ASIAN BULLETIN OF BIG DATA MANAGEMENT
Vol. 1. Issue 1 (2021)

Exploring a nexus among the big data Predictive analytics, Supply Chain Performance, and Organizational Performance: A case of an Asian country

Farhan Qadir

Chronicle

Article history
Received: April17, 2021
Received in the revised format: July 19, 2021
Accepted: October10, 2021
Available online: December13, 2021

Farhan Qadir is currently affiliated with King Edward Medical University, Lahore
Email: farhan.qadir@hotmail.com

Abstract

The goal of this study is to look into the relationship between big data predictive analytics, supply chain performance, and organizational performance in an Asian country. The study employs a variety of approaches, including quantitative data analysis and qualitative interviews with experts in the subject. According to the findings, applying predictive analytics to big data has a positive impact on the performance of supply chains, which in turn has a positive impact on the performance of companies. According to the poll, the application of big data analytics in supply chain management is not yet widespread in the region. Instead, many organizations continue to rely on more traditional techniques of managing their supply chains. According to the findings, businesses in the region may benefit from applying big data predictive analytics to improve the performance of their supply chains and organizations. In overall, the findings of this study contribute to a better understanding of the interaction between big data, supply chain performance, and organizational performance in the context of an Asian nation.

Keywords: big data, Predictive analytics, Supply Chain Performance, and Organizational Performance.

BACKGROUND

Big data and Predictive analytics (BDPA) are a broader concept which includes techniques that are particularly designed for big data management and is characterized by high velocity, variety, and volume (Jeble et al.,2020; Ngo et al.,2020). Challenges arising from predictive analytics, such as, system architecture (data storage, sharing, selection, transfer) and data analytics (search, visualization, and analysis) can easily be addressed by using big data. In addition, big data may lead to improvement in visibility, which in turn improves supply chain performance, organizational performance, robustness, and resilience (Dubey et al.,2018; Rodriguez & Da Cunha,2018). However, researchers (Dubey et al.,2019) have pointed towards the scarcity of literature in context to BDPA assimilation and how it affects organizational performance and supply chain performance. Therefore, this study integrated the management commitment, resource-based view (RBV), and diffusion after BDPA adoption for testing a model which proposes that how BDPA influences OP and SCP (Gunasekaranet al.,2017; Manavalan & Jayakrishna,2019). BDPA assimilation is one of the three-stages of post-diffusion process and refers to the extent of technology diffusion throughout the organization (Jahan &

Sazu, 2021). Acceptance and routinization are the other two stages of post-diffusion process, where acceptance shows the perception of stakeholders towards BDPA, while routinization represents how adjustments in the governance systems of organization are made to integrate BDPA. Lastly, assimilation shows the extent to which BDPA is well diffused throughout the organization. The present study examined that to what extent organizational resources (information sharing and connectivity) affect its BDPA assimilation and acceptance capabilities, along with the effects of commitment, BDPA assimilation, and top management as a mediator on OP and SCP. Hence, this study extended the literature particularly concerning the role of top management's commitment and information sharing on firm performance and supply chain transformation to achieve competitive advantage (Sodero et al.,2019).

LITERATURE REVIEW

Resource-based View (RBV)

