Guest editorial

Big data analytics in logistics and supply chain management

Introduction

In recent years, big data analytics (BDA) capability has attracted significant attention from academia and management practitioners. We are living in an era where there has been an explosion of data (Choi *et al.*, 2017). Kiron *et al.* (2014) argued that a majority of fortune 1,000 firms is pursuing BDA-related development projects. Chen and Zhang (2014) argued that big data (BD) has enough potential to revolutionize many fields including business, scientific research and public administration and so on. The use of BDA in the field of marketing and finance is on the rise. However, the operations and supply chain professionals are yet to exploit the true potential of the BDA capability in order to improve the supply chain operational decision-making skills (Srinivasan and Swink, 2017). Operations and supply chain professionals have access not only to data, which is continuously generated by traditional devices such as POS, RFID, but also GPS to a vast amount of data generated from unstructured data sources such as digital clickstreams, camera and surveillance footage, imagery, social media postings, blog/wiki entries and forum discussions (Sanders and Ganeshan, 2015). Today, supply chains are highly supported by advanced networking technologies – sensors, tags, tracks and other smart devices, which are gathering data on real-time basis (Wang *et al.*, 2016; Gunasekaran *et al.*, 2017), which provides end to end demand and supply visibility (Gunasekaran *et al.*, 2017; Srinivasan and Swink, 2017). Schoenherr and Speier-Pero (2015) argued that supply chain managers need to process a large amount of data to make decisions that may help reduce costs and increase the product availability to the customers.

The extant literature defines a BDA capability as a technologically enabled ability which can help process large volume, high velocity and several varieties of data to extract meaningful and useful insights; hereby enabling the organizations to gain competitive advantage (Fosso Wamba *et al.*, 2015, 2017). Galbraith (2014) further noted that historically, supply chain managers used to analyze data gathered from traditional data warehouses to gain insights. Moreover, Hazen *et al.* (2014) argued that the effectiveness of decision making in supply chains often hinges upon the quality of the data processed via organizational infrastructure, which enables the supply chain managers to quickly acquire, process and analyze data. Papadopoulos *et al.* (2017) argued that insights gained via increased information processing capability can reduce uncertainty, especially when operational tasks such as disaster relief operations are highly complex. However, despite increasing efforts from the operations and supply chain community to understand the associations between different types of operational visibility and analytics capabilities, the theory-driven research is limited. Hazen *et al.* (2016) further outlined how the use of organizational theories can help explain the complexity associated with the use of BDA capability to explain supply chain sustainability. Waller and Fawcett (2013a) noted that the intersection of logistics and supply chain management field with data science, predictive analytics and BD can provide numerous opportunities for research. However, in the absence of adequate skills, the supply chain managers often face a myriad of challenges to extract information from BD to take effective supply chain operational decisions (Waller and Fawcett, 2013a; Dubey and Gunasekaran, 2015a; Gupta and George, 2016). The role of contextual factors in developing BDA capability is well discussed in the information systems literature. What is less understood is how BDA under the effect of contextual factors affect logistics and supply chain processes. Waller and Fawcett (2013b) argued that recent experience with BD may help to explain some of the complex phenomena and unanswered questions in logistics and supply chain management.

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The main objective of this special issue (SI) is to provide a significant opportunity to the logistics and supply chain management community to affect practice through fundamental research on how BDA capability can be exploited by the organizations to provide logistics and supply chain insights.

Review of articles included in the SI

Our SI attracted 44 submissions. Each manuscript was examined to ensure that it was in line with our stated objectives in the published call for papers. We desk rejected some of the papers which failed to meet our objectives or the objectives of the *International Journal of Logistics Management (IJLM)*. Next, the manuscripts which were in line with our SI and IJLM 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 13 papers for our SI. All accepted papers in this SI are in line with our and IJLM objectives. The papers that are included in this: Dubey *et al.* (2018), Jeble *et al.* (2017), Song *et al.* (2018), Brinch *et al.* (2018), Hopkins and Hawking (2018), Gravili *et al.* (2018), Lamba and Singh (2018), Gupta *et al.* (2018), Lai *et al.* (2018), Hoehle *et al.* (2018), Bhattacharjya *et al.* (2018), Hofmann and Rutschmann (2018) and Queiroz and Telles (2018).

The first paper in this SI is on the application of big data and predictive analytics (BDPA) on humanitarian supply chains by Dubey *et al.* (2018). This paper examines what the antecedents of BDPA are. Second, how the BDPA can improve the visibility of humanitarian supply chains and coordination among the actors in humanitarian supply chains. Third, the authors examine the moderating role of swift trust on the path joining BDPA and visibility/coordination. To answer these research questions, the authors have grounded their model in contingent resource-based view (CRBV). In addition, the authors have tested their theoretical model using survey data gathered from informants at international NGOs that are engaged in disaster relief operations. The findings of the study offer some interesting contributions to BD, predictive analytics literature and swift-trust theory. Furthermore, it offers numerous directions to the managers who are engaged in disaster relief operations.

