Editorial

Thanos Papadopoulos and Angappa Gunasekaran

In recent years there has been a significant attention by both academics and practitioners to Big Data and Analytics, an outcome of an era where data is at the centre of every human activity (Choi et al., 2017). Researching and harnessing big data has been the subject of research in different disciplines, but nevertheless within the field of operations and supply chain management academics and practitioners are yet to realise the potential of big data to improve operations and supply chain performance (Wang et al., 2016; Gunasekaran et al., 2017; Papadopoulos et al., 2017; Srinivasan and Swink, 2017).

The literature defines 'Big Data Analytics' (BDA) as those algorithmic techniques, practices, methodologies, and applications that enable businesses to analyse and make sense of critical business data to help them understand their operations and market. BDA enables businesses to predict the likelihood an event and take timely business decisions, ensuring, for instance, that they are able to meet the needs of their customers over a sustained period of time. BDA highlights the importance of data in terms of its volume (referring to the amount of data), velocity (referring to frequency or speed by which data is generated and delivered), veracity (referring to data quality) and value (referring to the benefits from the analysis and use of big data) (Fosso Wamba et al. 2015; 2017). Improved productivity, competitiveness, and efficiency are amongst the benefits of BDA within supply chain and logistics management; for instance, gaining information from unstructured customer data can generate useful insights on product placement, pricing strategies, optimization strategies, layout optimization, operational risk management, and improved product/service delivery.

It is therefore no surprise that BDA has started receiving significant attention from supply chain and logistics management and management science researchers. In response, this special issue is seeking to pull together the latest thinking in this area. Much research on BDA has been limited to conceptual frameworks, definitions, and some empirical papers. However, limited studies have focused on applying big data modelling, algorithms, and analysis within supply chain and logistics management. The aim of this special issue is to help researchers and decision makers in understanding the modelling, algorithms, strategies, tactics and implementation processes involved in applying BDA in supply chains and logistics and the performance measures and metrics related to the application of BDA.

Review of Articles Included in the Special Issue

Our SI attracted 22 submissions. Each manuscript was examined to ensure that it was in line with our stated objectives in the published call for papers (CFPs). Some of the papers which failed to meet our objectives or the objectives of Computers & Operations Research were desk-rejected. Next, the manuscripts which were in line with our SI and COR objectives, as well as fit for the next round, were submitted for review to two or more experts per manuscript. Based on the reviewers' and guest editors' review, we rejected or invited the authors to undertake substantial revision based on the reviewers' inputs. Finally, after multiple rounds of review, we finally accepted 10 papers for our SI. All accepted papers in this SI are in line with our and COR objectives.

The first paper by Zhou and colleagues discusses the literature on BDA and supply chain management to develop a novel classification framework that addresses the following questions: (1) in what areas of SCM is BDA being applied? (2) At what level of analytics is BDA used in these SCM areas? (3) What types of BDA models are used in SCM? (4) What BDA techniques are employed to develop these models? The discussion tackling these four questions reveals a number of research gaps which lead to future research directions.

The second paper by Subramanian and colleagues investigates the role of big data in problems such as the strategic location of manufacturing plants and warehouses and the allocation of resources to the various stages of a supply chain. They present a multi-objective mathematical model to solve a location-allocation problem in a multi-echelon supply chain network to optimize three objectives simultaneously such as minimization of total supply chain cost (TSCC), maximization of fill rate and minimization of CO2 emissions. The third paper by Saen and colleagues uses Data Envelopment Analysis to assess the performance of sustainable SCM in presence of big data and presents a network DEA (NDEA) model to calculate optimistic and pessimistic efficiency. DEA is used in the following paper by Zhu and colleagues, who discuss the challenges related to its use within big data analytics and in particular the fact that using big data involves huge numbers of DMUs, which may increase the computational load to beyond what is practical with traditional DEA methods. To address this challenge, Zhu et al. use an algorithm to divide the large scale DMUs into small scale and identify all strongly efficient DMUs, and present a variant of the algorithm to handle cases with multiple inputs or multiple outputs, in which some of the strongly efficient DMUs are reselected as a reduced-size sample set to precisely measure the efficiency of inefficient DMUs.

