

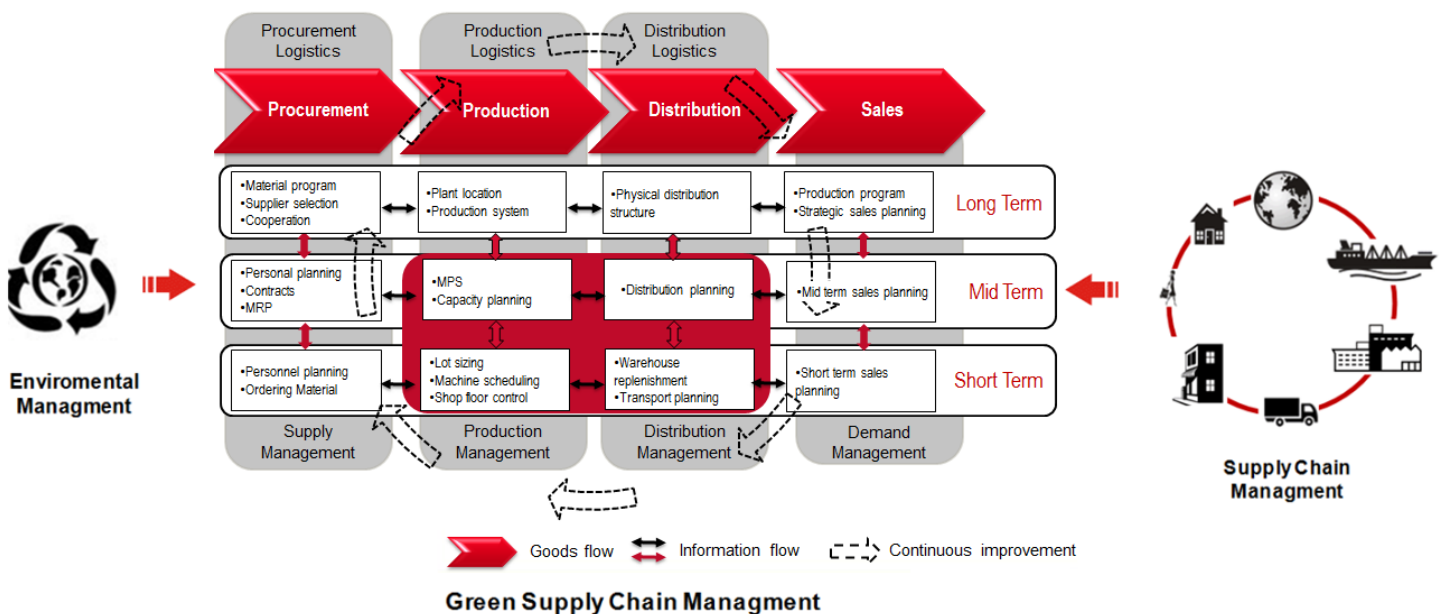
# Green Logistics Oriented Framework for Integrated Scheduling of Production and Distribution Networks

Since the applications of logistics are generally positive for the efficiency of transport systems, it has been suggested that logistics are environmentally friendly, thus emerged the concept of “green logistics”. Greening supply chains aim to balance marketing requirements with environmental issues. To meet challenges, such as energy conservation and pollution abatement, enterprises have tried to green their supply chains, that is, to create networks of suppliers to purchase environmentally superior products from or to build common approaches to waste reduction and operational efficiencies. This concept is shown in the figure below.

Nowadays, companies are required to address these environmental issues due to government regulations. At the same time, delivering products to customers faster

and more reliably than competitors has become a requirement rather than a competitive advantage. These two trends are not independent; companies have to satisfy the needs of their customers and even exceed the environmental expectations of their governments.

Production and distribution operations are two key functions in the supply chain. To achieve optimal operational performance in supply chains, it is critical to integrate these two functions, plan, and schedule them jointly in a coordinated manner. When integrated supply chain management is realized, materials are used more efficiently and resources are conserved. These decisions were traditionally being made separately; however, their integration can have a significant impact on the overall system and service performance.



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Finished in May 2017

Thus, the proposed research aims at studying a selected case of the batch process industry. Batch operations are economically desirable, especially when small amounts of complex products or even a large number of products are made using similar production paths. A batch process is frequently found in the fast moving consumer goods industry, in food processing, chemical manufacturing, oil refining, and in the pharmaceutical industries.

The dynamics and structural complexity of today's logistics systems drive central planning and control of logistic processes to become increasingly difficult. Many companies now realize that greater value can be offered to their customers by effectively integrating logistics management and product availability to improve the timeliness and consistency of delivery.

### Research Objective and Question

Industrial production and trade require an efficient and reliable supply network. Considering production and distribution of green logistics in batch process industry, a number of questions arise. Questions which need to be addressed when modeling an integrated framework:

- The level of integrity that can be modeled to configure all the features of green logistics system,
- The performance in terms of economical, environmental and managerial effect should be measured, and
- The main characteristics of the batch process industries that can affect the design of an integrated framework for supply chain systems.

Focusing on these challenges, a design of a green logistics oriented framework that integrates production and distribution decisions will be investigated. The buildup of a sustainable, efficient, effective and robust framework which addresses both economic and environmental issues to manage the dynamics in supply chain operations is required.

### Techniques and Methodologies

Due to the complexity of the described system, an analytical investigation is only able to solve small instances of this system in reasonable time, thus, simulative approach-

es should be used to investigate combined production and transport scenarios for a real time scale.

The combination of event-based simulation and mathematical modeling could be realized to consider dynamic, as well as environmental aspects. Event-based simulations can be used for the modeling of production-distribution plans, validating the outcomes of the proposed optimization models, and visualizing the constructed production-distribution plans adaptable to different scenarios. Simulation models are not based on an abstract mathematical formula; instead, they make the relations between the model and the real system easily understandable.

### Expected Results

The main objective of the proposed logistical research activities is an integrated framework design for a production-distribution green logistics system for the batch process industry. The importance of this integration is forced by its direct effect on the overall performance of the system.

The core of this integrated planning system will consider the optimal production and distribution decisions regarding logistics of batch process products.

This plan will consider different managerial issues related to production and distribution logistics, besides the economical and environmental issues. The model simulates the standard processes for logistics in the batch process industry.

These outcomes will be implemented as a software program and evaluated by means of simulation-based experiments. This simulation model can be used as a decision support tool. Constructed automated decision support systems help the decision-maker in determining the optimal master production schedules and the optimal distribution sequences for the production facilities in the batch process environment. The developed decision support system provides a systematic approach for production plans and solving transportation problems and emphasizes qualitative information. This approach enables managers to answer "what-if" questions, related to tactical and operational decisions.