Evaluating Workflow Management Systems

Michael Berger[1], Ernst Ellmer[1], Gerald Quirchmayr[1], Alfred Zeitlinger[2]

[1] University of Vienna, Institute of
Applied Computer Science
and Information Systems
Liebiggasse 4, A-1010 Vienna, Austria
email: {mib | ee | gq} @ ifs.univie.ac.at
tel.: +43-1-4063567/{11 | 12 | 19}
fax: +43-1-4060197

[2] First Austrian Savings Bank
Department of Business Organization
Neutorgasse 10, A-1010 Vienna, Austria
email: bank.orga@die-erste.co.at
tel.: +43-1-53100-3535
fax: +43-1-53100-3585

Abstract

In this paper we describe a project focusing on the evaluation of workflow management systems for a large Austrian bank. In the first part we establish a catalogue of evaluation criteria. It summarizes the huge amount of criteria into smaller classes (criteria categories) and orders the classes in a semantically structured directory. In the second part, we describe a tool implementing the evaluation framework. A database stores the criteria classes along with associated questions as well as the appropriate answers for a set of workflow products. The tool allows to extend the database as well as to perform a customized evaluation process. In the third part of the paper, we describe some of the results of using the tool for evaluating workflow management systems for the First Austrian Savings Bank.

1. Introduction

Observing the market of Workflow-Management-Systems (WfMS), it will quickly be noticed that the market is young and promising, for this reason steadily growing and changing very fast. There are hundreds of firms and products on the market, which claim that their product is realizing workflow management. For example in the market study of [10] about 158 suppliers and about 180 products are mentioned.

The term workflow management is not defined exactly and is used by suppliers and buyers differently. They mix terms like WfMS, document management system and groupware. Although there is a substantial number of scientific papers to classify them, e.g. [13], [3], [5], [8] and although of the workflow management coalition [14] takes great effort in developing a standardization of the terminology, no common terminology which is used by science as well as by business exists.

For the reasons mentioned above, evaluations of the opaque WfMS market are very time-consuming and complex. They require a lot of knowledge about the WfMS domain as well as about the application domain of the desired product. Enterprises interested in buying a WfMS are of course looking for the best solution for them. The question is how to find the appropriate product. As in most complex decision making situations there is no objectively and generally determinable best solution. Two steps are necessary in order to establish an effective evaluation process. First, the problem domain has to be characterized, and second, based on the identified characteristics of the application domain, the evaluation has to be performed. We performed a project together with the First Austrian Savings Bank in order to carry-out a workflow evaluation and to "learn" how to organize and support such evaluations, i.e. to provide methodological and tool support for WfMS evaluations.

In this paper we report on the outcome of this project. We started with developing the business automation life cycle for workflow management based on a general business automation life cycle. The business automation life cycle for workflow management gives an overview of functionality provided by a WfMS and the artifacts to be managed. Based on the functionality and artifacts, we developed a classification of requirements for workflow management systems. The requirements were then extended by supplier requirements and platform requirements based on [12]. In this way we developed a comprehensive catalogue of WfMS requirements. Based on the requirements classification we developed a question catalogue intended to acquire information about workflow management systems in order to

determine if they meet the requirements. To manage the large amount of requirements and their associated questions and answers for each product to evaluate we implemented a tool based on a database storing all the above mentioned information. The tool provides an interface to answer the questions for WfMSs to be evaluated and also enables the user to quickly retrieve these answers for evaluation purposes. Furthermore the tool can be viewed as easily accessible knowledge base about workflow management characteristics and features of concrete systems. The tool also allows the adaptation of an evaluation process to a special application domain by weighing the requirements according to their importance for the special needs of the evaluating organization. We used the tool described above for the evaluation of six workflow products for the First Austrian Savings Bank. This paper focuses on the description of the evaluation framework and on the presentation of example results while the detailed results of the concrete evaluation of six workflow products can be found in [1].

We identify the following characteristics of our WfMS evaluation framework also representing the lessons learned and thus the main benefits of the project we carried out with the First Austrian Savings Bank.

Comprehensiveness: The requirements catalogue is comprehensive in the sense that it integrates features of a lot of existing workflow evaluation catalogues and reference models [12], [14], [4], [6], [2]. Furthermore, the catalogue is useful as a basis for education purposes within the enterprise. Together with the business automation life cycle for workflow management it describes the purpose of workflow management systems as well as the functional components of such systems.

