International Journal of Economics, Finance and Management Sciences
2023; 11(1): 25-30
http://www.sciencepublishinggroup.com/j/ijefm
doi: 10.11648/j.ijefm.20231101.14
ISSN: 2326-9553 (Print); ISSN: 2326-9561 (Online)

Research on the Impact of Big Data Analysis Capability on Enterprise Supply Chain Resilience

Zhang Luyu

School of Business Administration, Guizhou University of Finance and Economics, Guiyang, China

Email address:
473764481@qq.com

To cite this article:
Zhang Luyu. Research on the Impact of Big Data Analysis Capability on Enterprise Supply Chain Resilience. *International Journal of Economics, Finance and Management Sciences*. Vol. 11, No. 1, 2023, pp. 25-30. doi: 10.11648/j.ijefm.20231101.14

Received: January 10, 2023; **Accepted**: January 30, 2023; **Published**: February 6, 2023

Abstract: Based on the current economic environment and from the perspective of dynamic capability, this paper divides big data analysis capability into big data perception capability, big data capture capability and big data transformation capability, and divides supply chain ambidexterity into supply chain agility and supply chain adaptability. A questionnaire survey was used to quantify the impact of big data analysis capability (BDAC) on supply chain elasticity (SC-RE). A total of 300 questionnaires were distributed to managers of supply chain nodes of enterprises, and 217 valid questionnaires were obtained. The regression results of questionnaire data showed that BDAC was positively correlated with SC-RE. Supply chain duality (SC-AM) is positively correlated with SC-RE. SC-AM plays a partial mediating role in the positive effect of BDAC on SC-RE. Based on the regression results of this paper and the research results of existing scholars, the corresponding conclusions are drawn, and some suggestions are put forward for enterprise managers. BDAC is an effective way to improve the performance level and competitive strength of supply chain enterprises. Enterprises should attach importance to the useful information contained in big data, take certain measures to enhance BDAC, improve the information processing capacity and speed of enterprises, reduce the probability of risk occurrence, so as to improve the supply chain resilience of enterprises and improve the level of supply chain risk management.

Keywords: Big Data Analysis Capability (BDAC), Supply Chain Resilience (SC-RE), Supply Chain Ambidexterity (SC-AM), Dynamic Capability

1. Introduction

Every year, a lot of firms face supply chain disruptions-events that interrupt the flow of products, resources, or services, restricting an organization's capacity to provide services to its customers and employees.

At the same time, in the era of COVID-19, enterprises are faced with many uncertainties. In order to actively respond to the national epidemic prevention and control policies, enterprises and employees should follow instructions at any time, including home quarantine of employees and silent management in cities. During this period, especially in the manufacturing industry, a large number of enterprises went out of business due to supply chain disruption. A series of reasons such as raw materials not coming in, products not going out, overstock of goods and so on make it difficult for enterprises to continue to maintain, and eventually lead to bankruptcy. These uncertain matters greatly affect the normal operation of enterprise supply chain. Therefore, enterprise supply chain management becomes more and more important, and improving the elasticity of enterprise supply chain becomes more and more urgent.

Disruptions in the supply chain are common. Production line failures, demand variations, sustainability concerns, and product quality issues are examples of internal risks. External risks include strikes, changes in the regulatory environment, weather conditions, financial instability, terrorism, and counterfeiting among other things. It also serves as a reminder that harm may be caused by humans and thus be somewhat controlled, or it can be caused by natural events, making it impossible to anticipate with accuracy. It is believed that certain firms are better equipped to lessen the severity and length of supply chain disruptions than their rivals; others believe that this is due to their greater adaptability. It is also the cornerstone of modern supply chain management thought and research, since SC-RE has the

potential to become a valuable strategic weapon in the present competitive context. Foreign academics have been paying close attention to the notion of supply chain in recent years. Therefore, SC-RE has become an important topic of academic attention.

Corporations today must contend with a market that is becoming more turbulent and unpredictable. Because of the very unpredictable environment in which they operate, many businesses are investing extensively in the use of information technology to enhance their intra-organizational and inter-organizational processes in order to preserve their competitive advantage. Examples include the use of big data analysis in everyday operations, which has yielded excellent results, particularly in huge corporations across the globe.

Little emphasis, on the other hand, has been dedicated to how BDAC might help to decrease the likelihood of supply chain interruptions. It is imperative for enterprises to improve SC-RE so as to effectively cope with and recover from supply chain disruptions and gain competitive advantages in a dynamic and changing business environment. In this paper, OIPT, the Resource-based View and the Dynamic Capability View are used to study how organizations influence SC-RE through BDAC.