According to the resource-based view, competitive advantage can be achieved by the organizations through developing strategic capabilities and resources (Jahan & Sazu,2021). Superior performance of a firm depends largely on the extent that firm has resources that are rare (R), valuable (V), properly organized, and imperfectly imitable (I) by its competitors (Hajar et al.,2021). There are various types of capital, such as, human capital, physical capital, reputational capital, intangible (such as, knowledge or information sharing), or tangible capital (such as, infrastructure), and technological capital (Marinelli et al.,2021). Value of resources significantly increase when they are combined defined resources as the intangible as well as tangible assets, while capabilities refer to the organization's non-transferable resources which also enhance other resources in terms of productivity (Yonget al.,2020). Thus, an organization essentially requires capabilities which largely depends on where the organization operates, i.e., its environmental conditions (Harsch & Festing (2020). Resource-based view suggests that competitive advantage cannot be gained by the resources on their own. Prior studies Saputra et al. (2021) pointed out how organization's top managers play their role in developing capability and in structuring firm's resource portfolio by integrating certain processes such as, accumulating, divesting, and acquiring resources. On the other hand, Sahooet al. (2021) also conducted a study to analyze why managerial decision making is important in acquiring and deploying the resources. Furthermore, other scholars (Li te al.,2021) attempted to investigate the combination of capabilities and resources which affect performance. According to Mishraet al. (2019) study, using organizational capabilities assists in achieving as well as maintaining competitive advantage. Resource-based View is considered in this study for conceptualizing BDPA assimilation as an organizational capability which have its influence on the OP and SCP.

Supply Chain Performance, BDPA Assimilation, and Organizational Performance

According to the scholars, BDPA is critical for supply chain transformation (Jabbouret al.,2020). BDPA can be helpful in improving efficiency, reducing costs of supply chain, quickly responding to environmental changes, enhancing the organization's operational

planning and sales capabilities, and adding power to supplier relationships (Lumata, et al.,2011). Ji-Fan Ren et al. (2016) highlighted that using big data analytics positively influence the organizational performance. In context to RBV, literature suggests that integrating supply chain capabilities positively influence firm performance when these capabilities are not easily imitable and are firm specific Kamble and Gunasekaran (2020) examined the IT capabilities' effects on organizational performance through developing supply chain agility and absorptive capacity. On the other hand, findings obtained from Jin, Vonderembse, Jin et al. (2014) revealed that competitive performance of a firm is also influenced by the IT-enabled sharing capabilities. However, there is a dearth of literature in the area of BDPA post-diffusion, particularly in context to the BDPA capabilities and its impact on organizational performance and supply chain performance. Thus, we hypothesize that:

H1: Supply chain performance of a firm and BDPA assimilation are positively related.

H2: Organizational performance and BDPA assimilation are positively related.

Supply Chain Performance and Organizational Performance

A study Kalyar et al. (2020) pointed out that market performance can be positively influenced by the supply chain performance of a firm, through enhancing the organization's financial performance, market share, and minimizing cost of the supply chain. 'Delivering quality products and services in precise time and quantity' and 'supply chain cost' are the supply chain performance measures that were proposed by Ganbold, et al. (2021) in their study. A few scholars Saleemet al. (2021) also argued that SC practices, like quality information sharing improves the performance of an organization. Another study reported the positive impact of supply chain productivity on the organizational performance, while Mani et al. (2020) reported a positive linkage between OP and SCP. Therefore, we propose that:

H3: Supply chain performance mediates between BDPA and Organizational Performance

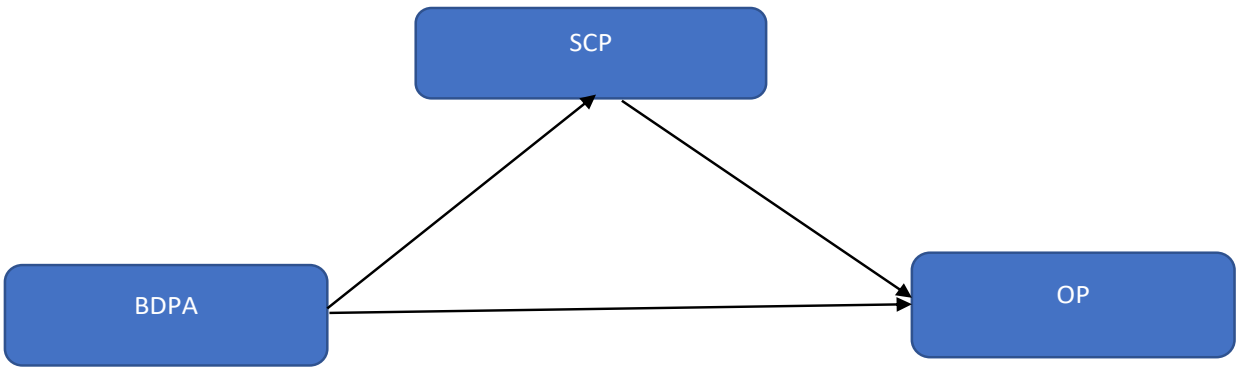

Figure 1.

