A model for the integration of production-distribution levels in the supply chain of non-perishable materials by considering intermediate warehouses

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Abstract: This research presents a mathematical model for information integrating manufacturers, distributors, and intermediate warehouses and transportation systems in the supply chain over multi period. Goods are spoilable and Capacity, production costs, warehousing costs and transportation of each transportation systems costs are limited. Rate of corruption of goods in the warehouse and transportation systems is known or predictable by experts. The amount of demand for goods is constant. The objective function of the proposed model is single-objective and the costs of production, transportation, warehousing, corruption, shortage and unpackaged goods are integrated minimally. The proposed model is non-linear and of a strict type and has been confirmed by solving a few small-scale problems. For validation, a case study was performed and genetic Meta heuristic algorithms were used for solving the problem. The results of the solved model showed that Decision making integrated is better than the case that sections are decided separately.

Keywords: Supply chain, Integration of production-distribution sectors, Perishable materials, Optimization

Introduction: One of the most important issues in supply chain is integrated production-distribution planning. Integration of two production-distribution and three-supply, production and distribution loops are important optimization issues in the supply chain. Research in this area involves locating new or special facilities and a combination of allocation locating. The current research is a type of allocation and examines the impact of supply chain integration with several manufacturers, warehouses and distributors and the transportation system. The goods in this chain are perishable and with a lifetime limitation. Production capacity, warehouses, and transportation systems are limited. The mathematical model developed is single-purpose and minimizes the cost of the whole chain. For the first time in the current study, distributor middle warehouses have been modeled taking into account corruption in the warehouse and during shipping. The proposed model is solved once considering the cost of corruption and once without it and the results are compared.

Methodology/Approach: In this study, a single-objective model is presented for the integrated production-distribution problem considering the lifetime limitation of the goods. The supply chain in question consists of three levels of manufacturers, distribution centers, and end customers. The model is offered for several product types over multiple time periods. The integrated problem-solving model minimizes the entire cost of the chain, including: warehousing, distribution, commodity rotation, and shipment, which maximizes product quality when the product reaches the consumer. In order to evaluate the performance of the proposed model and to validate it, several different sample problems have been solved in various dimensions. A Proposed Genetic Algorithm for Solving Models Genetic Algorithm and CPLEX10.2 software have been solved, the results of which show the accuracy of the models. The proposed genetic algorithm is coded in the MATLAB R2015a programming environment and its functions are used within the algorithm.

Findings and Discussion: The main purpose of this research is to manage and make the right decisions on the amount of transport, production, inventory and distribution in a supply chain network. In order to make better and more practical decisions in the field of inventory and transportation for distribution of perishable products at

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supply chain levels, taking into account the real world conditions. Determining the optimum amount of production for each manufacturer, the amount of shipment carried out by each warehouse transport system, and the optimum inventory availability with respect to demand and the perishability factor of the warehouse are the objectives of the study. To simplify the real-world problem with the model in question, some simplifying assumptions have been used. In general, the optimal storage conditions vary depending on the type of goods and depend on many parameters. Generally, oranges can be stored at 7-2°C for 12 to 8 weeks. The distances are straight lines. The planning horizon is intended for three periods. There are 60 middle warehouses (30 traditional warehouses and 30 cold storage warehouses). The results showed that in the integration of production-distribution departments without limiting the product life span, the most important criterion in terms of cost is distance. Volumes account for up to 35% of corrupt products due to the lack of a cold supply chain. But in view of the factor of corruption in the model, the integration of the chain leads to the use of new technologies in the maintenance and transport of goods and reduces the cost of corruption. Although maintenance and shipping costs increase slightly, the overall cost of the chain eventually declines. In a model that does not include the costs of corruption.

Conclusion: As a result of the decision to use traditional supply chains, in addition to the negative environmental consequences, high costs of corruption on the chains are imposed. Integrated decision making is better than the case of each sector being decided individually. This research as a back-up model can help managers make better decisions with regard to real-world conditions and constraints and make use of the potential of the food and agriculture industry. There are still many areas for the development of future research. Consider real-world assumptions in problem modeling, such as: Demand for the product as a possible rate of decay based on the quality of raw material demand dependent on the price of the product and considering the problem in an uncertain environment.

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