# Collaborative Workflow Management for Logistics Consortium

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**Abstract.** Logistics activities require strong information systems and computer support. This IT support requirements has expanded with the advent of e-commerce; utilizing B2B (Business to Business) and P2P (Partner to Partner) e-commerce. There has been an increasing tendency to set up consortia that represent several players in a given field collaborating with one another to form a large logistics consortium in order to form one organization to compete with larger competitors and/or extend beyond their region of operation. This paper deals with the management of collaborative workflow changes in such consortia and the adaptation of these changes to existing workflow systems. We also discuss issues of adaptation to new systems, workflow mining techniques for adaptation and a proposed prototype to capture the meta-data to implement the workflow system.

## 1 Introduction

This paper aims to develop the modeling approach for dynamic business processes for large logistic consortia, where business strategies can be captured vigorously while simultaneously allowing workflow changes to be handled. Often we see that the business processes are composed of several parts, a structured operational part and an unstructured operational part, or they could be composed of semi-structured parts with some given and some unknown details. Unpredictable situations may occur as a result of changes by management. The inability to deal with various changes greatly limits the applicability of workflow systems in real industrial and commercial operations. This situation raises problems in workflow design and workflow systems development. We propose workflow modeling and workflow mining techniques for the adaptation of workflows to the existing workflow system

## 2 Collaborative workflow model for logistics consortium

The advent of the web to bind organizations together, for carrying out sales over great distances and at any time has created new modes for marketing and enabled partnerships, previously inconceivable within a wide array of businesses, as well as other human activities. A consequence of this connectivity and information richness is that one is faced with an increasingly dynamic business environment and marketplace.

Warehouse logistics are activities that require strong information systems and computer support. This IT support has expanded with the advent of e-commerce. However, with the advent of B2B (Business to Business) and P2P (Partner to Partner) e-commerce, there has been

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an increasing tendency to set up consortia that represent several players in a given field. Such consortia consist of companies or organizations in a given field that get together and produce a single site or what appears to be single site in order to increase traffic through the site compared to other competitor's sites and/or extend beyond their region of operation.

### 2.1 General Organizational Workflow Models

In general, we found that most workflow modeling and workflow designs are only concentrated on the operational aspects of the organization [Siebert, R, Han Y et. al, Marshak, R.T]. Although operational aspects of workflow designs are crucial to the organization, we note that they are passive in changes and are not dynamic. They only change when there is a management decision. Collaborative workflow is a new type of workflow that has to be integrated into the existing operational workflow.

### 2.2 Organizational Workflow Models

As per the paper by **Marshak, R.T**.: "*Falling in Love with Distinctions*", in the "New Tools for New Times: The Workflow Paradigm", Future Strategies Inc., 1994 [Marshak, R.T] states, in any organization, a workflow can be disseminated into three categories. These three types of workflow are supported by three categories of workflow systems.

1) **Ad-hoc workflows** involve human coordination. For example, office processes such as product documentation or sales proposals.
2) **Administrative workflows** involve repetitiveness. For example, routing an expense report or travel request through an authorization process.
3) **Production workflows** (automated tasks being performed repeatedly) production workflow encompasses an information process often involving interaction with one or more distributed/ heterogeneous/autonomous information system.

According to **Dr Hala Skaf-molli** [http://www.loria.fr], workflow can be categorized into four groups:

1) Collaborative workflow
2) Production workflow
3) Administrative workflow
4) Ad-hoc workflow

### 2.3 MAO Model [Managerial, Administrative and Operational]

In our study, we have found that there are many workflow components within an organization and these workflow components interact with each other to achieve the organizational goals and objectives. Therefore, we disseminate the organization's workflow into the following levels:

a. **Operational workflow** relates to the core business operations. It is usually measured by its performance and by the volume of its output. The operational workflow is the main source of value generation for the organization.
b. **Administrative control workflows** are involved in making decisions and the prioritizing and scheduling of tasks. The administrative task workflow is measured by its efficiency.
c. **Managerial workflow** carries out business decisions, which in turn control entire business administration and is measured by the financial and final results.

Here, we see that customers, suppliers and partners are external entities to the organization's administrative component. Alternatively, they can be partly out of the actual organization in the form of branches. Similarly, operational components can be outside the organization in the form of a partner possibly in an overseas location.