Conceptual Framework

RESEARCH METHODOLOGY

This study aimed to determine if there is a relationship between Big Data Predictive Analytics (BDPA), Supply Chain Performance (SCP), and Organizational Performance (OP) in an Asian country. A total of 410 individuals from various fields of endeavor were surveyed using a technique based on questionnaires to obtain information. The survey consisted of a total of 600 questions, including demographic inquiries, questions addressing the BDPA, SCP, and OP, as well as questions regarding other control factors. Several approaches, including email invitations, online survey platforms, and direct personal contact, were utilized to distribute the survey to responders. In order to ensure the reliability and validity of the questionnaire, a pilot study was conducted to undertake preliminary testing. Partial Least Squares Structural Equation Modeling was used to analyze the data in order to evaluate the research hypotheses and investigate the relationship between BDPA, SCP, and OP in the context of an Asian nation (PLS-SEM). The goal of the study was to provide information that local businesses might utilize to improve the efficiency of their supply chains and the overall performance of their organizations by applying BDPA.

RESULTS

The analysis in the study was conducted using Sem-pls, a two-step process comprising the measurement model and structural model.

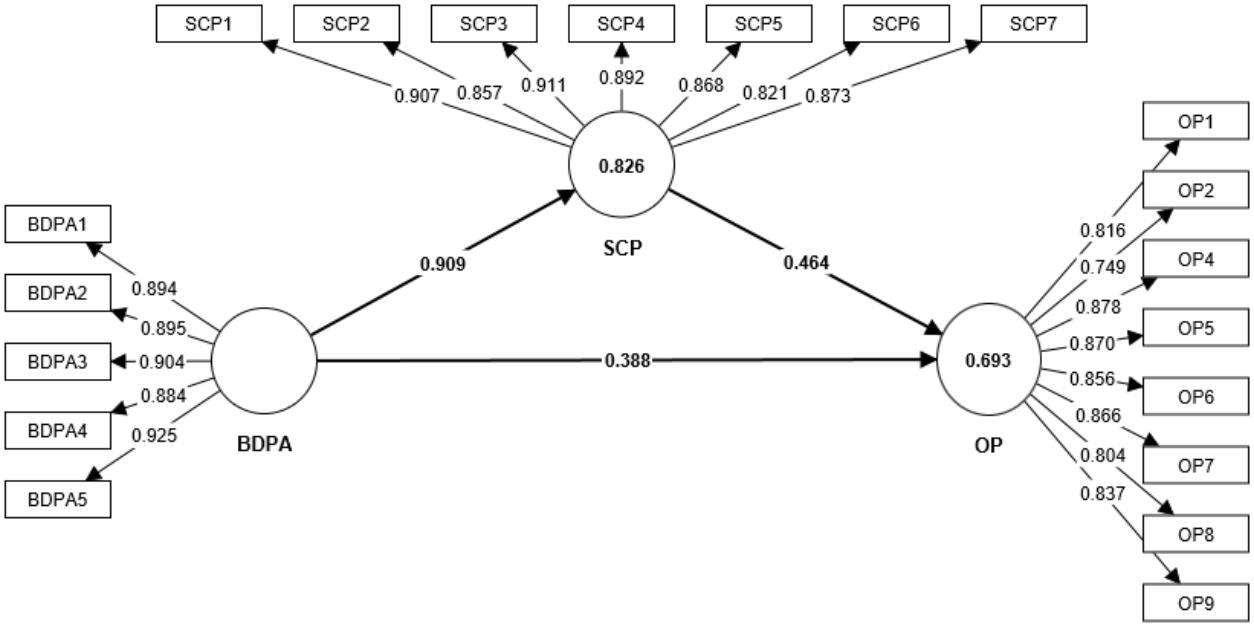

Figure 2.
Measurement Model

The "outer loadings" are the regression coefficients that depict the associations between latent and observable variables in partial least squares structural equation modeling (PLS-SEM). By computing the structural equations of the PLS-SEM model with the assistance of outer loadings, we can understand the direct effects of the latent variables on the observable variables. Larger outer loading values indicate a stronger correlation between the latent and observable variables. The magnitude of the outer loadings can also help identify the most significant predictors in the model, as illustrated in Table 1.

Table 1.
Outer Loadings

