each document profile consists of:

- 2.1. pointers to the viewers or the standardized software for the retrieval of the digital process-bound archival documents or pointers to the finding-aid system for the retrieval of non-digital archival documents;
- 2.2. definition (name, form, storage medium, used data and pointers to these data);
- 2.3. role played by the archival document in the business process;
- 2.4. authorizations concerning the specific archival document;
- 2.5. appraisal of the specific archival document;
- 2.6. used warehousing of the specific archival document.

The *third level* is the ‘trigger and register aspect’.

- 3.1. trigger data for creating, retrieving and using all necessary specific process-bound archival documents at the right moment;
- 3.2. audit trail, which retains all data of the use of the archival documents within the process.

The relationship between the aspects of the conceptual model and the elements of the process-specific archival document-file is shown in Table 1.

**Table 1. Relationship between conceptual model and process-specific archival document-file.**

Elements of the conceptual model	Elements of the process-specific archival document-file											
	1.1.	1.2.	1.3.	2.1.	2.2.	2.3.	2.4.	2.5.	2.6.	3.1.	3.2.	
Context	√	√	√	√				√				
Quality		√	√		√						√	
Appraisal	√		√				√	√			√	
Warehousing			√	√	√	√	√		√		√	
Logistics			√			√				√	√	

The ‘document profile aspect’ is attached to each of the process-bound archival documents. When these are the result of a non-standardized ad hoc case, element 1.3. will also be attached.

## 7. THE TEST: THE CASE-STUDY OF THE CITY OF VELDHOVEN

### 7.1. The city of Veldhoven: an overview.

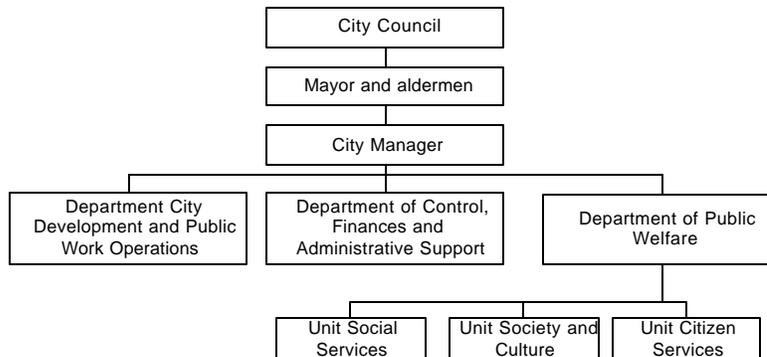
Veldhoven is a town with approximately 40,000 inhabitants. The city has many responsibilities, such as assigning individual rent subsidy, developing spatial plans, taking care of welfare, local education, local culture and garbage collection.

The management of the Departments is confronted with the following problems:

- performance is lacking, partly as the result of two parallel-running document-flows, one consisting of paper-based archival documents, the other of digitized archival documents.
- record keeping and IT management do not seem to fulfill the growing demands for support from the operational workforce.
- as a result, it is difficult to realize responsiveness.

The management of the Departments sees IT as a tool for realizing performance as regards effectiveness and efficiency by managing and controlling the document-flows of digitized and non-digitized archival documents. But in using IT, realizing performance in terms of legitimacy and accountability becomes necessary too. This wasn’t realized in the existing situation.

In our case, we concentrated on the Department of Public Welfare and, within that, on the unit of Social Service. Figure 3 shows the organizational structure of the city of Veldhoven.



**Figure 3. Organization chart of the city of Veldhoven.**

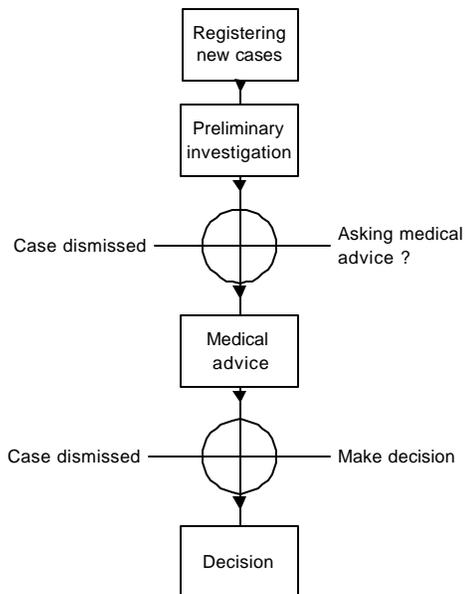
## 7.2. Law Provisions for the Disabled.

