

# **Towards Cooperative Simulation-aided Decision making in the Digital Age: A Review of Literature in Distributed Supply Chain Simulation**

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## **Abstract**

The aim of this research is to synthesise extant literature in distributed supply chain simulation and to present a framework which may encourage the wider adoption of this technology in the increasingly interconnected enterprises of the digital economy. Towards realisation of this aim, we will be conducting a methodological review of literature on distributed supply chain simulation and will complement it with our domain-specific knowledge in both supply chains and parallel and distributed simulation. The extended abstract presents the methodology for the review. This research is being funded by **NEMODE Network+** as part of the RCUK Digital Economy theme.

Keywords: Distributed simulation; supply chains; literature review

## **1. Introduction and Motivation**

Our research lays emphasis on capitalising on the advances in ICT for the generation of added value among existing supply chain partners. It is proposed that added value is created through the process of cooperative decision making, aided by the use of Modelling and Simulation. The increasingly interconnected enterprises of the digital age provide the potential of cooperative decision making by not only sharing data (like ERP systems, which are widespread) but also sharing process models for distributed execution. For example, a simulation model of a logistics provider (e.g., UPS) may be logically combined with two warehouse process models belonging to customers that it serves (e.g., Amazon and DELL) and these models may be executed in three different computers over a network like the Internet. Further, this distributed approach to simulation will support experimenting with value constellations, by which we mean the reconfiguration of roles and relationships among the supply chain players, since it address the issues concerning data/information security and privacy.

## **2. Distributed Supply Chain Simulation**

Simulation models typically represent the processes associated with various business units. However, in the case of supply chains more than one business unit may need to be modelled as different organisations may be responsible for various supply chain operations such as manufacturing, transport and distribution. Organisations can be protective about their internal processes and can have concerns regarding

data/information security and privacy. Thus it could be argued that creating a single supply chain simulation model representing the various inter-organisational processes is usually not an option since this will run counter to organisational privacy. Further, issues such as data transfer, model composition and execution speed may also make a single model approach problematic (Mustafee et al., 2012). A potential solution could be to create several distinct and well-defined simulation models, each modelling the processes associated with one specific supply chain business unit, linked together over the internet. This approach is referred to as distributed supply chain simulation.

### **3. Research Aim**

The aim of this research is to synthesise extant literature in distributed supply chain simulation and to present a framework which may encourage the wider adoption of this technology in the increasingly interconnected enterprises of the digital economy. Towards realisation of this aim we will be conducting a methodological review of literature on distributed supply chain simulation.

### **4. Research Methodology**

We have undertaken a search for relevant articles using the *ISI Web of Science (WOS)* and the *SciVerse Scopus* citation databases. The following criterion was used to identify articles which would be incorporated in our dataset: inclusion of the words *distributed* and *simulation* and *supply* and *chain* in the title, abstract or keywords of the published paper in the following manner: the words “*distributed and simulation*” and the words “*supply and chain*” within 10 words’ proximity to each other. The search identified journal publications and conference papers written in the English language from 1970 until 2011 (both inclusive). Results from this search strategy resulted in 148 papers; 102 articles from *ISI Web of Science* and 46 articles from *Scopus*. We then screened the articles by reading the abstracts and, when necessary, the full-text, and were left with 127 papers in the dataset. It is noted that the majority of the studies are published in conference proceedings (84 conference papers as against 43 journal articles). Moreover, the first paper in our dataset is as recent as 1996 and more than 80% of the papers have been published from 2003 onwards.

### **5. Future Work**

Future work will complement the *search, retrieve and read* process (described above) with our domain-specific knowledge and present the results of this literature review in well-defined categories, for e.g., motivation of research, problem context addressed, modelling granularity, underlying technologies and software, economic and institutional considerations – especially for supply chains that span multiple organisations, outcome of study, future work that may have been identified.

### **References**

Mustafee N, Taylor SJE, Katsaliaki K, et al. (2012). Motivations and Barriers in using Distributed Supply Chain Simulation. *International Transactions in Operational Research*, 19(5): 733–751.