

Uncertain Supply Chain Management

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Exploring nexus among big data analytic capability and organizational performance through mediation of supply chain agility

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ABSTRACT

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The organization needs to improve on a steady basis. For this purpose, organizations must gauge their performance regularly. To achieve this purpose, the agility of the supply chain may play a key role. Therefore, this study was designed to explore the relationship between big data analytics, organizational flexibility, supply chain agility, and organizational performance. This study assessed the mediation effect of supply chain agility as well. The research design of the cross-sectional and research approach was quantitative. The data of this study was gathered from the retail sector employees. In total, 516 questionnaires were distributed using simple random sampling. The usable response rate of the study was 54.90%. The gathered data was examined through smart PLS 3.3.2. The findings of the study revealed that Supply chain agility plays a crucial role in improving the performance of the organization. The study also confirmed the mediating effect of supply chain agility. The findings of the study are helpful for the policymakers of the retail sector.

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1. Introduction

To improve the performance of the firm on a regular basis, it is key to monitor the organizational performance. Therefore, the concept of organizational performance is the basic concept of research in the field of management and social research (Parast & Shekarian, 2019). Whereas the concept of organizational performance is debated a lot as well. The base of the debate regarding organizational performance is the effectiveness and efficiency of the organization. within an organization, it is the responsibility of managers to control and measure organizational performance (Rajaguru & Matanda, 2019). It is because measuring organizational performance can lead to asset management in a better way. On the other hand, organizational knowledge can be improved, and customer value can be enhanced as well. Additionally, organizational reputation is also affected by the measures taken by the organization to improve performance. Organizations can also track the performance of their employees by tracking the performance of their organization (Wu, Straub, & Liang, 2015).

Supply chain agility (SCA) is very important for any kind of organization that is focusing on producing goods to fulfil the needs of the customers. The supply chain of the organization must be agile if they are looking to produce goods that can fulfil the needs of the customers. Therefore, they must look to shorten the life cycle of the organization (Gligor, Esmark, & Holcomb, 2015). Whereas the introduction of new products is also mainly dependent upon supply chain agility because the demands and needs of the customers are regularly changing. Moreover, if the supply chain of the organization is agile, it will lead to the development of sustainable competitive advantage as the organization will be able to look for more opportunities through this (Tarafdar & Qrunfleh, 2017).

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The concept of big data has gathered a lot of attention and importance by researchers and practitioners because of its ability to improve and transform the entire business process. This is the age of data that is improving and gaining interest among industries and institutions because of the increase in new data. The applications and analytics of big data gain attention because of their ability to drive the decision-making capacity and ability of the organization. More and more organizations are gaining interest and investing in big data analytics with the purpose to gain important insight to gain a competitive edge (Constantiou & Kallinikos, 2015). Researchers have viewed organizational flexibility as a key response to organizational needs and the labor market is mainly associated with organizational flexibility. This is the era of technology, and the global business environment is changing rapidly. Most of the companies at the global level are facing unpredictability and uncertainty, due to which these organizations need to be more agile, flexible and dynamic. Organizational flexibility is one of the essential concepts that is linked to organizational agility. To sustain in the current market, flexibility plays a significant role (Yeniaras, Di Benedetto, & Dayan, 2021). Organizations with a flexible environment can use certain tools like innovation, workforce, technology, and organization. Organizational flexibility is linked to external and internal forces (Yousaf & Majid, 2018). The need to use a large variety, velocity and volume of data is expanding due to which technologies and techniques to visualize, analyze and store the data are evolving as well. In contrast, there is limited knowledge and understanding of how organizations need a change in their structure to adopt these innovative technologies (McAfee, Brynjolfsson, Davenport, Patil, & Barton, 2012). Still, several researchers have mentioned the importance of big data, but the mentioned difficulties regarding big data are still unsolved (Mikalef, Framnes, Danielsen, Krogstie, & Olsen, 2017). There is much research on flexibility and organizational performance, but the mechanism of the effect still requires more research (Shalender & Singh, 2015).