We concentrated on the business process, which is responsible for the execution of the Law Provisions for the Disabled. The execution of this Law concentrates on provisions concerning accommodation, transportation and making wheelchairs available for disabled citizens of Veldhoven. It is possible to provide other things, but only in exceptional cases. Table 2 shows the demand for deliverables in the execution of this Law in 1996.

**Table 2. Demand for deliverables in 1996.**

<i>Products</i>	<i>Demand</i>
Accommodation provisions	219
Transportation provisions	589
Wheelchair provisions	99
Other provisions	13
Second investigations	468
Appeals	17
Not specified	101
<i>Total products</i>	<i>1506</i>

The process was modelled as shown in Figure 4.



**Figure 4. The structure of the process.**

Within this process we analysed 11 different archival documents. These documents are linked to the phases of the process as shown in Table 3.

**Table 3. Archival Documents in relation to the process.**

<i>Nr</i>	<i>Archival Document</i>	<i>Process</i>	<i>Storage Medium</i>
1	Application form	Registering	Paper
2	Yearly income	Preliminary Investigation	Paper
3	Copy passport/driver's licence	Preliminary Investigation	Paper
4	Confirmation of receipt	Preliminary Investigation	Electronic file Paper

5	Spreadsheet check of yearly income	Preliminary Investigation	Electronic file
6	Notice citizen medical advice	Asking Medical Advice	Electronic file
7	Request medical advice	Asking Medical Advice	Electronic file Paper
8	Application Form Investigation	Medical Advice	Paper
9	Report medical situation	Medical Advice	Paper
10	Decision	Decision	Electronic file Paper
11	Explanation decision	Decision	Electronic file Paper

### 7.3. Analyzing the situation with the developed conceptual model.

Analyzing the process using the elements of our conceptual model, we came to the following conclusions:

- *Context*: no contextual information was attached to the business process and the process-bound archival documents, which created problems of legitimacy and accountability.
- *Quality*: no measures were taken to guarantee the quality requirements for the digitized virtual and non-virtual archival documents.
- *Appraisal*: the case-file of non-digitized archival documents is appraised, not the individual archival documents. Digitized archival documents aren't appraised at all.
- *Warehousing*: the arrangement of the paper-based case files is based on the process. Despite a special archival unit, retrieval and accessibility of these case files (at the right moment) is doubtful. Because of a lacking appraisal many more archival documents are kept than necessary. There are no rules or procedures for the warehousing of the digitized archival documents. There are doubts whether all the existing case-files are complete.
- *Logistics*: the workers most of the time use digitized archival documents, but the quality of those archival documents is lacking. So it is often necessary to ask the archive unit to retrieve specific case files. When these case files are in use in another place within the process, retrieval and accessibility aren't possible. At that moment, the worker can't deal with the case in hand.

### 7.4. Creating a new situation.

In using the elements of the conceptual model, we developed a model for a new situation in which the above-mentioned problems were solved. We decided, especially for reasons of logistics, to combine both flows of archival documents in one digitized flow, of course taking into account that it must be possible for one or more archival documents also to be kept on paper or microfilm for evidential reasons. Subsequently, we constructed and implemented a process-specific archival document-file to create a new situation. This file was implemented by the use of IT-tools; see Table 4.

**Table 4. The process-specific archival document-file and its implementation.**

<i>The process-specific archival document-file</i>		<i>Implementation</i>	
1.1.	Detailed descriptions and indexes (legal regulations, societal influences and relationships, time-schedules for the destruction of archival documents).	⇒	Knowledge base implemented in workflow-engine. STEP files.
1.2.	Detailed descriptions of procedures and rules fixing quality management (e.g. imaging-procedure), organization schedules and lists of business processes and their relationships.	⇒	Knowledge base implemented in workflow-engine. STEP files.

