

Applications of Workflow in Supply Chain Management: A Case Study

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Abstract—Supply chain management is increasingly important in modern enterprises. Various information systems have been developed in the domain of services-oriented supply chain management. But as the complexity of supply chain, there are still two big problems. On the one hand, most of the traditional supply chain management systems can not really achieve integration among different organizations. On the other hand, few systems can adapt the changes of supply chain very quickly. In this paper, we attempted to achieve the combination of workflow management and supply chain management. Based on the theories of workflow, we developed a process-oriented and event-driven supply chain management system which could be much more flexible, quickly and efficient.

Index Terms—Supply chain management, Business process, Workflow, Workflow management

I. INTRODUCTION

As the development of the global economic integration, the competition among enterprises is being superseded by the competition among supply chains. Agile supply chain management has become an effective and significant measure to enhance competitive advantage of modern enterprises [1],[2]. So, the effectiveness of a supply chain management is an important factor of determining enterprise's success or failure. In the fierce market competition, supply chain management will determine its vicissitudes.

For supply chain management is a very complex systems engineering, we need high efficiency information system to support it. But there are various kinds of enterprises in the supply chain. Different enterprises may have different information system and different types of data. Moreover, changes in supply chain take place frequently. And most of the commercially available supply chain management information systems do not offer sufficient flexibility for

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distributed organizations that participate in the chain. So, how to integrate the information in the whole supply chain and make the system more flexible is the principal problem for a supply chain management information system. Workflow and workflow management is just the technology that can deal with the problem.

In this paper we focus on the application of workflow technology and the theory of workflow management in the field of supply chain management.

The paper is organized as follows. Section 2 depicts some basic knowledge about workflow and workflow management. Section 3 describes the method using workflow to optimize a supply chain management information system. Finally, a simple case about Olympics supply chain management information system is discussed in Section 4.

II. BASIC KNOWLEDGE ABOUT WORKFLOW

Function structure had played an important role in organizations in the past. But now, the crucial factor has been business process. More and more attention is paid in the field of business process management. As a critical process-oriented technology, workflow has won more chances and attracts more and more focuses. It is considered today as one of the key technologies for providing efficiency and consistency of organizations.

Workflow Management Coalition defines workflow and workflow management system as:

The automation of a business process, in whole or part, during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules [3].

A system that completely defines manages and executes “workflows” through the execution of software whose order of execution is driven by a computer representation of the workflow logic [3].

Now we have got the idea about what is workflow and what is workflow management system. But why do we need workflow? Is workflow management system better than traditional information system?

In fact, as a key technology in supporting business process reengineering and an effective means realizing full or partial automation of a business process [4], workflow management has two inherent advantages. Firstly, the technology of workflow can separate business processes from programs, so

it will be very flexible while changing business processes. Secondly, the automation in traditional information system is at the level of tasks. That is to say tasks of each activity can be done automatically by computer system, but the contact among activities can not be finished automatically. However, workflow management system is process-oriented and event-driven. The automation can rise to a higher level.

III. APPLICATION OF WORKFLOW IN SUPPLY CHAIN MANAGEMENT

Supply chain management is the process of planning, implementing, and controlling the efficient, cost-effective flow and storage of raw materials, in-process inventory, finished goods and related information from point of origin to point of consumption for the purpose of conforming to customer requirements [5],[6]. The short-term objective of supply chain management is primarily to increase productivity and reduce the entire inventory and the total cycle time, while the long-term objective is to increase customer satisfaction, market share, and profits for all organizations in the supply chain: suppliers, manufacturers, distribution centers, and customers [7].

Supply chain management is a very complex systems engineering. A supply chain needs different kinds of enterprises to cooperate with each other for the same purpose, and all of them have different kinds of influences. That is to say we need a vast amount of data interchange and process management among enterprises. But each enterprise has its own information system, types of data in different information system is multiform. Although traditional supply chain management information system can unify data in each enterprise. We have to recompose the basic code when there are changes in our supply chain. From Figure 1 we can see the architecture of traditional information system. For it is 3-tier architecture, we have to recompose the basic code in business logic while changes take place. It is easy to see the redressal is very difficult and is a waste of time.