	BDPA	OP	SCP
BDPA1	0.894		
BDPA2	0.895		
BDPA3	0.904		
BDPA4	0.884		
BDPA5	0.925		
OP1		0.816	
OP2		0.749	
OP4		0.878	
OP5		0.870	
OP6		0.856	
OP7		0.866	
OP8		0.804	
OP9		0.837	
SCP1			0.907
SCP2			0.857
SCP3			0.911
SCP4			0.892
SCP5			0.868
SCP6			0.821
SCP7			0.873

Reliability analysis is crucial in Structural Equation Modeling (SEM) with Partial Least Squares (PLS) as it evaluates the consistency and stability of the measurement model (Hair et al.,2021). The measurement model in PLS-SEM reflects the links between latent and observable variables and has a significant impact on the model's quality and results. To assess PLS-SEM reliability, Composite Reliability (CR) and Average Variance Extracted (AVE) are commonly used. CR, calculated as the average of squared factor loadings for a latent variable, indicates high dependability when close to 1(Shrestha,2021). Similarly, AVE measures the variance explained by latent components in observed variables, with high dependability when close to.

Table 2.
Reliability Analysis

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
BDPA	0.942	0.943	0.955	0.811
OP	0.938	0.945	0.949	0.698
SCP	0.949	0.950	0.958	0.767

Table 3 below demonstrates the discriminant validity of the present study.

Table 3: Discriminant validity

	BDPA	OP	SCP
BDPA	0.901		
OP	0.810	0.836	
SCP	0.909	0.817	0.876

Discriminant Validity:

In order to ensure that the variables that are not intended to be related are indeed unrelated, discriminant validity is assessed. In this study, we utilized the Fornell and Larker approach to evaluate the results (Rönkkö & Cho,2021). Table 3 displays the analysis, where each bold loading for the constructs is greater than the other values, indicating that all variables possess strong discriminant validity. Thus, by examining both the convergent validity and reliability tables, along with the discriminant validity table, we can conclude that the data is both valid and reliable.

Structural Model:

We applied the structural model in order to validate the computed hypothesis. Each variable is identified as a latent construct.