Classification: The complex task of evaluating workflow management systems is mastered by building classes of similar criteria. These classes are hierarchically structured where each class contains a set of questions intended to find out if the requirements associated to the class of questions are met by a certain system or not.

Adaptability: The evaluation framework we designed is adaptable to the specific situation of the organization looking for a workflow management system. The requirements can be weighted according to their importance with respect to the application domain of the WfMS.

Extensibility: The architecture of the criteria catalogue supports extension. It is designed in order to allow introduction of new criteria and to associate them to a special class together with the questions related to this criteria. Because of its semantic structure, extensions don't negatively influence the clearness of the framework.

Tool support: Tool support for evaluation processes first provides an easy to use interface for answering the questions for a concrete WfMS. Furthermore, it allows to access quickly the answers to certain criteria. Third, by weighting the questions and associating values for the answers for a concrete system (e.g. 1: yes, 2: partly, 3:no) a ranking of the evaluated systems for a specific problem domain can be created automatically. Beyond that, the database of criteria, associated questions and answers for a set of different systems may serve as a knowledge base about workflow products.

The rest of this paper is outlined as follows. In Chapter two we describe the requirements determination process, i.e. the derivation of WfMS requirements from the business automation life cycle for workflow management. In Chapter three we introduce the requirements classification as well as the associated questions. In Chapter four we shortly describe the tool we developed and the data gathering process for the seven workflow products as well as example results of our evaluation. Chapter five concludes the paper.

2. Business automation life cycle for WfMSs

The business automation life cycle for workflow management systems is derived from the business automation life cycle consisting of the following five phases: (see Figure 1)

The **strategic decision process** is the core of the business automation life cycle. Its output is a business strategy, business goals and if necessary an engineering directive. The **business engineering process** is only started when an engineering requirement is stated through an engineering directive by the management. According to Jacobsen [7] we define business engineering as a set of techniques a company uses to design business according to specific goals. In opposite to other well known descriptions and definitions, we do not include the construction of information systems into the business engineering process (compare for example the approaches of business engineering of Jacobsen [7] and Österle [11]). The building of the business supporting information technology is part of the business development process. The **business development process** summarizes all activities to build information technology support for the engineered business. During the **business enactment process** the business is enacted (through information technology support) and data of the enacting process are collected. This phase can only by elaborated exactly according to the technology in use. The **business evaluation process** analyzes the data collected during the enactment process and compares it with the critical success

413

factors and therefore supports all other process activities. This process can be supported by analyzing and simulation tools.

As mentioned above the **business automation life cycle for workflow management systems** is derived from the business automation life cycle. The term business development can be used synonymously to the term build time as stated by the WfMC [14] and a lot of other authors. We divide these development activities into the workflow type modeling process (represents the dynamic view of an enterprise) and the organization modeling process (represents the static view of an enterprise).
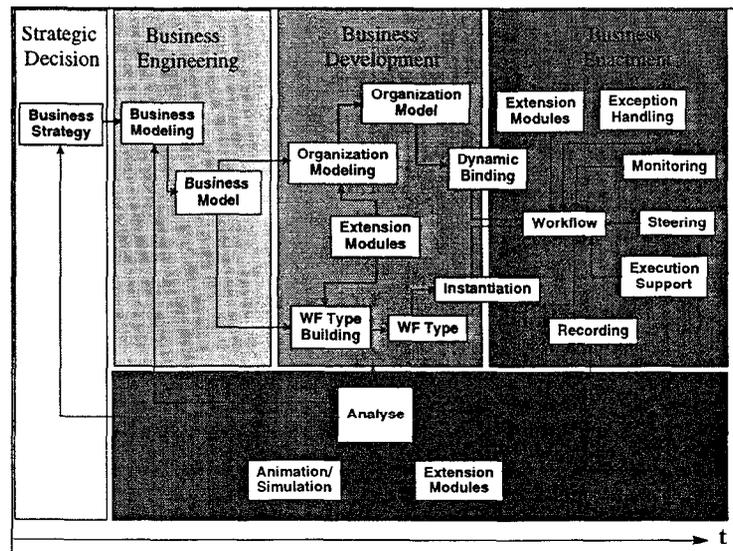