2. Hypotheses Development

2.1. BDAC and SC-RE

As an information asset, big data needs specific technologies and analytical methods to transform it into value. As an emerging information technology architecture, it is still an information technology in nature. Therefore, big data technology can be regarded as the upgrade of traditional IT, and the process of enterprise big data application practice to obtain commercial value cannot be separated from the existing IT foundation. IT is necessary to expand the research from big data to the level of BDAC by referring to the research on IT capability. Dubey believes that BDAC of enterprises are reflected in data acquisition, processing, integration and transmission, analysis capabilities and personnel [9]. In the current context, the probability of supply chain interruption events is also greatly increasing, and SC-RE has gradually become a hot field to solve this problem. Supply chain enterprises are experiencing increasing disruptions due to the continuous occurrence of outages and the challenges of maintaining business operations. Some capabilities have been identified to help enterprises proactively overcome these difficulties. This capability is often considered as dynamic capability, which can help enterprises respond to dynamic environment to meet customer needs [10]. Most scholars have pointed out that SC-RE plays a crucial role when enterprises are faced with interruption events or external risks [12].

The supply chain is an organizational structure that is focused on customer demands, strives to enhance quality and efficiency, and employs resource integration as a way of effectively coordinating the whole process of product design, procurement, manufacturing, sales, and service. Supplier resilience refers to an organization's capacity to recover after being subjected to a crisis [13]. When it comes to risk management, it covers the prevention of identified hazards, meeting business goals in the case of a shutdown, and maintaining the needed level of performance after a shutdown has taken place. SC-RE helps quickly adapt to impulsive events by minimizing instability. At the heart of this ability is an organizational mechanism that continually anticipates and adjusts for changes that are constantly occurring that can undermine the profitability potential of an organization's business.

Braunscheidel defined supply chain visibility as an organizational competency that can be developed [1]. In addition, according to Zhu, supply chain visibility is an optimal skill for minimizing the negative effect of supply chain interruptions [14]. The findings of Zheng, who found that visibility and analytical talents are complimentary and mutually helpful, are in agreement [15]. Insufficient empirical evidence has been found in the literature to suggest that strengthening supply network visibility skills may lower the likelihood and effect of supply chain disruptions while simultaneously increasing SC-RE. Risk management techniques in the supply chain need awareness of vulnerabilities across the supply chain. It is also necessary for managers to use data technology to assist them in identifying potential dangers or causes of outages, so that they may establish business continuity plans, which may aid in speeding up recovery time in the case of an outage. Therefore, the following hypotheses are proposed in this paper:

H1a: BDAC- sensing has a positive impact on SC-RE.

H1b: BDAC-seizing has a positive impact on SC-RE.

H1c: BDAC-reconfiguration has a positive impact on SC-RE.

2.2. BDAC and SC-AM

Multiple seemingly disparate goals (exploration and development) must be pursued simultaneously. Studies have shown that ambidexterity in organizations leads to higher levels of vitality, organizational performance and competitive advantage. Although there is a large amount of research on organizational ambidexterity, relatively few studies have been conducted from a supply chain perspective [2].

There is a vast body of literature in organizational research that implies that companies often face trade-offs, and that the activities that are most advantageous to short-term success may not be beneficial to long-term success in the long run. The relevance of long-term vs short-term worries or long-term versus short-term orientation is highlighted when considering the topic of "intertemporal choice" in this manner. Although the literature on organizational flexibility implies that seemingly competing aims may be resolved, there is some evidence to show that this is not always true [3]. The need for ambidexterity stems from the fact that an enterprise needs to adapt to a dynamic market to succeed in the long term, while leveraging its existing business model to succeed in the short term.

Competing in today's highly competitive, complicated, dynamic, and unpredictable business climate requires quick

and timely reactions to market developments and client requirements. By adopting supply chain agility, an enterprise can reduce instability and improve its responsiveness in a dynamic environment [7]. Moreover, the use of BDAC can further improve supply chain visibility, supply chain performance, and organizational performance, allowing organizations to be more flexible and adaptable, creating strategic value, and improving operational efficiency and planning.

SC-adaptability and SC-agility are two categories of SC-AM that may be found in a supply chain. SC- adaptability is described as a company's capacity to make adjustments to the design of its supply network when an opportunity presents itself. SC-agility is a notion that encourages improvements that are more drastic and long-term than those that are pursued in the real world [4]. Provider and logistical infrastructure development are ongoing processes, and the capacity to establish redundancy in your supply chain is a key component of supply chain flexibility. This enables the supply chain to overcome disturbances caused by the supply side. It also entails the construction of management systems that are capable of evolving quickly in order to attain efficacy in risk mitigation techniques [5]. As a result, we might say that BDAC skills can assist managers in recognizing fast changes in their environment, allowing them to establish business continuity plans and responding rapidly to changes. Therefore, the following assumptions are made:

H2a: BDAC- sensing has a positive impact on SC-AM.