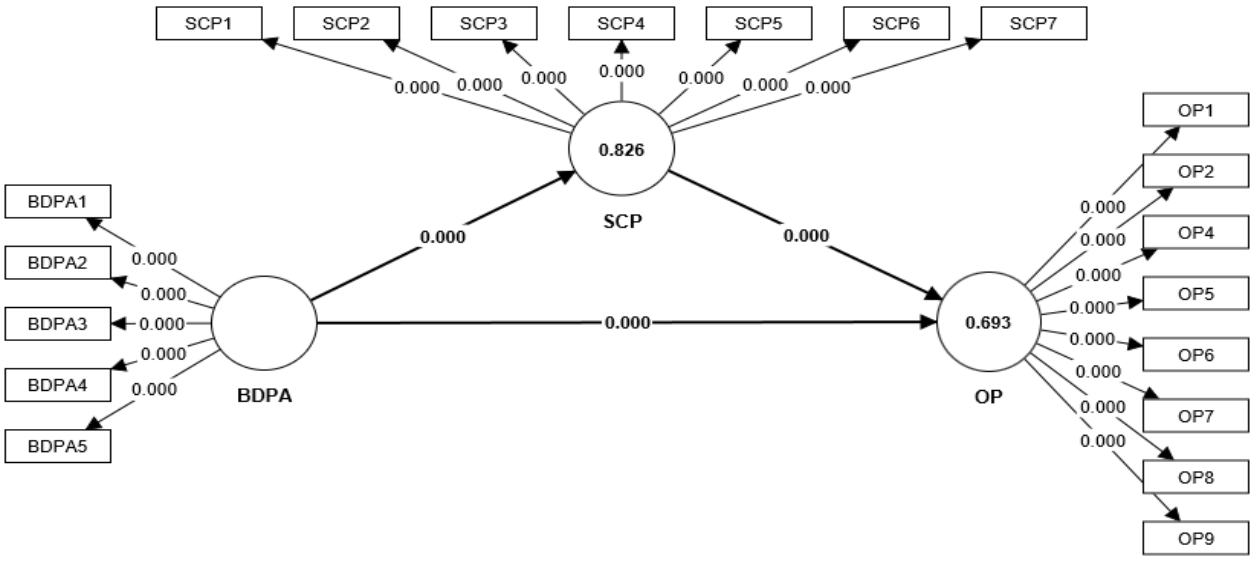

Figure 3.
Structural Model

The Structural Equation Modeling (SEM) using Partial Least Squares (PLS) method integrates a structural model that produces correlations between latent variables, capturing the causal structure of the data. Both of these approaches are referred to collectively as "structural modeling (Henseler & Schuberth,2021." The PLS-SEM structural model is developed by extracting a set of structural equations from the measurement model and then using those equations to estimate the outside loadings. Using previously observed data, this model can be used to test hypotheses and generate predictions regarding the relationships between latent variables. Table 4 provides the direct outcomes of the inquiry, which reveal that all of the hypotheses may be accepted with a high level of confidence.

Table 4.
Direct Results

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
BDPA -> OP	0.810	0.812	0.033	24.751	0.000
BDPA -> SCP	0.909	0.908	0.017	52.282	0.000
SCP -> OP	0.464	0.470	0.081	5.707	0.000

The results of the mediation investigation, which show that the mediation path is statistically significant, are shown in table 5 below.

Table 5.
Mediation Analysis

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values

BDPA -> SCP -> OP	0.422	0.427	0.077	5.486	0.000

DISCUSSION AND CONCLUSION

The present study suggests RBV as an important element to understand BDPA assimilation, which is an organizational capability that depends on the combination of IS and C resources. Moreover, BDPA assimilation positively influences the organizational performance and supply chain performance (Singh & El-Kassar, 2019) which ultimately leads to achieving a firm's competitive advantage both at supply chain and at firm level. Prior studies have tried to analyze BDPA in context to supply chain operations and management, but little importance has been given in context to OP and SCP (Deepu & Ravi,2020). According to Sundram et al. (20), SCP and the firm's financial and market performance are positively related. This gap is addressed in this study and thus suggests a positive association among BDPA assimilation and OP. This study contributed to the existing body of literature especially in context to the role of information sharing, supply chain integration, supply chain transformation and IT in organizational performance (OP) (Ganbold, et al.,2020). Findings obtained in this research are consistent to the Centobelliet al. (2020) study, which argues that significant benefits are gained through BDPA in the form of supply chain efficiencies and cost reduction, quick response to environment changes, enhanced operations planning and sales capabilities, and improvement in supplier relationships.

IMPLICATIONS

To develop BDPA assimilation capability and gain better OP and SCP, top managers are required to acquire IS and C resources as well as remain committed to the process of resource acquisition by investing and orchestrating on resource bundles. Moreover, OP and SCP are enhanced through BDPA assimilation capabilities which suggests that resources must be acquired by top managers, followed by developing BDPA capabilities for achieving improved OP and SCP.