1.3.	Detailed description of the specific business process (structures of process- and document-flow, logistics, authorization, used applications, appraisal and warehousing aspects). SDW and ARIS-files. Pointers to necessary software for retrieving process-bound archival documents.	⇒	Knowledge base implemented in workflow-engine. STEP files. This engine sets the rules for the used document management software. In ad hoc-cases attachment of knowledge base concerning 1.3. to each of the process-bound archival documents (including viewer for SDW- and ARIS-files).
2.1.	Description of used viewer(s), used software-standard and finding-aid system.	⇒	Document management software, linked to viewer software (images, text, spreadsheet, database) and finding-aid system for the retrieval of non-digital archival documents. Based on 1.3.
2.2.	Detailed description of the process-bound archival document and the data that are part of it.	⇒	Knowledge base implemented in workflow-engine and (document management) software; representation and handling set by rules in knowledge base. Based on 1.3. STEP files and SGML.
2.3.	Detailed description of role of each process-bound archival document in business process.	⇒	Knowledge base implemented in workflow-engine. Based on 1.3. STEP files.
2.4.	Detailed descriptions of authorizations concerning each process-bound archival document.	⇒	Knowledge base implemented in workflow-engine. Based on 1.3. STEP files.
2.5.	Used appraisal for each process-bound archival document.	⇒	Knowledge base implemented in workflow-engine and (document management) software. Based on 1.3. STEP files.
2.6.	Used warehousing for each process-bound archival document.	⇒	Knowledge base implemented in workflow-engine and (document management) software. Based on 1.3. STEP files.
3.1.	Description of triggers for creating, retrieving and using each process-bound archival document according to 'just-in-time'-concepts.	⇒	Knowledge base implemented in workflow-engine and (document management) software. Based on 1.3. STEP files.
3.2.	Audit trail, data of the use of the archival documents. Pointer to necessary software.	⇒	(Document management) software, event logging. ASCII file.

### 7.5. Benefits of the use of the process-specific archival document-file.

The process manager was made responsible for the warehousing of archival documents, assisted and consulted by the specialists of the former archival unit. Retrieval and accessibility became more effective. The digitized archival documents could be used at more places at the same time. The paper-based archival documents that are kept for evidential reasons only weren't used in the process operations. They are arranged according to the arrangement of the digital case-files. A finding-aid system was necessary for retrieval and accessibility for older paper-based files. The decision was made to store the digitized archival documents on CD-ROM. The process-specific archival document-file now functions as an engine, managing all the elements of the conceptual model. The flow of archival documents became more efficient and, as a result, the business process could be more responsive too. The performance of the business process is improved, and, besides effectiveness and efficiency, legitimacy and accountability are guaranteed too. For each task, the results of the implementation are shown in Table 5. In analyzing these results, we considered the parallelism and branching between tasks and the use of archival documents.

**Table 5. Results of the implementation of the conceptual model**

	<i>Before the implementation of the contextual model</i>	<i>After the implementation of the contextual model</i>
Making paper-based file	15 minutes	-
Registering and indexing paper-based file	10 minutes	-
Retrieval of paper-based file	5 minutes	-
Transportation of the asked-for paper-based files	20 minutes	-
Other document-handling	10 minutes	-
Making digitized case-file	2 minutes	2 minutes

Registering and indexing digitized case-file	3 minutes	3 minutes
Retrieval of digitized case-file	1 minute	1 minute
Registering new cases	60 minutes	30 minutes
Preliminary investigation	180 minutes	45 minutes
Waiting for medical advice	72 hours	72 hours
Make decision	180 minutes	30 minutes
<b>Total</b>	<b>80 h. 6 minutes</b>	<b>73 h. 51 minutes</b>

The average results are shown in Table 6:

**Table 6. Average results.**

<i>Working time benefits for each case</i>	6 hours
<i>Working time benefits for each case in money</i>	Euro 136, --
<i>Total cases according to Figure 5</i>	1506
<i>Working time benefits for all cases</i>	9036 hours
<i>Working time benefits for all cases in money</i>	Euro 204.816, --

## 8. CONCLUSION.

The question which we wanted to answer in this paper was: can the archivistic concept of the record keeping system within information-intensive organizations be used as an approach to improve the document-flow in a process, and, as a result, the process. We demonstrated that context, quality, appraisal, warehousing and logistics are necessary elements for improving the document-flow. Control of the document-flow can be organized in a more effective way by using our conceptual model and implementing the process-specific archival document-file. Not only the document-flow becomes more effective and efficient, legitimacy and accountability are guaranteed. Besides that, the responsiveness of the process is improved.

Ofcourse, applicability and benefits of the conceptual model only can be demonstrated more clearly in the near future. But we are optimistic about its global application: other case studies confirm the validity of the applied conceptual model. We emphasize that a document-oriented view is a very effective means to solve complex problems within dynamic organizations: it is a real 'document revolution'.

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