The second paper in this SI is on the application of BDPA on supply chain sustainability by Jeble *et al.* (2017). This paper examines what the resources needed to build BDPA capability are. Second, the paper examines how BDPA affects the supply chain sustainability under the moderating effect of supply base complexity. To answer these research questions, the authors grounded their model in the CRBV. The authors also tested their model using data gathered via the single-informant instrument. The findings of the study contribute to the growing debate surrounding BD, predictive analytics and supply chain sustainability.

The third paper in this SI is on the use of large data sets to examine the impact of financial restrictions on green innovation capability in the context of the global supply chain by Song *et al.* (2018). In this study, the authors have proposed a linear relationship between green innovation as a dependent variable; green supply chain integration and financial restriction as dependent variables. The study utilized customs, import and export data from 222,773 Chinese enterprises to test their proposed model. The findings suggest that greater supply chain integration and relaxation in financial restriction will boost the green innovation initiative of these firms. The study contributes to the prior research calls of scholars (see Waller and Fawcett, 2013a; Wang *et al.*, 2016), and how BDPA can be used to advance existing debates surrounding SCM.

The fourth paper in this SI is an exploratory study which aims to understand how supply chain practitioners view BD and its application in supply chain management by Brinch *et al.* (2018). In this study, the authors have used mixed research methods to address their research questions. First, the authors used the Delphi technique to understand the extent to which the supply chain practitioners were familiar with the application of BD in SCM. They further ranked the applications of BD in the SCOR process framework. The authors also supported

the Delphi study via cross-sectional data gathered using the survey-based instrument. The study provides an in-depth understanding of the various applications of BD in SCM. Second, the authors explore how BD applications in various stages in the supply chain can help the firm gain a competitive advantage. The study provides numerous directions for further research, which may help to expand logistics and supply chain management literature.

The fifth paper in this SI investigates the application of BDA and IoT in logistics by Hopkins and Hawking (2018). In this study, the authors have tried to develop a theoretical framework using a case study approach to understanding how logistics firms use BDA and IoT to support strategies to improve driver safety, reduce operating costs and reduce the negative effects of automobiles on the environment. The study provides directions for the logistics companies on how effective deployment of BDA and IoT can address some of the perennial problems of the logistics industry.

The sixth paper in this SI is on the influence of digital divide (DD) and digital alphabetization (DA) on the BD generation in supply chain management by Gravili *et al.* (2018). In this study, the authors have investigated the influence of the DD and DA on the BD generation process in order to gain insight into how BD could become a useful tool in the decision-making process of SCM. In addition, the authors have used a systematic literature review to understand the relationship between the literature on BDA, DD and SCM. The authors also explored the vector autoregressive, which is a stochastic technique to capture the linear interdependence between DD (as a part of internet usage) and trade in the context of the European Union. By examining the association between DD and internet acquisitions, a positive and long-lasting impulse response function was revealed, followed by an ascending trend. The findings suggest that a self-multiplying effect is being generated, and it is, in effect, reasonable to assume that the more individuals use the internet, the more electronic acquisitions occur. Thus, the improvement of the BD and SCM process is strongly dependent on the quality of the human factor.

The seventh paper in this SI attempts to develop a theoretical model, which tries to explain how the enablers of BD in operations and supply chain management are associated with each other by Lamba and Singh (2018). In this study, the authors have used fuzzy TISM to develop a theoretical model and have further examined the causality of the linkages using the DEMATEL technique. These techniques are grounded in graph theory. The current contribution of the authors makes significant strides toward the theoretical advancement of BDA and its application in the operations and supply chain management context. In the future, the proposed model may be tested using longitudinal data.

The eighth paper in this SI examines the role of cloud ERP on organizational performance by Gupta *et al.* (2018). Cloud-based ERP enables an organization to pay for the services they need and removes the need to maintain information technology infrastructure. In this paper, the authors have grounded their model in a CRBV and have further tested the role of cloud-based ERP services on supply chain performance and organizational performance, with cross-sectional data collected via a single-informant questionnaire. The findings of the study indicate that cloud ERP has a positive influence on supply chain performance and organizational performance measured in terms of market and financial performance. Furthermore, the study indicates that the supply base complexity has a significant moderating influence on the path joining cloud ERP and market/financial performance. The study contributes to the extant literature and further provides direction to the management practitioners.

