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An innovative framework of collaborative-based workflow in Development Chain Management

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ABSTRACT

Currently, most product development procedures have been characterized as unnecessarily complicated. To maintain a competitive edge and to simplify the procedures, joint efforts from different functional groups play such crucial role. Specifically, information from marketing, sales, engineering, sourcing, and manufacturing should be cross-referenced. In addition, adopting pre-defined workflows contributes to efficient collection of distributed information. Moreover, unlike traditional workflow, a collaborative-based workflow (CWF) in product development process boasts of complicated workflow forms with manifold views for a workflow execution. Traditional workflow solutions, for instance, can only transmit a workflow form through different actors. Such workflow solutions merely offer modeling approval-based workflow (AWF), such as drawing reviews or absence applications.

This paper illustrates the framework of CWF solution and proposes its application in the model workflow of a distributed product development system. This framework includes four interrelated modules. They are KM4, AS API, SmartForm, and Workflow Engine. In addition, four visual assistant modeling tools are introduced and they are Data Designer, AppDefinition, Layout Designer, and CWF Builder. To fulfill the varied business requirements, Data Designer, AppDefinition, and Layout Designer attempt to achieve a dynamic and efficient construction of complicated workflow forms in collaborative workflow solution. Other workflow-related setups, such as defining status diagrams, correspondence persons, and applicatory workflow forms, are accomplished in CWF Builder. The major contribution of this paper lies in the proposing of a framework for CWF and in the introducing of visual tools for CWF modeling. Compared to the traditional hard-coding method, the construction time for CWF system can be reduced significantly with the assistance of modeling tool. Time reduction on developing information systems, in this regard, is a very important issue for most modern industries. The concept in this paper can direct a global enterprise to efficiently construct workflow management system for global collaboration.

1. Introduction

Local development of marketing specialists has been limited by our market size and education system. Despite this systematic inadequacy, the engineering education in Taiwan has been successful in strengthening product design and development capabilities. Because of this particular development, Taiwan has a high-level of commitment to the product design and development segments.

To maintain this competitive edge, companies in Taiwan need a system to better execute their development capabilities. Specifically, network should be well-connected to enable the exchange of such information as marketing, sales, engineering, sourcing, and manufacturing. In addition, to gain a competitive edge in the global industry, it is common for companies to distribute their development personnel in various locations. However, the distances among these locations pose many serious communication problems.

In addition to the communication problem, heterogeneous data integration poses another threat to distributed product development operations. Different data management functions and solution infrastructures may be needed to respond to different organization structure. Moreover, combining product data from different locations over the Internet is also a challenge.

To enhance communication efficiency, an innovative solution of *collaborative-based workflow (CWF)* is introduced. The key challenge of CWF solution lies in its deviations of different views for collaborators. To investigate the suitability of current workflow solutions for such requirement, previous studies on workflow are reviewed in Section 2. After literature review, the incompatibility between CWF concept and current workflow solutions is explained in Section 3. Furthermore, a new product development application is also introduced to illustrate the concept of actual CWF in Section 3.

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According to the discussions in Section 2 through Section 3, to improve CWF construction efficiency, an innovative framework of CWF solution is introduced, and assistant modeling tools are developed. Section 4 is dedicated to stating the architectural concepts of modeling CWF. In Sections 5–6, the assistant tools for CWF modeling are illustrated. The procedure for constructing CWF system by these tools is also outlined by modeling the new product development application in Section 3.

2. Previous studies on workflow

Workflow control is important for a competitive product lifecycle management. As mentioned by Stark (2005), well-controlled overall product workflow contributes to the reduction of lead times, increased qualities, as well as decreased costs. Different solutions to workflow management have been developed to ensure a well-controlled workflow. A *workflow management system (WFMS)* is a software system that defines workflow models, generates workflow instances, and monitors workflow operations (Lawrence, 1997; WfMC, 1995). The basic ingredients of a workflow model are *workflow form* (user interface of reference data and input fields) and *routing* (workflow sequence and applicatory workflow forms). Most workflow-related literatures (Bae et al., 2004; Kradolfer, 2000; Ngai, Cheng, & Lee, 2003; Liu, Zhang, & Hu, 2005) regard the terminology of "process" as a part of workflow. In these literatures, the workflow model is treated as a process model associated with organization (or actor group) concept. Basically, most studies related to WFMS have investigated on workflow control innovation. However, few studies discuss the database structure for workflow form data storage. This is because of the identical database structure for most WFMS. For most WFMS, the data values of workflow form are simply recorded in one database table with field names mapping to the form fields, and one record in this table represents the form data of one workflow instance.