Figure 1: Business automation life cycle for workflow management systems

According to Ellmer [2] the **workflow type modeling** process is the building of abstract representations of real world processes called workflow types, which are executable by a WfMS. Through instantiation an instance of the workflow type is created, called workflow (instance), and the appropriate artifacts from the organizational model are assigned through dynamic binding. The **organization modeling** process summarizes all activities in order to build an organization model, which includes all necessary organizational information for dynamic binding. The organization model realizes the organizational integration of the WfMS into an enterprise. We describe workflow **type instantiation** as creating an enactable workflow instance out of a workflow type definition and thus make a workflow instance executable by a WfMS. Through **dynamic binding** the appropriate artifacts from the organizational model are found for the running workflow instance. Further the development process can be supported by a lot of additional software modules which are depicted as **extension modules** in Figure 1.

The business enactment process describes all activities and artifacts which are necessary to enact an instance of a workflow type. At our abstract level these are workflow instance, exception handling, monitoring, controlling execution support and recording. The

workflow instance is a currently enacted workflow by a WfMS in a certain state of execution. **Workflow controlling** means that the workflow instance is steered by the WfMS more exactly by the workflow engine. **Workflow monitoring** means to provide management and control information on the state of the workflow execution. **Workflow exception handling** treats exceptional situations, in which the predefined workflow is insufficient or wrong. **Workflow recording** collects data of the actions and events occurring during the execution of a workflow instance. The **workflow execution support** process summarizes all services (activities and artifacts) which agents need (humans or machines) to perform their tasks. The **extension modules** expand the functionality of the business enactment process.

As mentioned above the business evaluation process analyses the data collected during the enactment process and compares it with the critical success factors and thus supports each other life cycle phase. Workflow management systems offers sometimes an animation and simulation tool.

3. Classification of WfMS requirements

Because of the amount of criteria which should be taken into consideration on evaluating WfMSs, we developed a framework which arranges the requirements of WfMSs in a structured way. The

414

structure of the classification of requirements will be described in this section. Each explained requirement (criteria) class consists of a list of questions which have to be answered for a specific system in order to determine if it meets the associated requirements.

According to Schreiber [12] we divide our classification into three main classes software requirements, system platform requirements and supplier requirements. [1] gives a detailed description of the whole evaluation framework.

The **supplier requirements** are divided into the classes general supplier requirements, support and maintenance, contractual conditions of a supplier, costs and references.

The **system platform requirements** class describes the technical aspect of the integration of WfMS into existing information systems. The system platform is divided into the classes system concept, system hardware, operating system and system software requirements which we further subdivide into the classes programming language, database system, communication system and user interface.

The **software requirements class** consist of criteria concerning the WFMS itself. These requirements are divided into criteria concerning the **quality** of the WfMS and criteria concerning the **functionality** of the WfMS.

The class **software quality requirements** is divided into the classes efficiency, reliability and robustness, usability and ergonomics, data protection and security, maintenance and adaptability, friendliness for change and system independence and openness.

The class **software functionality requirements** is composed of the class general requirements and the class WfMS. The class general requirements is divided into the classes classification, installation, documentation, technical questions.

The structure of the class **WfMS** is derived from the business automation life cycle as explained above. Most WfMS support four sub processes of the business automation life cycle (all process except the strategic decision process), but the core of WfMS are the business development process and the business enactment process. The **business engineering phase** is the realm of business engineering tools like ADONIS, ARIS, BONAPART, etc. The **business evaluation process** is covered by costing.

The business development requirements of a WfMS are subdivided into the application building class and the method class. The class method is further divided into questions to the method process meta model, modeling techniques and roles.

The requirements of the application building class are classified according to the business automation life cycle for WfMS, therefore they are explained in the section business automation life cycle for workflow management. In this chapter we only mention the classes which are not explained sufficiently above, like the parts of the organization model. The requirements class organization model is subdivided into:

The **function model** is described as a set of applications of an enterprise which are invoked by the workflow. The **data model** is described as the set of data of an enterprise which is used by an instance of a workflow. We describe an **organizational model** as a model of the organizational structure of a corporation. The organization model consists of organizational artifacts like places, roles, agents, functions etc. Each WfMS has a different meta model, so it is important to study whether it is possible to represent ones organization with these artifacts before buying a specific WfMS.

