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## Port Supply Chain Simulation Model under Interactive Analysis

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### Abstract

To probe into special port supply chain and analyze the interaction between ports, this paper establishes a port supply chain simulation model through system dynamics (SD) approach, and then, Simulink tool is adopted for that model. Through the simulation, the affluence of some port's operation improvement on the other is clearly shown and the profit of ports is changed with interaction. What's more, it's proven that some partial efficiency increasing may not make the overall improvement, so supply chain management in whole point is very necessary. That port system dynamics simulation model shows the characteristics of a kind of special supply chain and can be helpful for the actual supply chain management project.

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*Keywords:* Supply chain management; Supply chain simulation; System dynamics

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### 1. Introduction

Today, Competition is not only within enterprises themselves but also between supply chains which the enterprises belong to. Supply chain management (SCM) becomes an important management conception for enterprises in the current vehement environment<sup>[1]</sup>. As what Wood has stated, since the supply chain represents 60 to 80% of a typical company's cost structure, a 10% reduction can yield a 40 to

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50% improvement in pre-tax profits [2,3]. For SCM, on account of avoiding large expense for the failure of SCM projects, simulation is a widely and useful method, many scholars have worked over the supply chain in order to achieve some value things:

Dating back to early 1960s, Forrester has built a system dynamics model of the three-echelon production distribution system and demonstrated how market demands are amplified through the transactions in the supply chain [4,5]. Minegishi and Thiel make a system dynamics simulation for a food supply chain system. This work sheds light on the complex nature of this specific type of supply chain and in particular on the coordination of variables controlling the food production [6]. Gavirneni, from the viewpoint of information distortion, simulates an overall supply chain model, that emphasizes the value of information and extended existing inventory theory [7]. Towill from system dynamics perspective also demonstrates that supply chain integration with exchange of information was as beneficial as lead time reduction throughout the supply chain via JIT [8]. Dejonckheere et al. examine the beneficial impact of information sharing in multi-tier supply chains and discovered that information sharing helped to reduce the bullwhip effect in the chains with different inventory policies [9].

In current simulation literature for SCM, the research on supply chain with branched structure and for interaction analysis is little, in addition, the study for the special kind of supply chain is needed to improve, so this paper establishes a port supply chain simulation model through system dynamics, showing little improvement of a port's operation's efficiency in supply chain can bring out some change of other ports, which also leads to some operational alternation of the whole supply chain.

The rest of the paper is organized as follows. In section 2, a port supply chain simulation model using SD method is established. In section 3, Simulink tool is adopted for the above simulation model, and then, the results expected from the simulation are described. In section4, the conclusions are presented finally

## 2. Port Supply Chain System Dynamics Model

Through the SD approach, a simple port supply chain model with branched structure is established, which is shown in Fig.1. There are three basic ports in supply chain: The cargo transported from some place(Start) to the other(End) is through two transportation routes(three ports). The cargo from Port1 is splitted into Port2 and Port3. i.e. the owner can choose one of routes to the destination(End). In this way, some factors in one of routes are changed can interact the carriage operation of the other, and then, the whole activities in that port supply chain can be altered.

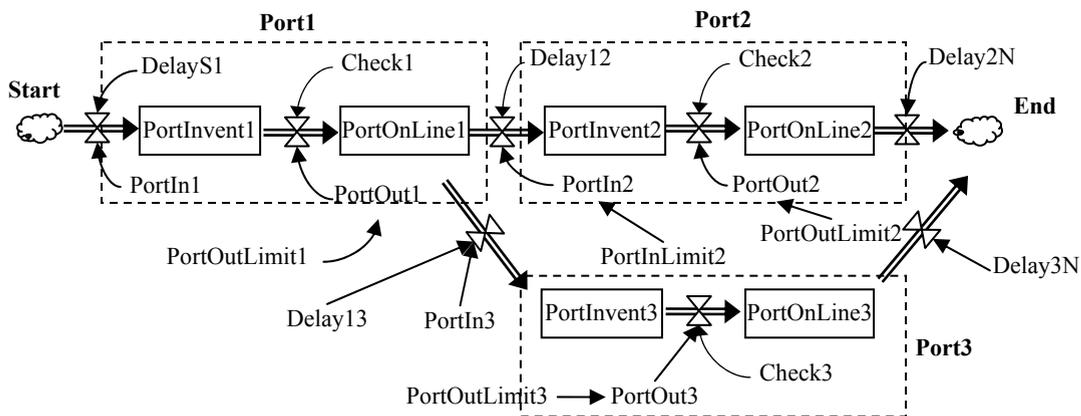


Figure1. Port Supply Chain Simulation Model

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