Representing, Modeling and Engineering a Collaborative Supply Chain Management Platform

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ABSTRACT

Global optimization among partners of a supply chain is a trend often found in scientific literature. To achieve such a result, technological tools to collect suitable information within shortest delays are required. Devices such as RFID or GPS positioning systems deliver real-time information on material flows. However, data fragments need to be integrated in a global information sharing system where each of the involved actors can perform computations as well as operations to take autonomous action and manage resources at best. In this perspective, the paper presents a research aimed to build an e-collaborative software system for outbound logistic actors. Advanced knowledge representation models are used, notably a framework driven by the core services provided by the involved actors and structured using the classical three decision layers. The actor’s rationale is then detailed which further leads to the design of a multi-agent system. The proposal is validated using a critical success factors framework for IT evaluation in SCM.

Keywords: E-Collaboration, Modeling and Engineering, Multi-Agent Systems in Supply Chain Management, Outbound Logistics, Service-Oriented Development

INTRODUCTION

In today’s economic context, information systems development and management has become a determinant issue. New concepts and technologies continuously emerge allowing a better representation and more efficient data exchanges in complex software problems. The significance of these can notably be found in supply chain management (SCM). Indeed, modern supply chains involve series of actors incarnated by various collaborating or competing companies where several roles played by lots of individuals are interacting to achieve common as well as individual goals. In such a context, one needs powerful tools to represent logistic flows, to deliver strategic information to supply chain partners and to ensure e-collaboration. Collaborative decision will tend to avoid local equilibriums (at actor level) and wastes in the global supply chain optimization, giving opportunities to achieve the greatest value that the chain can deliver at lowest cost (Pache & Spalanzani, 2007; Samii, 2004). This paper is

DOI: 10.4018/jisscm.2012070101
part of the effort to combine advanced software engineering (SE) and project management concepts to structure complex collaborative software development and deliver added value information technology (IT) systems in SCM.

Outbound logistics (OL) is the part of the supply chain which focused on the product delivery with consequently a strong highlight on stocking and transportation. The development of a collaborative platform for OL actors induces high complexity which implies the necessity of a software engineering (SE) framework presenting various levels of knowledge and views to:

- Furnish adequate documentation to each stakeholder;
- Allow strategic reasoning (opportunities/risk balance);
- Cover all of the traditional software development disciplines;
- Be integrated in a mature development life cycle;
- Ensure adaptability and flexibility;
- Envisage third party software data reuse.

To that extend, we propose a framework structured through three levels of knowledge:

- A strategic level where the applicative package is represented in terms of highly aggregated functionalities called services (with actors as service providers) providing a basis for opportunities/risk management. Besides being a view of the software problem every stakeholder can understand, this high level representation enables them to evaluate (with the services as scope elements) the opportunities and threats that would result from the use of the software application. This view is consequently useful for top-management;

- A tactical level where each of the services are detailed in a static manner using rich organizational concepts, i.e., tasks, goals and resources and their depending actors. this view is useful for middle managers in charge of the development of the objectives defined at strategic level;

- An operational level where each of the elements required for service fulfillment are operationalized through the behavior of software agents in charge of the successful realization of the sub-processes defined at tactical level through atomic tasks.

The paper is structured as follows. Firstly, the context of this research is overviewed. The structure of the software development framework is then depicted using a pyramidal perspective. The concepts and technologies used into the software development framework are positioned. Afterwards, the application domain – outbound logistics – is outlined, followed by the description of the software applicative package development. Finally, a framework made of success factors for IT realizations in SCM is applied onto our contribution for validation purpose. Finally, the paper turns to the related work and conclusions are derived.

**PAPER POSITION AND CONTRIBUTIONS**

This section introduces the research context, focus and method to highlight its main contributions and limitations.

**Research Context**

In August 2005, the Belgian Walloon Region introduced the *Marshall Plan*, a vast economic investment to reinforce attractiveness and competitiveness of Walloon’s companies in order to raise employment rate. This plan notably integrates poles of competitiveness, and, among these poles, *Logistics in Wallonia*, created in July 2006, which is concerned with transportation and logistics. Into this latest pole, *TransLogisTIC*, proposed as a driving project, has officially started in March 2007.

Currently, the real-time visibility of information flows throughout the whole OL chain fails to ensure competitive integrated logistics. However, decisions at European level request
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