Assessing the Impact of Input Model Misspecification on Integrated Supply Chain Decisions

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Abstract

In simulation optimization, the validity of the optimal solution relies profoundly on the accuracy of the input model that is used to drive the uncertainty in the simulation model. However, determining the exact input model that perfectly mimics the underlying input processes that generate the true uncertainty in the real system is impracticable, because of the frequently limited available data. In practices, hypothesis testing imbued in the goodness-of-fit (GOF) test and validity test is often used to justify whether a certain input model is 'close enough' to represent the true input processes. The results of these tests, however, are likely that we fail to reject several input models, which then raise the likelihood of misspecifying the input model. We examine the optimality of the solutions obtained by relying on misspecified input models in optimizing integrated supply chain decisions, i.e. when operational, tactical, and strategic decisions are simultaneously optimized in terms of service level and operating cost. The results suggest that in such integrated setting, while the optimal scenarios obtained from each input model may likely vary, the corresponding objective function values do not significantly differ, especially when we account for the trade-off between service level and cost. Furthermore, our result also shows that the input uncertainty inherited by a certain input model does affect the interactions among various decision levels. Hence, the importance of obtaining a sufficiently accurate input model becomes more crucial in optimizing an integrated supply chain system via simulation optimization.

Keywords
simulation modeling, input uncertainty, simulation optimization, supply chain decision, integrated supply chain

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Biography
Mansur M. Arief is a Master's student in Industrial & Operations Engineering (IOE) at the University of Michigan (UM). He completed his bachelor degree in Industrial Engineering Department at Sepuluh Nopember Institute of Technology (ITS) in Surabaya, Indonesia. His primary research interests lie in the area of stochastic optimization, simulation modeling, and the applications in supply chains and intelligent transportation systems. Currently, he is assisting a research related to intelligent transportation systems affiliated with UM Transportation Research Institute (UMTRI) while pursuing his Master's from UM-IOE and SCM MicroMaster's from MITx. In addition to serving as the lead technical operations for Operations and Supply Chain Management (OSCM) Forum and Operations and Supply Chain Management: An International Journal, Mansur also actively engages with the Institute for Operations Research and the Management Sciences (INFORMS) Student Chapter at the University of Michigan and the Indonesian Supply Chain and Logistics Institute (ISLI).