The current study fills this gap by exploring the mediational role of organizational agility between organizational flexibility, extensive data analytics capability, and organization performance. Through organizational flexibility, any organization can adopt competencies and resources of the organization according to the changing external and internal environment. Moreover, this study examines the significance and magnitude of the direct and the indirect effects of the flexible environment's extensive data analytics capability on the organization performance.

2. Literature Review

Performance is made of the firm's achievements and results, including the actual organizational outputs that should be measured with the intended objectives, goals, and outputs. There are three areas in which the performance of the organization is involved. These three areas include market performance, shareholder return and financial performance. The financial performance is measured as profits and ROI. Whereas shareholder return is represented as a total shareholder and economic value added (Njagi & Kombo, 2014). The focus of every organization is to continue their good performance and improve performance regularly. Therefore, in management research, organizational performance is one of the keys and critical aspects. Performance of the organization is a very comprehensive measure that includes consistency, quality, and productivity (Ebrahim & Rangan, 2014). The concept of SCA is developed from the concept of organizational agility. Therefore, it is essential to know and understand the true meaning of agility before understanding its application in the context of the supply chain. Word agility is treated as the integration of the elements of the business at the comprehensive level.

Moreover, it is also linked with the organization's comprehensive basis, including profitability, quality, innovation, flexibility, and speed (Fayezi, Zutshi, & O'Loughlin, 2017). Researchers have defined the concept of agility as the organizational ability to complete the transformation among different manufacturing assemblies. Agility is the ability of the organization to develop and produce a range of products that are comprehensive more efficiently with high quality and low cost.

Moreover, these products are developed according to the individual specifications of the customers. Scholars also argued that the agile enterprise must not respond to the uncertainties more quickly. These organizations must also adapt to the opportunities and changes within the structure and processes (Tse, Zhang, Akhtar, & MacBryde, 2016). For the business to survive in the challenging business environment, the organization must be able to perform the tasks with agility, and agility must be applied within their relationships with the supply chain. Scholars stated that the primary concern of the supply chain is regarding the performing change within the organization professionally, which shows the competency to adopt the transformation. Scholars have defined supply chain agility as the organizational capability to respond or adapt quickly to the unpredictable and dynamic business environment (Gligor et al., 2015).

Scholars have pointed out that BDA plays a vital role in supporting the organization's decision-making at the supply chain and corporate level. It is reported that the usage of the BDA supply chain within the organization is minimal. Big data analytics is based on the survey of data on a large scale by supply chain management professionals. Senior management of the organization is responsible for motivating the decision-makers to use BDA (Sabharwal & Miah, 2021). Scholars study BDA implications capability on making decisions. They revealed that several benefits could be gathered from BDA at the supply chain and corporate level. BDA benefits include higher efficiency of operations, higher visibility, higher transparency of the supply chain, and consumer behavior. Past researchers studied the effect of big data on the organization's performance (Gunasekaran et al., 2017).

On the other hand, big data analytics positively links information sharing and connectivity. Scholars also pointed out that the capability of BDA is based on talent capability, technology capability, and management capability. Above mentioned studies pointed out that big data analytics has a positive effect on the performance of the supply chain and corporate performance, and the same results were claimed by (Jha, Agi, & Ngai, 2020).

The concept of flexibility is well understood and discussed in past studies. Researchers have given attention to the concept of flexibility since the 1980s. One of the fundamental concepts of agile firms is flexibility. The concept of organizational flexibility is located in the literature of the manufacturing sector (Ni et al., 2021). In these studies, researchers have paid attention to investigating how flexibility can affect the organization's functions. Most past researchers were encouraged to assess the effect of organizational flexibility in supply chains and operations. The operational development of flexibility is based on consequences, mechanism, antecedents, and types (Vecchiato, 2015). In terms of flexibility, cost and time are the base to develop flexibility within the organization. Scholars pointed out that managing cost and time is vital to implement change in processes, structures, and systems. Researchers extended the argument by suggesting that cost and time are the critical drivers of flexibility within the firm. Moreover, the options of competitiveness are the things that ultimately define flexibility. Scholars termed these and range in the past studies (Yousaf & Majid, 2018).