References

Centobelli, P., Cerchione, R., & Ertz, M. (2020). Agile supply chain management: where did it come from and where will it go in the era of digital transformation?. Industrial Marketing Management, 90, 324-345.

david, J., Hwang, B. G., & Zhang, C. (2020). Factor-based big data and predictive analytics capability assessment tool for the construction industry. Automation in construction, 110, 103042.

Deepu, T. S., & Ravi, V. (2020). An integrated ANP–QFD approach for prioritization of customer and design requirements for digitalization in an electronic supply chain. Benchmarking: An

International Journal, 28(4), 1213-1246.
Dubey, R., Gunasekaran, A., Childe, S. J., Blome, C., & Papadopoulos, T. (2019). Big data and predictive analytics and manufacturing performance: integrating institutional theory, resource-based view and big data culture. British Journal of Management, 30(2), 341-361.
Dubey, R., Luo, Z., Gunasekaran, A., Akter, S., Hazen, B. T., & Douglas, M. A. (2018). Big data and predictive analytics in humanitarian supply chains: Enabling visibility and coordination in the presence of swift trust. The International Journal of Logistics Management.
Ganbold, O., Matsui, Y., & Rotaru, K. (2021). Effect of information technology-enabled supply chain integration on firm's operational performance. Journal of Enterprise Information Management, 34(3), 948-989.
Ganbold, O., Matsui, Y., & Rotaru, K. (2021). Effect of information technology-enabled supply chain integration on firm's operational performance. Journal of Enterprise Information Management, 34(3), 948-989.
Gunasekaran, A., Papadopoulos, T., Dubey, R., Wamba, S. F., Childe, S. J., Hazen, B., & Akter, S. (2017). Big data and predictive analytics for supply chain and organizational performance. Journal of Business Research, 70, 308-317.
Hair, J., & Alamer, A. (2021). Partial Least Squares Structural Equation Modeling (PLS-SEM) in second language and education research: Guidelines using an applied example. Research Methods in Applied Linguistics, 1(3), 100027.
Hajar, M. A., Alkahtani, A. A., Ibrahim, D. N., Al-Sharafi, M. A., Alkawsi, G., Iahad, N. A., ... & Tiong, S. K. (2021). The Effect of Value Innovation in the Superior Performance and Sustainable Growth of Telecommunications Sector: Mediation Effect of Customer Satisfaction and Loyalty. Sustainability, 14(10), 6342.
Harsch, K., & Festing, M. (2020). Dynamic talent management capabilities and organizational agility—A qualitative exploration. Human Resource Management, 59(1), 43-61.
Henseler, J., & Schuberth, F. (2021). Partial least squares as a tool for scientific inquiry: Comments on Cadogan and Lee. European Journal of Marketing, (ahead-of-print).
Jabbour, C. J. C., Fiorini, P. D. C., Ndubisi, N. O., Queiroz, M. M., & Piato, É. L. (2020). Digitally-enabled sustainable supply chains in the 21st century: A review and a research agenda. Science of the total environment, 725, 138177.
Jahan, S. A., & Sazu, M. H. (2021). The Impact of Data Analytics on High Efficiency Supply Chain Management. CECCAR Business Review, 3(7), 62-72.
Jahan, S. A., & Sazu, M. H. (2021). The Impact of Data Analytics on High Efficiency Supply Chain Management. CECCAR Business Review, 3(7), 62-72.
Jeble, S., Kumari, S., Venkatesh, V. G., & Singh, M. (2020). Influence of big data and predictive analytics and social capital on performance of humanitarian supply chain: Developing framework and future research directions. Benchmarking: An International Journal, 27(2), 606-633.
Jin, Y., Vonderembse, M., Ragu-Nathan, T. S., & Smith, J. T. (2014). Exploring relationships among IT-enabled sharing capability, supply chain flexibility, and competitive performance. International Journal of Production Economics, 153, 24-34.
Kalyar, M. N., Shoukat, A., & Shafique, I. (2020). Enhancing firms' environmental performance and financial performance through green supply chain management practices and institutional pressures. Sustainability Accounting, Management and Policy Journal, 11(2), 451-476.
Kamble, S. S., & Gunasekaran, A. (2020). Big data-driven supply chain performance measurement system: a review and framework for implementation. International Journal of Production Research, 58(1), 65-86.
Li, S., Jia, R., Seufert, J. H., Hu, W., & Luo, J. (2021). The impact of ability-, motivation-and opportunity-enhancing strategic human resource management on performance: the mediating roles of emotional capability and intellectual capital. Asia Pacific Journal of Human Resources, 60(3), 453-478.
Lumata, L., Ratnakar, S. J., Jindal, A., Merritt, M., Comment, A., Malloy, C., ... & Kovacs, Z. (2011).