H2b: BDAC-seizing has a positive impact on SC-AM.

H2c: BDAC-reconfiguration has a positive impact on SC-AM.

2.3. BDAC, SC-AM and SC-RE

As can be seen from the above analysis, all three dimensions of BDAC can have an impact on the ambidexterity of supply chain, which enables the organization to quickly identify the problems that have occurred or may occur in the supply chain in the short term, avoid the risk of supply chain interruption in the short term and improve the resilience of supply chain [6]. In the long run, BDAC can help enterprises continuously identify potential risks and make corresponding countermeasures as soon as possible, so that the supply chain is in a dynamic and efficient state [8]. Therefore, the following assumptions are made:

H3a: SC-AM partly mediates the relationship between BDAC-sensing and SC-RE.

H3b: SC-AM partly mediates the relationship between BDAC-seizing and SC-RE.

H3c: SC-AM partly mediates the relationship between BDAC-reconfiguration and SC-RE.

3. Research Method

This paper mainly uses the questionnaire survey method, the survey object is all over the country enterprise managers. The scale of BDAC refers to the research results of Zheng, Dubey; SC-AM draws on the research results of Wamba; Referring to the research results of Song, Pettit, SC-RE adopts 5-point Likert scales, in which 1-5 represent respectively strongly disagree, somewhat disagree, unsureness, somewhat agree, strongly agree [8-11, 15]. Collect the contact information of enterprises through various channels, explain the research purpose of this paper to enterprises by sending emails and making phone calls, and guide them to complete the online questionnaire. SPSS22.0 was used to process and analyze the questionnaire data.

4. Data Analysis

4.1. Descriptive Statistics

This paper issued questionnaires to enterprise managers from all over the country for data collection, involving manufacturing, high-tech, information transmission, computer services and other industries. 300 questionnaires were distributed online through the online questionnaire platform, and a total of 300 questionnaires were collected. After cleaning and screening, 217 valid questionnaires were finally obtained, and the recovery efficiency of sample data was up to 72.3%. The basic information of the samples is shown in Table 1 below:

Table 1. *Descriptive statistical analysis of samples.*

Control variable	Category	Ratio
Gender	Male	39.63%
	Female	60.37%
Age	<30 years old	20.74%
	31-40	31.80%
	41-50	31.34%
	>51 years old	16.13%
Number of employees	<100 people	24.42%
	101-500	30.41%
	501-1000	28.11%
	>1001 people	17.05%
Establishment Year	<1 year	17.97%
	1-5	33.18%
	6-10	25.81%
	>11 years	23.05%
Nature of the company	State-owned or state-holding enterprises	31.80%
	Sino-foreign joint venture	34.10%
	Wholly foreign-owned enterprise	24.42%
	The private enterprise	9.68%

According to the results in Table 1, in terms of gender, males account for 40%, while females account for 60%. In terms of the time of establishment of the enterprises that participated in the survey, 23% of them have been established for more than 11 years, 26% for between 6 and 10 years, 33% for between 1 and 5 years and 18% for less than 1 year. In terms of the number of employees, 30 percent are 101-500, 28 percent are 501-1,000, 17 percent are more than 1,001, and 24 percent are less than 100. The annual revenue of enterprises under 5 million accounted for 59%, more than 5 million accounted for 41%. The samples include companies in various industries, so this study has certain significance for each industry, and the conclusions obtained from the study have certain enlightenment for enterprises in various industries.

4.2. The Reliability Test

This questionnaire was subjected to a reliability test, which yielded the findings shown in the following Table 2. Using Cronbach's Alpha coefficients, it was determined that the scale has excellent reliability and can meet the demands of future research. Cronbach's α coefficient of all variables was greater than 0.8, indicating good internal consistency of the questionnaire. The findings of this study may be utilized to develop a new scale that will be more reliable and can meet the needs of further research.

Table 2. *The reliability test.*

Variable	Cronbach's Alpha	Item
Big data sensing capability	0.854	3
Big data seizing capability	0.822	3
Big data reconfiguration capability	0.898	4
SC-AM	0.925	10
SC-RE	0.808	4
The whole scale	0.955	24

4.3. Validity of the Test

Validity test was conducted on the completed questionnaires, and the test results are shown in Table 3 below. Following the findings of the exploratory factor analysis shown below, the coefficient of the KMO test was found to be 0.959, indicating that the questionnaire had excellent validity. It is also shown by this test's significance that the test is endlessly near to zero, indicating that the questionnaire has strong validity and reliability.

