Contingency Strategies in Managing Supply Systems With Uncertain Lead-Times

Panos Kouvelis
n the wake of the devastating earthquake and tsunami in Japan in March 2011, some U.S. car buyers were contemplating a much less dire situation: How would they get their hands on a Prius?

The popular Toyota hybrid was manufactured almost entirely in an area just outside of the areas worst hit by the disaster, while high gas prices and a recovering economy continued to drive rising U.S. demand for the already best-selling car.

Some of the issues Toyota faced are addressed in “Contingency Strategies in Managing Supply Systems With Uncertain Lead-Times,” by Panos Kouvelis, Emerson Distinguished Professor of Operations & Manufacturing Management and director of Olin’s Boeing Center for Technology, Information and Manufacturing, and Jian Li of the College of Business and Management at Northeastern Illinois University. The paper is published in the journal *Production and Operations Management*.

The authors point out that with greater globalization and outsourcing, supply chains have increasingly long and variable lead times that are especially vulnerable to disruption due to natural disasters, political turmoil or labor disputes. These disruptions often result in delayed deliveries or unmet demand. Kouvelis and Li assert that when used exclusively, the conventional approach to lead-time uncertainty, statistically planned Safety Lead-Time (SL), may fail to address these issues fully, causing unnecessarily high economic costs in the form of lost sales and expediting fees.

Kouvelis and Li present two additional contingency strategies that are useful for avoiding these high costs and restoring supply after disruptions have caused a late delivery. The authors identify these strategies as Disruption Safety Stock (DSS) and Dynamic Emergency Response (DER). The paper demonstrates that both strategies are useful when combined with the current conventional approach, and offer different benefits in response to specific circumstances.

DSS is planned before an emergency and consists of holding inventory equal in size to a “normal” order. This inventory would then be deployed with expedited execution in the event of a late delivery. Kouvelis and Li’s analysis shows that in a situation of high-lead time variability, this strategy is cost-effective and easily implemented in combination with the conventional SL and in fact decreases the length and cost of SL implementation.

In the second strategy, DER, the firm would establish a relationship with nearby suppliers willing to serve as emergency resources. In the event of a late delivery, the firm would obtain resources from these suppliers at the opportunity cost of their capacity resources. Kouvelis and Li demonstrate that DER in combination with SL is also highly effective and similarly decreases reliance on SL, but its performance is subject to fluctuations in prices of the emergency market.

Kouvelis and Li caution that these approaches have trade-offs. DSS guarantees availability and price of emergency stock but incurs high inventory-holding costs. DER, however, relies on last-minute emergency supply, which may not always be available and, if available, may impose high costs. But for firms with long supply chains, these strategies represent powerful tools in securing and maintaining steady supply in an increasingly uncertain world.