Scholars further divided the factors into range heterogeneity and range number referred to as dissimilarity and quantity of the options available for the organization. Heterogeneity adheres to principles that are commonly accepted and regulate the organizational ability to manage a range of structures, costs, and time in response to external and internal uncertainties. Different kinds of categories of flexibility are presented within the firm and characterized through different variable classes used in the research: market, mix, volume, delivery, and machinery. More importantly, one of the critical areas in organizational flexibility that has been given much attention in past studies is the response of uncertainty to the organization (Raffaele & Connell, 2016). The first scholar who developed the association among different kinds of flexible responses and different kinds of uncertainties within the organization was (Gerwin 1987). Several past studies have discussed a variety of antecedents of flexibility. It is argued by Tamayo-Torres, Gutierrez-Gutierrez, and Ruiz-Moreno (2014) that organizations can update their approaches and strategies as a response to the changes in the external environment through strategic flexibility (Fayezi et al., 2017).

3. Hypotheses Development

3.1 *Big data analytics capability, SCA and OP*

To strengthen big data analytics capabilities, the firm needs organized efforts to develop relational knowledge, technical knowledge, management knowledge, technological knowledge, and business knowledge. Scholars indicated that the capabilities of BDA are fundamental for the agility of the supply chain. On the other hand, scholars also observed that SCA is positively affected by IT capability (Swafford, Ghosh, & Murthy, 2008). On the other hand, scholars also noted that big data analytics positively relationship with supply chain visibility (Srinivasan & Swink, 2018). The same findings were reported by Gunasekaran et al. (2017), who mentioned that both these variables are complementary to each other.

One of the desired capabilities with the purpose of mitigating the result is the supply chain visibility. It has resulted from the disruption of the supply chain. On the same aspect, researchers also discussed that the organizations that invest in the capability of the supply chain have a chance to develop their own big data analytics (Srinivasan & Swink, 2018). In comparison, there exists a positive relationship between SCA and BDA (Dubey, Gunasekaran, & Childe, 2019). Thus, it is argued that managers can easily sense the requirement of change because of the usage of data technology. Researchers argued that big data analytics have a positive relationship with organizational performance Gunasekaran et al. (2017). In the same vein, the organizations that have top performance tend to use analytics five times more than the companies having a low performance do. In the end, researchers also argued that big data is also used by organizations to improve their overall performance (S. Wamba, Gunasekaran, & Akter, 2017; S. F. Wamba, Gunasekaran, Papadopoulos, & Ngai, 2018). Thus:

H₁. *Big data analytics has a positive impact on SCA.*

H₂. *Big data analytics has a positive impact on OP.*

3.2 *OF, SCA and OP*

The organization's internal supply chain comprises supply chain flexibilities, distribution functions, procurements, manufacturing, and product development that represents the organizational abilities in these functions. Therefore, the flexibility of the supply chain shows the abilities of the organization that can be used to minimize the lead-time of the organization, enhancing the capacity of production and providing a different variety of products to the customers according to their expectations. Thus, a natural synergy is present among these abilities. All these synergies are very critical to enable SCA. Moreover, the flexibility of the organization has a positive effect on the performance of the organization (Shukor, Newaz, Rahman, & Taha, 2020).

Moreover, it is also one of the critical elements of supply chain flexibility. Thus, it positively affects the performance of the organization as scholars have defined organizational flexibility as the organizational ability to adapt to fast, uncertain, and substantial occurring changes in the environment that can impact the performance of the organization (Saeed, Jiao, Zahid, Tabassum, & Nauman, 2020). Therefore, it is believed that organizational flexibility is believed to improve the organization's performance (Acharya, 2019).

Accordingly, we propose the following hypotheses:

H₃. *OF has a positive impact on SCA.*

H₄. *OF has a positive impact on OP.*

3.3 SCA and OP

The studies conducted by Swafford et al. (2008) examined and revealed the positive and direct effect of supply chain agility on the performance of the organization. More specifically, the pace at which an organization functions its supply chain to adapt to the changes of its market and improve its performance to be more competitive measures the agility of the supply chain. Studies also mentioned that sales per employee, profit margin, market share, and return on assets are also improved because of the supply chain agility of the organization. In the same way, scholars reported that the organizations categorized as agile have a high level of performance compared to those that are not or less agile (Khan & Wisner, 2019). Such firms are called lean firms that are less agile. Such firms focus on the efficiency of the organization rather than the required changes within the firm (Alkrait & Almaktoom, 2021).