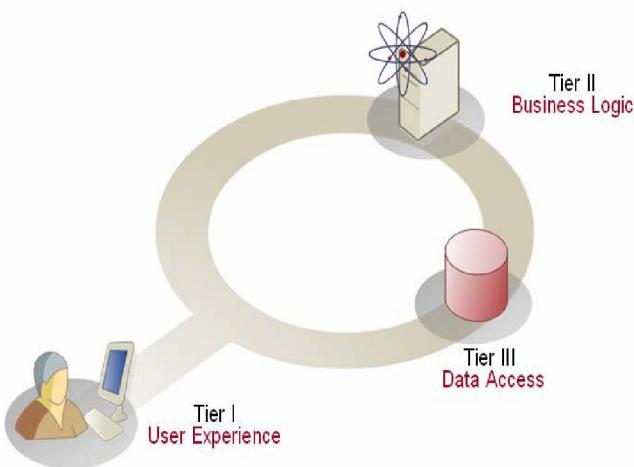


Figure 1. Architecture of traditional information system

To solve the problem, workflow management system which is process-oriented and event-driven has much more flexible, quickly, high efficiency character in the local use of process management. It also can provide the tools and functionality to design and automatically coordinate the execution of business processes [8].

How can workflow management system solve the two main problems of supply chain management information system? Let us see the architecture of one kind of workflow management system in Figure 2.

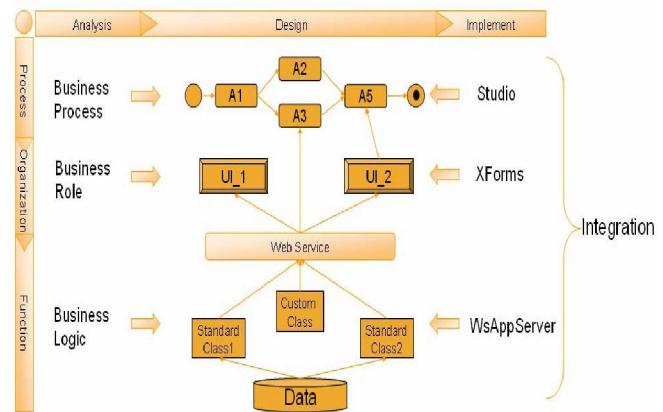


Figure 2. Architecture of workflow management system

In workflow management system, every system user has one proper role. Users with different roles may have different user interfaces, may see different data and may have different influences to the system. One organization in a supply chain owns one or more users. The only thing we have to do is to give proper roles to organization users, so the organization can be a part of the supply chain management information system without building complex business logic.

In fact business logic is also needed in workflow management system. We can write simple code to accomplish business logic which is separated from business process.

Business process in a supply chain management system is event-driven and can be modulated easily. Changes about business process have nothing to do with business logic. So the whole system will be very flexible, and we can solve the two problems of supply chain management system by using this architecture.

There are three steps to accomplish a workflow management system. Firstly, with the help of workflow designing tools we can accomplish the model of workflow process. Then, we have to set proper parameters which is called model instantiation. Finally, it is time for running the model and man-machine interface.

After introducing the advantages of workflow and how to accomplish a workflow management system, a simple case about Olympics supply chain management information system will be discussed in Section 4.

IV. OLYMPICS SUPPLY CHAIN MANAGEMENT INFORMATION SYSTEM

In this section I will introduce the development of one simple supply chain management information system based on Cordys BCP (Business Collaborative Platform). Then the advantages of workflow technology will be much clearer.

At first, we had better get some basic information about our project.

Our project is a simulation about Beijing Olympic Games' supply chain management information system. The main objective of the project is using Cordys BCP to develop an information system to achieve Olympics supply chain management and realize the collaboration among different organizations [9].

The supply chain of Beijing Olympics Games has following characteristics:

- The quantities of items demanded are enormous.
- The inventory of stadium should be as less as possible.
- The logistics of Olympics materials should be just in time.
- Asset management is needed to track the important items throughout its lifecycle.
- Many constraints should be considered, such as on time delivery, distribution capacity, warehousing capacity, and budget etc.
- Collaboration among different roles is an important factor for achieving Olympics Games.