BDPA: an efficient polarizing agent for fast dissolution dynamic nuclear polarization NMR spectroscopy. Chemistry–A European Journal, 17(39), 10825-10827.

Manavalan, E., & Jayakrishna, K. (2019). A review of Internet of Things (IoT) embedded sustainable supply chain for industry 4.0 requirements. Computers & Industrial Engineering, 127, 925-953.

Mani, V., Jabbour, C. J. C., & Mani, K. T. (2020). Supply chain social sustainability in small and medium manufacturing enterprises and firms' performance: Empirical evidence from an emerging Asian economy. International Journal of Production Economics, 227, 107656.

Marinelli, L., Bartoloni, S., Pascucci, F., Gregori, G. L., & Farina Briamonte, M. (2021). Genesis of an innovation-based entrepreneurial ecosystem: exploring the role of intellectual capital. Journal of Intellectual Capital.

Mishra, D., Luo, Z., Hazen, B., Hassini, E., & Foropon, C. (2019). Organizational capabilities that enable big data and predictive analytics diffusion and organizational performance: A resource-based perspective. Management Decision, 57(8), 1734-1755.

Rodriguez, L., & Da Cunha, C. (2018). Impacts of big data analytics and absorptive capacity on sustainable supply chain innovation: A conceptual framework. LogForum, 14(2), 151-161.

Rönkkö, M., & Cho, E. (2021). An updated guideline for assessing discriminant validity. Organizational Research Methods, 25(1), 6-14.

Sahoo, S., Kumar, A., & Upadhyay, A. (2021). How do green knowledge management and green technology innovation impact corporate environmental performance? Understanding the role of green knowledge acquisition. Business Strategy and the Environment, 32(1), 551-569.

Saleem, H., Li, Y., Ali, Z., Ayyoub, M., Wang, Y., & Mehreen, A. (2021). Big data use and its outcomes in supply chain context: the roles of information sharing and technological innovation. Journal of Enterprise Information Management, 34(4), 1121-1143.

Saputra, N., Sasanti, N., Alamsjah, F., & Sadeli, F. (2021). Strategic role of digital capability on business agility during COVID-19 era. Procedia Computer Science, 197, 326-335.

Shrestha, N. (2021). Factor analysis as a tool for survey analysis. American Journal of Applied Mathematics and Statistics, 9(1), 4-11.

Singh, S. K., & El-Kassar, A. N. (2019). Role of big data analytics in developing sustainable capabilities. Journal of cleaner production, 213, 1264-1273.

Sodero, A., Jin, Y. H., & Barratt, M. (2019). The social process of Big Data and predictive analytics use for logistics and supply chain management. International Journal of Physical Distribution & Logistics Management, 49(7), 706-726.

Sundram, V. P. K., Chhetri, P., & Bahrin, A. S. (2020). The consequences of information technology, information sharing and supply chain integration, towards supply chain performance and firm performance. Journal of International Logistics and Trade, 18(1), 15-31.

Yong, J. Y., Yusliza, M. Y., & Fawehinmi, O. O. (2020). Green human resource management: A systematic literature review from 2007 to 2019. Benchmarking: An International Journal, 27(7), 2005-2027.