The agile organizations are primarily measured through their competitiveness capabilities, including leadership, volume flexibility, product variety, dependability, speed, quality, and low cost in the products of new technology. Organizational performance can be measured through performance, customer loyalty, sales from the new products, profits, and sales compared to the competitors. Thus, it is expected that the performance of the organization will be improved because of supply chain agility (DeGroot & Marx, 2013). A study was conducted by Yusuf et al. (2014) to assess the effect of supply chain agility on the performance of business including customer loyalty, market share, and net profit. The researcher reported a positive relationship among these variables. On the other hand, scholars also reported that the performance of the organization would be higher in case of the higher level of supply chain agility Swafford et al. (2008).

H₅. *SCA has a positive impact on OP.*

3.4 Supply chain agility as the mediator

Past studies examined the mediating effect of agility among the relationship of supply chain IT and performance of the organization Vickery, Droge, Setia, and Sambamurthy (2010) and found the role to be significant. On the other hand, Swafford et al. (2008) also posited the mediating role of agility among integration of IT and performance of the competitive business. It shows that researchers revealed that agility of the supply chain enables the competencies of the supply chain to adapt to changes in the environment and to improve their performance (Martinez-Sanchez & Lahoz-Leo, 2018). Scholars argued that organizations could create synchronization among transportation, reducing the cost of transportation and synchronization among demand and supply (Eckstein, Goellner, Blome, & Henke, 2015).

Additionally, by this way, organizations will be able to customize the products through the efficiency of the product by avoiding markdown of the product, which is caused by a large amount of inventory (S. F. Wamba, Dubey, Gunasekaran, & Akter, 2020).

3.5 Mediation hypotheses

H₆. *SCA is a mediator between BDA and OP.*

H₇. *SCA is a mediator between OF and OP.*

3.5 Institutional Theory (Underpinning theory)

The proposed model of the study is underpinned by Institutional theory that was propounded by (Meyer & Rowan, 1977). According to institutional theory, the environment of the organization can play an important role in developing the structure of the organization. As a result, the efficiency of the firm is improved. In the present study, big data analytics and organizational flexibility helps the organization to gain supply chain agility, which in turn affects the performance of the organization (Chu et al., 2018)

4. Methodology

This research adopted a quantitative research approach to answer the research questions of the present study. Moreover, a cross-sectional design was adopted in the study as the data was gathered in an uncertain period. The present study's data was collected from the employees working in the hospitality sector of the UAE. The data was gathered in the form of a survey questionnaire that was developed on the Likert 7 scale. On this scale, one represents strongly disagreeing, whereas seven

shows a strongly agreed opinion of the researcher. The questionnaire was developed from the items adapted in the past studies. The items of Organizational flexibility were adapted from (Dubey et al., 2019), supply chain agility was adopted from Swafford et al. (2008), Firm performance was adopted from (DeGroote & Marx, 2013) and Big Data Analytics Use was adopted (Cheng & Lu, 2018). The adapted questionnaire was distributed among 516 respondents (employees of the retail sector), for which 302 were the usable responses returned. Thus, the usable response rate was 54.90%. The gathered data was examined through SPSS 25 and PLS 3. This study used SPSS for the screening of the data, whereas the PLS was used for the measurement model and testing of the proposed hypothesis.



Fig. 1. Theoretical framework

5. Research Findings

This study used Smart PLS 3 for the analysis because it is very user-friendly and easy to use. Moreover, it provides deep insight into the data very quickly. Moreover, it is the most reliable tool when the model is complex. The proposed research model of this study is complex involving mediation. Therefore, this tool is more appropriate for this study.

The analysis through PLS is based on two steps. The first step is the measurement model, whereas the other is the structural model. Under the measurement model, the discriminant, validity, and convergent validity of the data were evaluated. Moreover, it also examined the values of Cronbach Alpha and composite reliability through reliability and validity. In this context, Hair, Ringle, and Sarstedt (2011) proposed that the values of CR must be more than 0.70.