There are 6 main roles involved in Olympics supply chain, as in Figure 3:

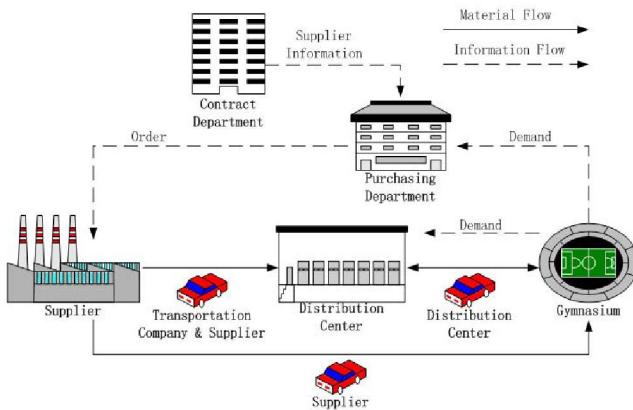


Figure 3.Main roles of Olympics supply chain

Gymnasiums are the organizations really need the items. Contract department selects suppliers and evaluates their performances. Purchasing department is in charge of collecting the demands of gymnasiums. Supplier is the one who supplies the items. Distribution center is the one who stores the items, distributes and collects them when they are needed. Transportation companies are in charge of the importing transportation between foreign suppliers and

distribution centers.

Figure 4 shows the main business and functional departments of Beijing Organizing Committee, including five parts: demand management, inventory management, order management, distribution management and warehousing management.



Figure 4.Main business and functional departments of Beijing Organizing Committee

All the departments have to make their on hand inventories clear. Inventory management is in charge of managing inventory in stadiums and making purchasing plans, so it is one necessary part of Olympics supply chain management. Besides, different departments have to submit their estimated requirements. Demand management is to collect the demand information from stadiums. Moreover, purchasing department makes procurement plans and orders before the games and monitors the processes. Distribution center stores the items, distributes the items during the games and collects the items after the games. In order to achieve effective collaboration, demand management, order management, distribution management and warehousing management are all absolutely necessary.

All in all, we need a smart and flexible information system to help us control the complex logistics process and achieve effective supply chain management. Here, we just introduce the primary part of the whole Olympics supply chain management information system which is the order management system.

The order management system is developed on the platform of Cordys BCP. Based on the theory of workflow, Cordys BCP is a comprehensive, open and flexible Enterprise Service Bus environment allowing organizations to easily connect, develop, deploy and manage web services based solutions [10].

Integrator, Orchestrator, Studio, Wsapps (Web-Services Application Server) and Portal constitute Cordys BCP. There are two important parts in Studio, BPM (Business Process Model) and Xform. Look back to the architecture of the workflow management system in section 3. Business

process can be created with BPM. BPM provides a feature-rich and easy-to-use environment for modeling business processes and applications respectively and, so it is very flexible to deal with changes. Xform is in charge of friendly user interface. In fact, Cordys Studio is an application- package that provides a comprehensive multi-user workbench for designing collaborative applications and business models [10]. Business logic can be achieved by Wsapps. Based on the tables in database, java code achieving basic business logic can be written automatically. We also can write java code for other logics using Wsapps. Moreover, Integrator can deliver a comprehensive and flexible infrastructure that allows organizations to easily integrate legacy and new applications [10]. Orchestrator can be seen as an event-driven execution layer and with the help of Portal we can monitor and improve our business process.

So with the help of Cordys BCP, every organization does not need to build a new information system to take part in the supply chain, but through internet. Our order management system can achieve faster processing of order, faster data retrieval through the web application and automatic update of data upon receipt of a purchase order.

Figure 5 shows the main business process of order management created by Cordys BPM, including 6 steps such as make order, delivery, etc.

