DISTRIBUTED ORDERS MANAGEMENT OF CUSTOMIZED PRODUCTS IN SUPPLY CHAIN 4.0

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Abstract:

Recent advances in information technology and the emergence of new concepts such as Internet of Things (IoT) enables real-time data collection of different production plans and other supply chain units. This research proposes a connected decision support system designed to solve the order acceptance and scheduling (OAS) problem of customized products in make-to-order (MTO) supply chains. A new integrated framework that links supply chain operations is presented to overcome uncertainties in order variations and maximize the agility and responsiveness of those systems.

Two different techniques are proposed to test the framework. The first technique is a novel mixed integer programming mathematical model, which converts a traditional supply chain into a connected supply chain. This model enables the optimization of order acceptance, production planning, maintenance, and transportation decisions all at the same time. The second technique is a multi-agent system (MAS) model, which is simulated using an agent-based modeling where different units interact with each other and optimize their decisions based on the information received from other interacting agents. The model is simulated based on two different information sharing scenarios. A game-based negotiation technique is implemented to help the decision maker to find the most optimal solution for the entire supply chain network.

In both techniques, the products are produced based on job-shop scheduling plans while considering the real-time access to available supply and distribution resources. To validate the efficiency and scalability of the proposed frameworks, the models are tested with a four-layer supply chain. Then, several experiments are executed to study the effects of different factors such as order uncertainty, costs, maintenance, and customer satisfaction.

This research demonstrates the possibility and effectiveness of transforming a traditional supply chain to a connected supply chain, SC 4.0, as well as distributing the decision makers over the supply chain network.