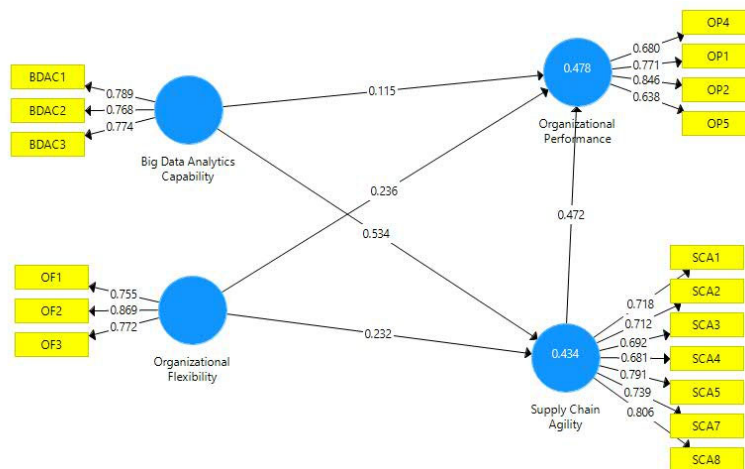


Fig. 2. Measurement Model

Table 1

Factor Loading

	BDAC	OF	OP	SCA
BDAC1	0.789			
BDAC2	0.768			
BDAC3	0.774			
OF1		0.755		
OF2		0.869		
OF3		0.772		
OP1			0.771	
OP2			0.846	
OP4			0.680	
OP5			0.638	
SCA1				0.718
SCA2				0.712
SCA3				0.692
SCA4				0.681
SCA5				0.791
SCA7				0.739
SCA8				0.806

Therefore, it is important to examine the values of factor loading to be evaluated in the beginning. Chin (1998) proposed that the threshold value of factor loading is 0.60. It is evident from the values of Table 1 that this benchmark is achieved.

Table 2
Reliability

	CR	AVE
BDAC	0.820	0.604
OF	0.842	0.640
OP	0.825	0.545
SCA	0.892	0.541

The next phase is to examine the values of AVE and composite reliability as part of convergent validity. Chin (1998) proposed that the values of AVE must be more than 0.50, as used in the past study of Jabeen and Ali (2022). At the same time, the minimum value of CR must be more than 0.70. It is evident from the above table that CR and AVE both have values more than the benchmark proposed. This convergent validity of the data is confirmed.

After that, the current study examined the discriminant validity of the data collected. Discriminant validity is assessed to establish the distinctiveness of the constructs of the study. For this purpose, two techniques were adopted to establish discriminant validity. First, Fornell and Larcker (1981) technique was adopted for which the square root of AVE of the values at diagonal of the matrix must be more than the discriminant validity of the remaining values. It is evident from the values of Table 3 that this criterion is fulfilled, as the values at the diagonal are more than the remaining values.

Table 3
Fornell and Larcker (1981)

	BDAC	OF	OP	SCA
BDAC	0.777			
OF	0.385	0.800		
OP	0.500	0.487	0.738	
SCA	0.623	0.438	0.647	0.735

Later, discriminant validity was examined through the Hetero Trait-Mono-Trait (HTMT), also known as HTMT criteria; under this criteria, the values must be less than 0.85 as per the strict rule (Perumal, Ali, & Shaarih, 2021). It is evident from the values in Table 4 that the values are less than 0.85. Thus discriminant validity is confirmed through HTMT and Fornell and Larcker (1981) criteria

Table 4
HTMT

	BDAC	OF	OP	SCA
BDAC				
OF	0.546			
OP	0.707	0.660		
SCA	0.809	0.547	0.810	

Then this study examined the proposed hypothesis and values of R square through the structural model. This study assessed the structural model through bootstrapping procedure for which 5000 sub-samples were taken.

