

## Security for Dynamic Supply Chains: Decision Support System for Intermodal Logistics

The issue of logistics security has increased in importance due to a heightened awareness of the threat of terrorism, as governments seek to protect citizens, important symbols and critical infrastructure within their national borders. The volume of cross-border trade, rising steadily, is seen as a potential vulnerability, and the transport sector has come under particular scrutiny, both as a target of an attack and a means for enacting a terrorist attack. Particular concern is raised by movements of dangerous goods and by freight container logistics, the latter because of the lack of transparency of container logistic processes, caused by their complexity and the sheer numbers of containers in transport. Not only are shipments considered targets, but also the transport networks that support logistics processes.

New regulations and policies surrounding logistics processes, especially at ports, have created additional costs, and have placed additional constraints on the continuity of transport flows. Moreover, losses due to theft and damage of goods remain a constant in the industry. The measures for security, however, must not be allowed to undermine the efficient working of logistic processes, which remains a priority both on a political as well as on an economic level. As a consequence of this need for increased security, approaches that meet new security requirements, while at the same time increase the efficiency of transport processes are sought. In order to achieve both goals, an origin-to-destination approach is required.

Intermodal logistics can meet requirements for efficient logistic processes and security by capitalizing on the advantages of the various transport modes: air, short-sea shipping, road, rail and inland waterway.

Intermodal logistics are enabled by logistics infrastructure and intelligent logistic systems. Planning for intermodal systems and transport processes is, however, a demanding and complicated task; therefore, the European Commission has proposed the concept of a freight integrator - a transport provider knowledgeable in intermodal logistics and able to organize shipments over a combination of modes, optimized for efficiency. Beyond the operational planning tasks, a freight integrator is able to organize the financing of investments into logistics infrastructure to improve the optimality of the transport solutions, and to enable the system to deal with dynamics in the transport industry.

The goal of the research is to provide an instrument to support strategic investment decisions in logistics infrastructure. Firstly, the transport modes rail, road and inland waterway are compared and evaluated on aspects of security and costs. A measure for the security aspect is achieved by isolating vulnerability factors, on which these modes can be compared. This information, paired with cost structures of the modes, provide a means of quantification, which can then be integrated into a decision support model. Secondly, a decision framework is established, involving an investigation into the constraints placed on the decision problem by political, technical, economical and market factors. Finally, the objectives of the included decision makers are formulated, and are assigned priorities and targets, the latter of which permits an evaluation of the goal achievement. A goal programming framework is applied, as it offers the ability to consider multiple objectives simultaneously in determining a feasible, optimal solution.



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