On the other hand, some literatures (e.g. Kobayashi, Tamaki, & Komoda, 2003; Ulrich & Eppinger, 2003) utilize process model to describe the framework of product development and supply chain operations. McGrath (2004) states the next generation of product management is driven by information technology. Such management systems are named *Development Chain Management (DCM)* systems. It is clear that the meaning of the "process model" in WFMS differs to that in DCM. Currently, most WFMS studies have addressed small scaled workflow management, such as review controls and document revision controls. This kind of workflow issues do not require complicated information to make decisions. However, the workflow solution used in a distributed concurrent engineering environment requires substantial deviations of different views for collaborators. Hence, for DCM workflow, complicated data structure with multiple database tables is utilized to store data of workflow forms in general. Rouibah and Caskey (2003) present the benefits, distinctiveness, and challenge of workflow solutions used in a distributed concurrent engineering environment.

In summary, traditional WFMS solutions can not fully support the workflow requirements used in DCM. In DCM, the workflow solution used in a distributed concurrent engineering environment, named CWF, requires substantial deviations of different views for collaborators. Currently, few studies have been done on constructing workflow solutions for DCM. Without a proper CWF framework, the DCM concept can not be accomplished.

3. The concept of collaborative-based workflow

Most literatures merely indicate "work order" when it comes to process and workflow and they do not specify the differences between the latter two concepts. Given the lack of appropriate methodologies, it is very difficult to manage processes or workflows in different scales by the same techniques. For example, the complexity in the management of new product development process is very different from that of an absence application workflow. Therefore, to propose the CWF framework, some terminologies used in the DCM, such as "process" and "workflow", have to be clarified in advance.

3.1. Overview

In this paper, the terminologies of *business process (BP)*, *collaborative-based workflow (CWF)*, and *approval-based workflow (AWF)* are defined to clarify three different management issues related to "process" and "workflow". In this paper, both process and workflow contain organizational concept, and therefore, unlike most literatures' opinion in Section 2, "whether executable or not" is not the key factor to tell the differences between process and workflow. Alternatively, this paper utilizes "model" or "template" to describe the definitions of a process or a workflow, and "instance" to describe the execution activities of a process or a workflow.

3.2. Characteristics of BP, CWF, and AWF

To clarify these three terms, Fig. 1 shows the concepts of BP, CWF, and AWF, and describes the relationship among them as follows:

As shown in Fig. 1, these three terms are closely related. To clarify these three terms, new product development is a good example. To develop new products by project teams, most companies may define their own suitable BPs in advance. The main characteristic of BP is that a BP consists of multiple phases. For example, the BP for generic product development consists of planning, concept development, system-level design, detail design, testing and refinement, and production ramp-up (Ulrich & Eppinger, 2003). To complete each phase, many tasks should be accomplished concurrently or consecutively. Furthermore, a phase gate (i.e. milestone) has to be defined to represent the completeness of each

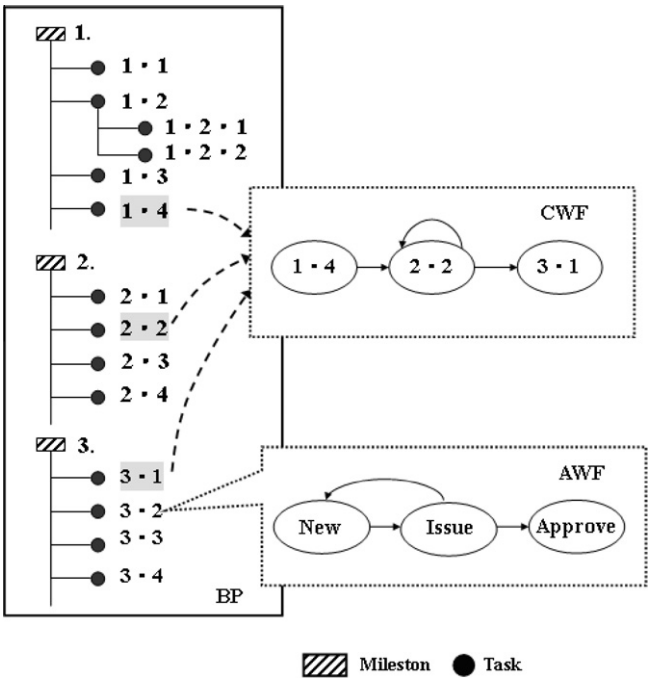

Fig. 1. Business process, collaborative-based workflow, and approval-based workflow.