The requirements of a WfMS during the workflow type modeling phase are summarized in the class workflow type modeling. We divided the requirements into the classes hierarchical structure, application, data, organization, control flow, causality, protocol data and transaction.

The requirements during the **business enactment process** are structured as described at the business enactment process for WfMS. Because of the detailed description in this part, we do not further elaborate these classes now. Only the workflow execution support will be described: We divide the requirements of this class into workflow client for end user requirements and workflow administration client requirements. The requirements of the client for end users are further divided into requirements classes concerning the work list, help, manipulation of documents, signalizing work, form designer, deadline and repeat feature, printing, searching and memo.

4. Data Gathering and Selected Results

The classification of requirements explained in chapter three is the basis for an evaluation of workflow tools for the First Austrian Savings Bank. For the gathering of data we developed a database which maintains the questions and answers. It provides a graphical interface to support the input and rating of the data. Figure 2 shows this graphical interface.
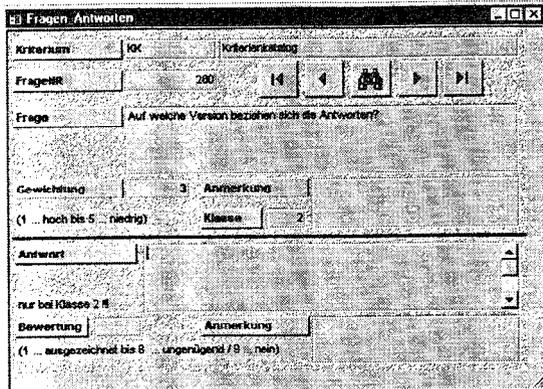
415

Figure 2: Snapshot of the input window

We evaluated the following six workflow management systems: ComponentWare (FABA), Entire Workflow (Entire), OpenWorkflow (Unisys, Wang), Staffware (Staffware), Workflow (C.S.E) and WorkParty (SNI). The suppliers (producers) are mentioned in brackets.

The database was sent to the suppliers (producers) for answering the questions. Because of the co-operation with the First Austrian Savings Bank (the second largest bank in Austria) all suppliers were highly interested in answering the questions.

Because of the scope of this paper we only give an overview of the questions and answers for the requirement classes "classification and miscellaneous" as well as the class "workflow exception handling" in the following section

The class "Classification and Miscellaneous"

I) How would you classify your product (WfMS, DMS, workgroup, DMS with WFMS-functionality, etc.)?

ComponentWare: DMS, WfMS and Intranet based on an object-oriented basis. The main part of the groupware functionality is executed through MS Exchange
Entire: WFMS
OpenWorkflow: DMS with Workflow-Functionality
Staffware: WfMS
WorkFlow: WfMS with DMS- and groupware functionality
WorkParty: WorkParty is WfMS, with the component SmartAssist workgroup, and with ARCIS as DMS
II) Which sort of workflows can be supported by your system a) production workflows b) administrative workflows c) ad hoc workflows. This classification was first mentioned by McCready [9].
III) Which co-ordination model is the basis of your system: Is the workflow modeled a) as a process b) as a flow of documents c) as a conversation structure?

IV) Is the basis of your product a) a database b) a mailing system?
V) Do you support the interfaces of the WfMC reference model?

product/question	II	III	IV	V
ComponentWare	a), b), c)	a)	a)	yes
Entire	a), b)	a)	a)	yes
OpenWorkflow	a), b), c)	b)	a)	yes
Staffware	a), b)	a)	a)	yes
WorkFlow	a), b), c)	a), b), c)[1]	a)	yes
WorkParty	a) b)	a)	a)	yes

Figure 3: Table of supplier answers for the questions II - V

The Class "Workflow Exception Handling"