Singh and colleagues work in the sustainability area and propose environmentally sustainable procurement and logistics model for a supply chain based on MINLP (Mixed Integer Non Linear

Program) and MILP (Mixed Integer Linear Program) form requiring a variety of the real time parameters from buyer and supplier side such as costs, capacities, lead-times and emissions. They show that large sized problems possessing essential 3V's of big data, i.e., volume, variety and velocity consume non-polynomial time and cannot be solved optimally; to solve such problems involving big data a heuristic (H-1) is also proposed.

Challenges in forecasting within the big data era are discussed in the sixth paper in our special issue by Nikolopoulos and Petropoulos that looks into optimality: Could we better off by targeting for faster and robust systems that would aim for suboptimal forecasting solutions which, in turn, would not jeopardise the efficiency of the systems under use? The trade off between optimal versus suboptimal solutions is illustrated in terms of forecasting performance versus computational cost.

The seventh paper by Lee and colleagues focuses on speed optimization of liner shipping vessels using weather archive big data to estimate real fuel consumption functions. In particular, Copernicus data is 'analysed' using data mining techniques (Particle swarm optimization, a metaheuristic optimization method) to identify the impact of weather conditions based on voyage data obtained from a liner companies in Turkey that has liner services in the Mediterranean and the Black Sea. The approach is then tested using a case study and implications are discussed.

The eighth paper by Papanagnou and Matthews-Amune explores the conjunction of sales structured data with non-structured data to improve inventory management either in terms of forecasting or treating some inventory as 'top-selling' based on specific customer tendency to acquire more information through the internet. The paper considers a VARX model with non-structured data as exogenous to obtain the best estimation and we perform tests against several univariate models in terms of best fit performance and forecasting.

The nineth paper by Papagiannidis and colleagues looks at one of the challenges within BDA and SCM literature, that is, the analytical difficulties in understanding and extracting valuable knowledge from huge volumes of data, and this knowledge can then be used for enhancing the performance of many different processes for organizations and throughout the supply chain. The authors propose a novel big-data data-mining methodology and the Internet as a new source of useful meta-data for industry classification and identifying industrial clusters in almost real time in a specific geographic region, contributing to strategic cooperation and policy development for operations and supply chain management across organisational boundaries through big data analytics.

The last paper by Irani and colleagues investigates organizational factors that contribute to the reduction of food waste through the application of design science principles to explore causal relationships between food distribution (organisational) and consumption (societal) factors. By building cause-effect models and conducting 'what-if' simulations through Fuzzy Cognitive Map approaches, this research provides practical insights into existing and emergent food waste scenarios, suggesting the need for big data sets to allow for generalizable findings to be extrapolated from a more detailed quantitative exercise. Therefore, the contribution of this work lies in providing policy makers with the tools to evaluate policies whilst offering a practical basis through which food chains can be made more resilient through the consideration of management practices and policy decisions within a big data context.

Limitations and future research directions

The articles published in this SI focused on the applications of BDA on operations and supply chains. They explored questions such as:

(i) What types of BDA models and techniques are used in SCM?
(ii) How can BDA be used for facility layout design?
(iii) How can BDA be used in inventory planning and management?
(iv) How can BDA be used in supply chain sustainability and environmentally sustainable procurement?
(v) How BDA can be used in the strategic location of manufacturing plants and warehouses and resource allocation?

However, the main limitations of research published so far are firstly, the inability to account for all business functions for instance quality control in manufacturing and inventory control systems in warehousing (Zhou et al., forthcoming); and secondly, the insufficient focus on the links between all the functions. So far researchers (even in this SI) have been focusing within one function and we had not received any papers focusing on how they can be interlinked and optimized. Therefore, we believe that future research should tackle these gaps: firstly, investigate other functions where BDA could be applied, and secondly, interlink these functions via BDA applications. Finally, although we saw that there are combinations of BDA techniques, we are yet to see more of these combinations taking place (where appropriate) to develop more advanced and adaptive BDA models for supply chains. These techniques could include particular visualization techniques (Zhou et al., forthcoming).

Conclusions

In this Special Issue we explored the use of BDA for supply chain management. We have provided different perspectives, methodologies, and applications of BDA in this context. BDA has the potential to change the landscape within supply chain management, and hence we believe have provided enough food for thought for those academics and practitioners who would like to further engage in studying and contributing to BDA and supply chain management.

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