Table 5
Direct hypothesis

HYP		Original Sample (O)	Standard Deviation (STDEV)	T Statistics	P Values
H1	BDAC → OP	0.115	0.061	1.880	0.030
H2	BDAC → SCA	0.534	0.055	9.701	0.000
H3	OF → OP	0.236	0.059	4.009	0.000
H4	OF → SCA	0.232	0.060	3.843	0.000
H5	SCA → OP	0.472	0.057	8.282	0.000

The values of Table 5 demonstrate the statistical results of the direct hypothesis. According to the values, there exists a significant positive relationship between BDAC and OP (Beta=0.115, t=1.880). Moreover, there is a significant effect of BDAC on SCA (Beta=0.534, t= 9.701). Later, the values of table 5 revealed that OF and OP are significantly positively related to each other (Beta=0.236, t=4.009). Moreover, OF is affecting SCA significantly with (Beta=0.232, t=3.843). In the end, SCA and OP also have a significant positive relationship (Beta=0.472, t=8.282). Thus, H1, H2, h3, H4, and H5 proposed in the study are statistically supported.

Table 6
Mediation hypothesis

HYP	Relationship	Beta	SD	T value	P Values
H6	BDAC → SCA → OP	0.252	0.044	5.722	0.000
H7	OF → SCA → OP	0.110	0.029	3.722	0.000

Later, the values of the indirect hypothesis were evaluated. Table 6 shows the statistical results of the indirect proposed hypothesis. According to these values, SCA mediates significantly among BDA and OP (Beta=0.252, $t=5.722$). Moreover, the mediating role of SCA between OF and OP is confirmed with Beta=0.110 and $t=3.722$. Thus, H6 and H7 of the present study are also confirmed.

Table 7
R Square

	R Square
OP	0.478
SCA	0.434

In the end, the present study examined the values of R square. Table 7 shows that OP is affected 47.8%, and SCA is affected 43.4% by the independent variables of the study.

6. Discussion

The organization needs to measure its performance on a regular basis. The performance of the organization can also be improved by regularly monitoring the performance. This way, organizations can develop their competitive advantage in the current business market. Therefore, this study examined the effect of big data analytics, organizational flexibility, supply chain agility, and organizational flexibility. The mediating role of supply chain agility was examined as well. The study's findings proposed that organizational flexibility plays a significant role in developing supply chain agility in the organization. The organization must be flexible and adapt strategies to the external environment. These findings align with the past studies conducted by (Lloréns, Molina, & Verdú, 2005). The findings of the study also revealed that organizational performance would be directly affected as well if the strategies of the organization were flexible. These findings are in-line with (Saeed et al., 2020). On the other hand, big data analytics also improves the performance of the organization as the organizational decision-makers can easily decide based on information they have regarding internal as well as external stakeholders. These results are in line with the findings of Gunasekaran et al. (2017). Additionally, big data analytics also have an essential role to play to improve the agility of the supply chain. It is because the managers can easily assess the performance of the suppliers and take the necessary decisions in time. These findings are in line with (Dubey et al., 2018). In the end, the organization needs to have an agile supply chain to improve its performance. This result is consistent with the findings of Yusuf et al. (2014).

7. Conclusion and Limitations

Firms need to gauge their performance regularly. If the performance is measured regularly, it will help improve the performance as well. In this essence, this study finds that big data analytics helps the organization to develop supply chain agility. The same is the case with organizational flexibility. If the organization is flexible, it will quickly adapt to micro and macro environment factors. In such a situation, the survival of the organization becomes very easy.

Additionally, an organization can quickly develop agility in the supply chain. Furthermore, the organization that has an agile supply chain has better performance as compared to other organizations. Additionally, organizations can develop a competitive advantage as well.

Like other research, this study has a few limitations as well. This research involves the respondents from UAE. In contrast, future studies can use the sample from non-Asian countries. This study was cross-sectional. Future studies that follow this model can use longitudinal design. Moreover, these IVs predict the DV of more than 47%. Thus, other variables should be tested in a similar model.

This paper has both theoretical and practical implications. This paper provides deep insight into the way institutional theory can play to examine organizational performance. In terms of practical implications of the study, these results can be the guidance for the managers of a supply chain in order to improve their organizational performance. Additionally, these findings bridge the gap of limited studies conducted that assessed the mediating role of supply chain agility. These results are helpful for policymakers and academicians in future studies.

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