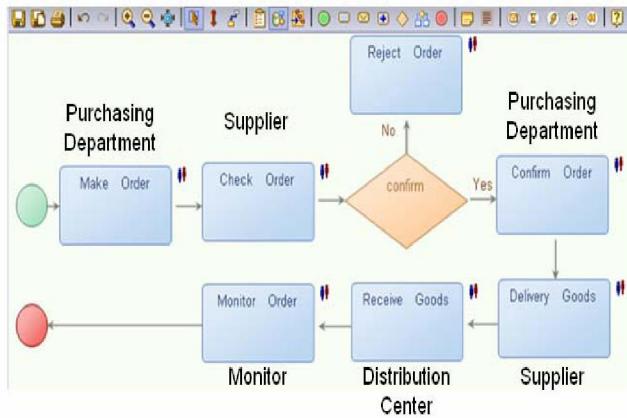


Figure 5. Business process of Order Management

The order management focuses on the life cycle of orders. So our order management system is a role-based and process-oriented collaboration around the state management of purchasing orders. The order state transition can be seen in Figure 6. Purchasing department makes order to supplier, then supplier manufactures the items and delivers them to distribution center. The order state passes through the whole process. Every new order has “Initial” state. When purchasing department fills the order information and press button “Order”, the state is turned to “Ordered”. Then supplier can confirm, revise or reject the order. If supplier revises the order, purchasing department can confirm or cancel the order. After the order state becoming

“Confirmed”, supplier will notify distribution center for delivery and during delivery the state is “Delivered”. Finally distribution center will receive the items and the state will be turned to “Received”.

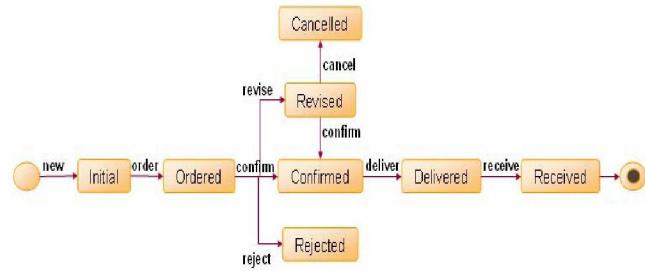


Figure 6. Order state transition

The logic of order state transition is achieved by Wsapps. WsApps integration mainly includes:

- Initialization Event Handler.
- Enabling Event Handler.
- Constraint Handler.
- Database Operation Handler.

To enable auto-initialize, we need Initialization Event Handler. For instance, when we create a new order, Initialization Event Handler can help us achieve the logic of setting “Order time” automatically.

With the help of Enabling Event Handler we can apply access mode. Figure 7 is one example of Enabling Event Handler.



Figure 7. Example of Enabling Event Handler

Based on roles and states, different users in different periods may have different potencies. In Figure 7, the one above is purchasing department’s user interface and the one below is the user interface of one supplier. In our business logic, purchasing department can select orders by item, by supplier or by order state. However, supplier is not allowed

select orders by supplier. So there is no select by supplier menu in supplier's user interface.

In our system, unreasonable input will be forbidden. The logic is achieved by Constraint Handler. Figure 8 gives us an example of Constraint Handler. There will be an alert when receipt date is earlier than order date.

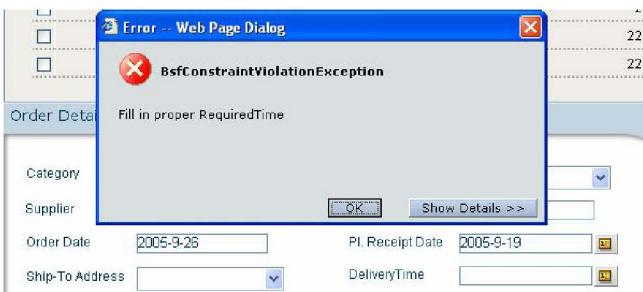


Figure 8. Example of Constraint Handler

Database Operation Handler is in charge of logics about database.

So with the help of Cordys BPM, Xform and WsApps, we can achieve flexible process, friendly user interface and powerful logic in our order management system.

V. CONCLUSIONS

To compete in today's business environment, companies are required to integrate business activities into a global response strategy. To cope with sudden changes, companies need to conduct their business activities in a flexible manner [2]. This paper proposed the application of workflow in the field of supply chain management. The advantages of workflow technology can be seen clearly after the introduction of Olympics supply chain system. More advanced applications will also be investigated in the further.

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