### 2.4 Collaborative MAO Model

The advent of the Internet has provided mechanisms to allow organizations to bind together for carrying out sales over great distances at any time. It has created new modes for operation for service and marketing and enabled partnerships, previously inconceivable, within a wide array of businesses as well as other human activities. A consequence of this connectivity and information richness is that one is faced with an increasingly dynamic business environment and workflow. Several factors characterize this collaboration [Chang, E. et. al 2000], namely:

a. A strong information infrastructure that extends beyond the original closed walls of the individual enterprise.
b. High connectivity and electronic handling of information of all sorts including data and documents.
c. An increasingly collaborative approach between what were more traditional, individual enterprises.
d. Utilization of new forms of electronic interaction, provision of services and utilization of services.
e. Ability to self-organize and reconfigure the business of the organization; perhaps even the organization as a whole.
f. Use of multiple channels for sales and marketing.

A key factor in the success of such **collaboration** is the creation of the underpinning information infrastructure to carry out the required services and development to enable and support the creation and the strengthening of small-medium enterprises (SMEs) to achieve some of the characteristics of collaboration. We have found that our MAO model (refer to figure 1) is suitable for a collaborative environment.

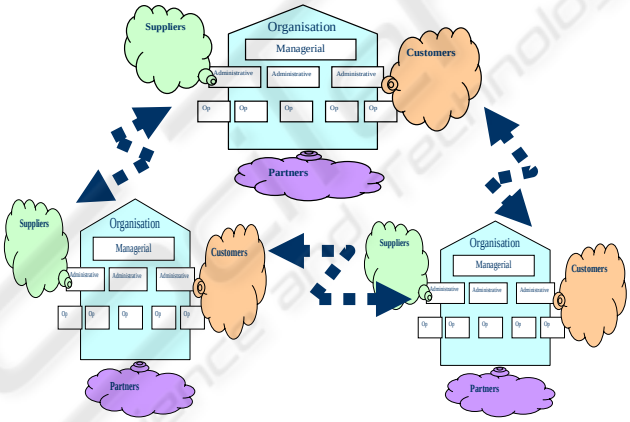


**Fig 1**. Collaborative Organizational Workflow

## 3 Issues in Adoption of New Systems

An organizational workflow is a composition of a number of workflow components. Some workflow components are active when changes take place and some are stationary.

So far, little has been addressed in literature in the classification of workflow components, their inter-relationships or formal definition of their attributes and processes. There has been some existing workflow modeling techniques used in literature to help model the workflow and dynamic aspect of the workflow, such as Petri Nets [Aalst, W.M.P et al,1999, 1996, Jensen, K

1992], Event-driven Models, State Event and Action Rules [Nutt G 1996, Aalst, W.M.P van der; Jablonski, S 2000, Joeris, G 2000, Ortner, W., Starty C, 1999], UML Activity Diagrams, Sequence Diagrams and Extended Activity Diagrams [Gautama, E Chang, E. 2001, Stary, C 1996, Gantama, E.,et al, 2003]. We found that these techniques allow for modeling of existing processes. However:

a. They do not model the inter-relationship between the workflow components. Some aspect of concurrency and asynchronous execution of the different workflow process (i.e. multi-threading);
b. Their current use does not deal with the dynamic aspect of workflow models or provide a clear indication where the flexibility is allowed, when changes occur or how the organization can adapt the changes at Just-In-Time; also
c. These modeling techniques only model one aspect of the organizational workflow and sometimes have too low a level of representation and they are basically not applicable at the conceptual level of development of complex organizational workflow systems [Bossidy, L. & Charan, R. 2003, Mohan C 1999, Chang, E. et. al 2003].The necessity is for modeling the workflow at a higher level of granularity that involves many sub-workflow components and workflow processes, their interfaces, interaction and relationships. Management is often not in a position to make realistic assessment of whether their organization can execute the decisions taken by their collaborative consortiums and if these decisions can be implemented in the workflows at the production level.

In this paper, we propose using workflow mining to support the transfer of this unstructured information and also to determine if these decisions are valid enough for workflow implementation, thus helping management to get feedback on their decisions in the better running of the organization.

## 4 Workflow mining technique for Adaptation

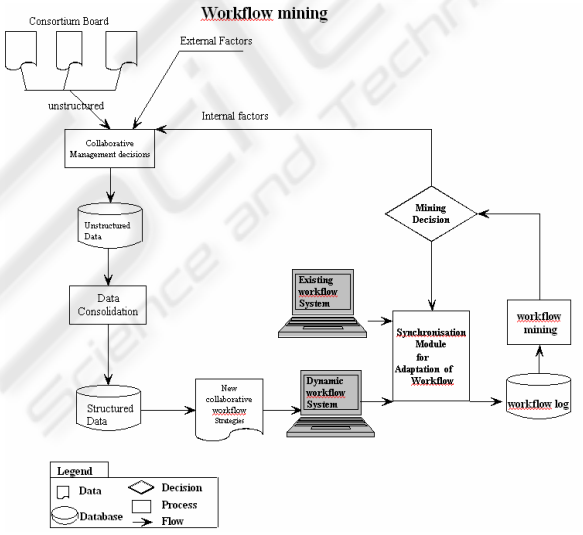


**Fig 2**. Workflow Mining Strategy for Logistics Consortium

The decisions taken by the consortium board, which is represented as unstructured data is passed on to the collaborative consortium management. This data which is unstructured is converted into structured data through a process of unstructured data management (UDM), a

