Big Data Driven Supply Chain Network Design – Insights, Impacts, and a Framework for Assessment

Tiru Arthanari, Shohil Kishore and David Sundaram

University of Auckland, New Zealand

Abstract: There is a huge amount of hype associated with the term "Big Data" (Walker, 2014; Chen, Chiang & Storey, 2012; Chen, Mao & Liu, 2014). Its applications to industry appear limitless (Chen, Alspaugh & Katz, 2012). However, research applying big data to the supply chain management domain fails to demonstrate useful results (Richey et al., 2016). We therefore propose the following research objective: *Does big data have a practical impact on the future of supply chain management?*

In this article, we argue that the insights gathered from big data cannot effectively be used to improve supply chain performance unless the supply chain is contextually robust. Supply chain robustness is defined as "the ability of a system to maintain its operational capabilities under different circumstances" (De Neufville, 2004). In this scenario, if a supply chain is unable to adapt, decision makers attempting to rapidly react to insights may actually disrupt supply chain performance instead of improving it.

To effectively incorporate these insights, we must first evaluate the underlying traditional supply chain network design [SCND] with the purpose of understanding vulnerabilities and then attempting to discover processes that are more flexible, adaptive and robust. We hypothesise that seminal supply chain structures are incapable of effectively utilising big data, significantly diminishing supply chain performance in this context. To initially evaluate our hypothesis, we illustrate a scenario that utilises the Lambda architecture's speed layer to process our data

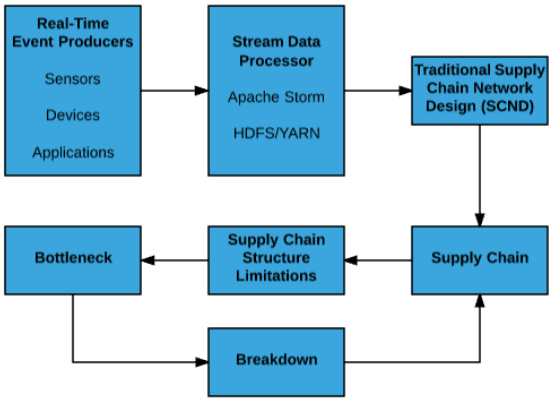

Fig. 1. Traditional Supply Chain Response To Real-Time/Stream Data

using Apache Storm (supported by HDFS and YARN) in real-time, then feed insights gathered from the various data sources into a traditional SCND (Figure 1). We have chosen to focus on the speed-processing layer as a large proportion of big data is useful within a relatively short period of time (Marz & Warren, 2015). This allows us to simulate the impact of real-time data on the supply chain and identify potential weaknesses in traditional structures. We expect that these SCND models will not be able to manage this data, resulting in a bottleneck, lack of real-time usability, and/or a lack of sufficient usable insight. To evaluate robustness in the context of an actual experiment, we will be using the signal to noise ratio of the Taguchi methods tool kit to carry out our experiments (Taguchi, 1986). In addition, simulation experiments representing real-life scenarios could be evaluated against alternative SCNDs, as well as SCNDs with adjusted levels of robustness.

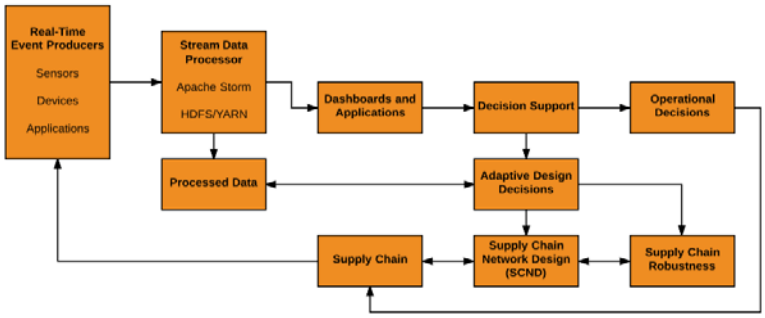

Fig. 2. Big Data Driven Supply Chain Network Design

Secondly, through further experimentation, we also intend to construct a robust and dynamically adaptive SCND, as we would like to understand how supply chains could effectively adapt or react to large amounts of data. To do this, we intend to build a model based on an augmented version of the framework in Figure 1 that allows us to utilise the insights we gather from data to drive SCND instead of suffer from operational incapability (Figure 2).

Keywords: Supply Chain Network Design, Big Data, Supply Chain Management, Assessment Framework.

Contact Details:
Tiru Arthanari (t.arthanari@auckland.ac.nz)
Shohil Kishore (s.kishore@auckland.ac.nz)
David Sundaram (d.sundaram@auckand.ac.nz)