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Chapter XIII

LOSIMOPU: Logistics Simulator on Policy Under Uncertainty

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Abstract

This chapter presents a software simulator called LOSIMOPU. LOSIMOPU allows users to build a supply chain model and analyze the sensitivity of logistics on assigned policy and capacity under uncertainty. LOSIMOPU consists of five kinds of participants (end-customer, intermediate supplier, end-supplier, transportation server, and electronic payment server) and an e-marketplace for the supply chain. Each participant is implemented as a distributed object so that it runs concurrently and has capacity and policy for playing its role. The e-marketplace defines the trade protocol for the workflow management and transaction analysis. LOSIMOPU visualizes expected indices of assigned parameters for decision support. This chapter discusses the background of the proposal, the goal of the simulator, the milestone, the technical issues for development, and the prototype system.

Introduction

Although individual business applications have been integrated into an ERP (Enterprise Resource Planning) system for constructing value chain, there is still a limit on business process restructuring, because one company activity has a relation to other companies. The management in a specific company is not always useful at global competition, and workflow controls for cooperating among companies are required.

One of the workflow control methods among companies is known as SCM (Supply Chain Management). Supply chains are an integrative philosophy to manage the total flow of a distribution channel from the suppliers to the ultimate customers (Coyle, 1996). Customers, vendors, manufacturers, and parts suppliers are players in supply chains. Although the term *chain* seems to be a single connected line, supply chain is a complex network. SCM is building the structure of the business model that promotes information sharing among players in order to eliminate lurking waste in operating processes and shortens the total lead time.

The purpose of SCM is to increase throughput and profits. In particular, a constraints theory on throughput (Goldratt, 1993) that requires the managers to detect the bottlenecks in the business process has impacted many industries. For SCM, there are two research approaches: (1) OR/MS technology, such as mathematical programming, which optimizes the objective function in order to allocate resources, such as persons, machines, and money (Karaesmen, 2002; Mine, 1966); and (2) IT technology, such as workflow management, information sharing, and electronic payment that integrates enterprise systems (Hammer, 1993; Knoshafian, 1995).

These researches have tackled the technical issues independently, not only to assess the risk and the chance of the business process reengineering, but also to evaluate the implementation issues; the SCM designers require the means that integrate both OR/MS (Operations Research/Management Science) technology and IT. Because there are so many factors in business activity, the supply chains are too complex to analyze mathematically. The followings are examples on complexness:

1. SCM is a time-variant and large-scale combinatorial problem. In a supply chain, there are several players, such as vender, manufacturer, and supplier. They also have competitors. Sometimes, one that was a competitor may become an alliance. Thus, the problem is time-variant. Furthermore, one's optimal policy under its constraints is not always optimal for the total supply chain. Therefore, it is difficult to decompose the static optimization problem.
2. There are uncertainties in a supply chain. In a supply chain, there are various uncertain factors, such as demand of product, supply capacity, lead time, and mechanical problems. For example, the lead time for delivery may take long because of traffic. Therefore, uncertainties make SCM more complex.
3. Evaluation measures differ in companies. There is a variety of evaluation measures for SCM. Cost, sales, profit, and lead time are examples. Then, the policy for increasing sales is different from the policy for decreasing cost. Therefore, it is difficult for the planner to formalize SCM as an optimization problem.