process of mining, organizing and analysis to extract actionable information. Here, UDM is used as a text mining tool to convert the unstructured information into structured data by considering precision, thoroughness and relevance of the unstructured information provided (please refer to figure 2).

Creating workflow processes is complicated and time consuming as per the requirements of management. To support the continuous design process, we propose using a workflow log which contains information about the workflow processes, information collected at runtime and can be used in the diagnosis and redesign phases to derive a model explaining the events recorded in workflow mining. Internal factors are passed on for further consideration in the decision making processes by the management; otherwise it is a cyclic process in creating a new workflow model from existing workflow.

## 5 Prototype Implementation

We propose using a meta-data based application generator for dynamic workflow system management. This meta-data application generator [John Davis et al 2004] contains meta-data definer, run-time updater, application meta-data and a run-time processor. Meta-Data Definer is made up of a meta-data design editor which provides efficient methods for defining the meta-data, Third party design import wizards to import third party design toolsets and convert them into corresponding meta-data syntax and a data source reverse engineering wizards to reverse engineer existing data base schemas and convert this schema to corresponding data dictionary meta-data to accelerate the meta-data system design process.

Run-time updater updates live program and data dictionary meta-data for existing applications. Application meta-data consists of platform independent application meta data. Run-time processor consists of platform dependent visual component mappings, event processing mapping and DBMS mapping. Here, mapping of meta-data takes place for various structures, components and data schemas and in the final stage, we propose using some level of platform dependent drivers to generate a workflow.

A workflow model represents a group of workflow components. It explicitly captures different characteristics of the target area. Frequently, the choice of characteristics to retain is dictated by relevance [OMG 1999]. We propose the steps of modeling the workflow which can result in effectively capturing the changes

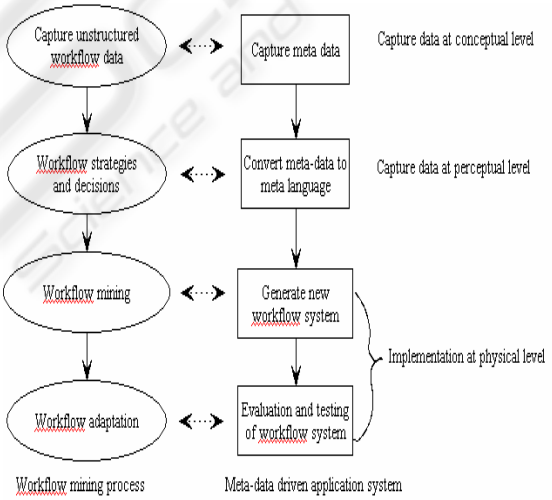


**Fig 3**: Conceptual View of Meta-data Driven Architecture for Collaborative Management

Requirements from customers are changing and functionalities have to be added to the software already created, which may require new technologies. Therefore, to enable the integration of the old system with the new system and any other system created in the future, meta-data driven architecture has to be used.

Meta-data driven architecture includes the iterations of deploying, combining and managing data as well as applications. Meta-data driven architecture is made up of a platform-independent UML model and one or more potentially platform-specific models. In addition, the platform independent model contains information about how the UML base model is implemented on the middleware platform.

Meta-data driven architecture utilize Model Driven Architecture (MDA) concepts [OMG 1999]. Currently there are at least 40 tools that incorporate at least one major aspect of MDA: UML based modeling transformation between the applications over all design models and the models that are specific to the underlying computing architecture (.NET, EJB and so on); and the generation of code in a specific language. Williams estimates that MDA generates about 50% to 60% of the application code but it also depends on applications, using this approach we hope to generate a new workflow system.

## 6 Conclusion

In this paper, we have discussed the issues faced in collaborative organizations, the development of workflow systems based on decisions taken at managerial levels and the adaptation of these issues in new workflow systems. We have proposed using workflow mining technique for adaptation to existing workflow and introduced the concept of workflow mining and workflow log, where we need to work on the issues and their further role towards adaptation into the workflow system.

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