The ninth paper in this SI examines the determinants of BDA in logistics and supply chain management by Lai *et al.* (2018). The authors have undertaken an extensive literature review of extant literature on BDA and SCM and have further classified the factors into four constructs: technological factors, organizational factors, environmental factors and supply chain characteristics. Furthermore, drawing from the innovation diffusion theory, the authors have proposed their theoretical model using the four constructs, and have further tested the process using single-informant survey data from 210 organizations. The findings of the study

suggest that perceived benefits and top management support have a significant influence on the adoption intention. Subsequently, environmental factors such as competitors' adoption, government policy and supply chain connectivity have a significant moderating effect on the direct relationship between driving factors and the adoption intention. The results offer some interesting contributions to the BDA and SCM literature.

The tenth paper in this SI examines the customer's tolerance in the context of omnichannel retail stores via logistics and supply chain analytics by Hoehle *et al.* (2018). In this study, the authors argued that mobile technologies are increasingly being used as a data source to enable BDA. These BDA enable inventory control and logistics planning for omnichannel businesses. First, the authors in this study introduced three emerging mobile shopping checkout processes in the retail store. Second, they suggested that new validation procedures (i.e. exit inspections) necessary for implementation of mobile technology-enabled checkout processes may disrupt traditional retail service processes. Third, the authors have proposed a construct labeled "tolerance for validation" defined as customer reactions to checkout procedures. The authors have also developed a measurement scale for the proposed construct and gathered data using a structured questionnaire from 239 customers. The statistical analyses suggest that customers have a higher tolerance for validation under scenarios in which mobile technologies are used in the checkout processes, as compared to the traditional self-service scenario in which no mobile technology is used. The customers do not particularly show a clear preference for specific mobile shopping scenarios. Hence, these findings contribute to our understanding of the challenges that omnichannel businesses may face as they leverage data from digital technologies to enhance collaborative planning, forecasting and replenishment processes. The proposed construct and measurement scales can be used in future work on omnichannel retailing.

The 11th paper of this SI examines how unstructured data in the form of tweets can be exploited to improve customer service by Bhattacharjya *et al.* (2018). In this study, the authors argued that in recent days, the interaction between firms and their customers in the form of tweets have increased. However, these tweets often constitute a large volume and the extraction of valuable information from these unstructured data may offer unique opportunities to understand their customers' need. The authors have demonstrated the need for tweet analytics via parcel shipping companies and their interactions with customers in Australia, the UK and the USA. The findings from the study contribute to the customer engagement theory. The research provides a unique opportunity for the practitioners, confirming that tweet analytics can be exploited to address other logistics and supply chain activities.

The 12th paper of this SI examines how BDA can be used for forecasting in supply chains by Hofmann and Rutschmann (2018). In this study, the authors argued that BD can minimize the forecast errors, thereby improving the forecast accuracy. The authors have proposed a conceptual structure based on the design-science paradigm via three steps: description of conceptual elements of the framework utilizing justifiable knowledge; specification of the principles of the theoretical framework to explain the interplay between elements; and creation of a matching framework by conducting investigations within the retail industry. The developed framework could serve as the first guide for meaningful BDA initiatives in the supply chain. This study attempts to offer unique contributions to the forecasting technique via BDA.

The 13th paper of this SI examines the role of BDA in logistics and supply chain by Queiroz and Telles (2018). In this study, the authors have investigated the role of supply chain partnerships, human knowledge and innovation culture on supply chains in BD environments. The authors have further tested their proposed BDA-SCM triangle using data gathered via single-informant instrument from Brazilian corporations. The study provides an understanding of the barriers related to BDA adoption and the relationship between supply chain levels and BDA knowledge. The authors have further noted their limitations, which offer unique opportunities to the BDA and SCM scholars to build upon current findings.

Limitations and future research directions

We have accepted 13 articles based on a rigorous review in line with our SI and the *IJLM* objectives. Our articles have attempted to answer some of the questions noted by Waller and Fawcett (2013b). Such as:

- When should we use BDPA in SCM?
- Under what context can BDPA in SCM be used?
- How can predictive analytics be used to advance theory in SCM?
- How does BDPA in SCM affect organizational performance and under what circumstances?

However, some of the questions remain unaddressed:

- How can BDPA be used in inventory planning?
- How can BDPA improve information sharing?
- How can BDPA be used for facility layout design?
- How can BDPA be used in vehicle routing problems?
- How can BDPA help to minimize environmental uncertainties?

Hence, we can argue that we need strong predictive analytics capability because consumer behavior has become an integral part of the supply chain (Waller and Fawcett, 2013b). Thus, the ability to predict the consumer behavior has implications for product innovation, product manufacturing, distribution, design and demand.

Concluding remarks

The BDA is one of the most promising topics which can provide numerous opportunities for academic and management practitioners. It can be used for building theories which is one of the untapped potentials of the BDPA; even though many scholars often term BDA as one of the management fads. Despite criticisms, we believe that BDA have immense potential to revolutionize existing supply chain theories.

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Further reading

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