WorkParty did not answer the question of this class.
0) Who has the right to change a just enacting workflow instance?
ComponentWare: Is dependent on the access control list of the workflow and the users.
Entire: A user can change the enactment according to the definition during build time.
OpenWorkflow: Has to be defined during build time.
Staffware: The process owner, administrator and all defined groups of users
WorkFlow: Everyone, who has the right to see and change the graph of the workflow.
I)   Is it possible to insert a task during run time?
II)   Is it possible to suspend workflow instances?
III)   Is it possible to break off instances?
IV)   Has the user the possibility to reject the execution of a task?
V)   Is it possible to create ad hoc workflows during run time?
VI)   Is it possible to reset certain executed activities?
VII)   Does a modification of a workflow instance result in a consistency check?
VIII) Does your product support the jumping over a certain amount of tasks during run time?
IX)   Does your product support the moving of activities during run time?
X)   Does your product support horizontal delegation (forwarding a task to a colleague at the same hierarchy level)?
XI)   Does your product support vertical delegation (forwarding a task to a colleague in a level upper and lower level)?

---

[1] CSE answers that they support all coordinations models dependent on the requirements of the buyer.

416

Produkt/question	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
ComponentWare	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes
Entire	yes	yes	yes	yes	no	yes^2	yes	no	yes	yes	yes
OpenWorkflow	yes	yes	yes	yes	yes	no	no	yes	yes	yes	yes
Staffware	no	yes	yes	yes	no	no	no	no	no	yes	yes
WorkFlow	no	yes	yes	yes	yes	no	yes	no	no	yes	yes

Figure 4: Supplier answers for the questions I - XI

5. Conclusions

In this paper we presented an approach for evaluating workflow management systems. This approach was developed from an evaluation project carried out together with the First Austrian Savings Bank. It consists of three parts. First, a business automation life cycle for workflow management characterizing the main functional components of a workflow management system as well as the main phases of business performance and automation. Based on the life cycle a set of requirement classes for workflow management systems was developed. For each class we identified a set of questions in order to check for a concrete system if the associated requirements are met. Beyond developing this evaluation framework, we also implemented a tool based on a database for managing meta data (structure of the requirements classes) as well as data (answers to questions for certain systems). This tool also provides a comfortable way for inserting or retrieving data about workflow management systems. We also presented some results from a first usage of the evaluation framework as well as the associated tool for the evaluation of six workflow management systems.

Acknowledgments

We acknowledge the support of the First Austrian Savings bank for the evaluation project.

References

[1] Berger, M., Niederhuber, Ch., Evaluating Workflow Management Systems, Technical Report, Univerity of Vienna.

[2] Ellmer, E.,Three Perspectives on Process Supporting Environments - Integrating Workflow and Software Process Research. In *Proceedings of the International Symposium on Applied Corporate Computing*, October 25-27, 1995, Moterrey, Mexico.

[3] Ellis, C. A., Gibbs, S. J, Rein G. L., Groupware: Some Issues and Experiences. CACM, Vol. 34, pp. 38-58.

[4] Grefen, P., Vries, R. R., A Reference Architecture for Workflow Management Systems, Memorandum INF95-36, Univeristy of Twente.

[5] Hales, K., Lavery, M., Workflow Management Software: the Business Opportunity, Ovum, London.

[6] Jablonski, S., Workflow-Management-Systeme - Modellierung und Architektur, Thomson's Aktuelle Tutorien/9, 1995.

[7] Jacobsen, I., Ericsson, M., Jacobson, A., The Object Advantage - Business Process Reengineering with object technology, 1995.

[8] Koulopoulos, T. M., The Workflow Imperative - Building Real World Business Solution.

[9] McCready, S., There is more than one kind of Work-flow Software, Computerworld, November 2, 1992.

[10] Neis, F., Mueller, F., Produkt und Marktübersicht für Dokumenten und Workflow Systeme, Wiesbaden, Zürich, 1995/96.

[11] Österle, H., Business Engineering Prozeß- und Systementwicklung, Heidelberg 1995.

[12] Schreiber, *Beschaffung von Informatikmitteln - Kriterien, Pflichtenheft*, Bewertung, Bern, Stuttgart 1991.

[13] Schulze, W., Böhm, M., Klassifikation von Vorgangsverwaltungssystemen, in: Geschäftsprozeß-modellierung und Workflowmanagement - Modelle, Methoden, Werkzeuge (Vossen, G., und Becker, J.), pp 279-293), Bonn.

[14] WfMC-Homepage, http://www.aiai.ed.ac.uk/WfMC/

---

^{2} Only if the evoked programs support a reseting.

417