Table 3. *KMO and Bartlett's test.*

Kaiser-Meyer-Olkin Mesure of Sampling Adequacy		0.959
Bartlett's test of sphericity	Approx. Chi-square	3634.959
	df	276.000
	Sig.	0.000

4.4. Regression Results

The questionnaire data has passed the reliability and validity test. For follow-up research, BDAC has three dimensions: big data sensing ability, big data seizing ability and big data reconfiguration ability. Calculate the arithmetic mean of the score of the three dimensions, and get the data of this dimension. SC-AM is divided into two dimensions, agility and adaptability. Firstly, the scores of the two dimensions are calculated as arithmetic average respectively, and then the values of these two dimensions are calculated as geometric average to obtain the data of SC-AM. SC-RE has four questions, and the arithmetic average score of the four questions is taken as the data of SC-RE.

4.4.1. The Impact of BDAC on SC-RE

BDAC-sensing, BDAC-seizing and BDAC-reconfiguration are taken as the predictive variables, and SC-RE is taken as the result variable for regression respectively. The relevant data after the regression results are sorted out are shown in Table 4 below. According to the data in the table, the model 1's β=0.418, sig<0.01, R2=0.232, indicating that big data sensing ability has a positive impact on SC-RE, with a coefficient of 0.418 and a high degree of significance. The model 2's β=0.48, sig<0.05, R2=0.23, indicating that big data seizing capability has a positive impact on SC-RE, with a coefficient of 0.48 and a high degree of significance. The model 3's β =0.486, Sig<0.05, R2=0.236, indicating that big data reconfiguration ability has a positive impact on SC-RE, with a coefficient of 0.418 and a high degree of significance. In conclusion, hypothesis 1 is verified.

Table 4. *The impact of BDAC on SC-RE.*

Predictor variable	Model 1 BDAC-SENS	Model 2 BDAC-SEIZ	Model 3 BDAC-RECO
R^2	0.232	0.230	0.236
β	0.481	0.480	0.486
t	8.052	8.014	8.154
Sig.	0.000	0.000	0.000

4.4.2. The Impact of BDAC on SC-AM

BDAC-sensing, BDAC-seizing and BDAC-reconfiguration are taken as the predictive variables, and SC-AM is taken as the result variables for regression respectively. The relevant data after the regression results are sorted out are shown in Table 5 below. According to the data in the table, in the model 4 β=0.722, Sig<0.05, R2=0.522, indicating that has a positive impact on SC-AM, with a coefficient of 0.722 and a high degree of significance. In model 5, β=0.693, Sig<0.05, R2=0.48, indicating that big data seizing capability has a positive impact on SC-AM, with a coefficient of 0.693 and a high degree of significance. In the model 6, β=0.706, Sig<0.05, R2=0.498, indicating that big data reconfiguration ability has a positive impact on SC-AM, with a coefficient of 0.48 and a high degree of significance. In conclusion, hypothesis 2 is verified.

Table 5. *The impact of BDAC on SC-AM.*

Predictor variable	Model 4 BDAC-SENS	Model 5 BDAC-SEIZ	Model 6 BDAC-RECO
R^2	0.522	0.480	0.498
β	0.722	0.693	0.706
t	15.321	14.077	14.604
Sig.	0.000	0.000	0.000

4.4.3. Mediating Effect of SC-AM

Regression is conducted with SC-AM serving as a predictive variable, and SC-RE serving as an outcome variable. Table 6 shows the findings of the regression analysis. According to the data in the table, in the model 7, β=0.407, Sig<0.05, R2=0.166, indicating that SC-AM has a positive impact on SC-RE, with a coefficient of 0.407 and a high degree of significance. As a consequence of the aforementioned study, the impact of BDAC on SC-RE highly passed the significance test, and the effect of SC-AM on SC-RE also passed the significance test, as shown in the chart below. SC-AM therefore serves as a partial intermediary between big data analytic capabilities and SC-RE. Therefore, hypothesis 3 is verified.

Table 6. *Mediating effect of SC-AM.*

Model 7	R^2	β	t	Sig.
SC-AM	0.166	0.407	6.537	0.000

5. Conclusion

Hypotheses 1, 2, and 3 are all confirmed based on the aforementioned regression findings. It seems that the capacity to do big data analysis has a favorable impact on the flexibility and dexterity of the supply chain. The dexterity of the supply chain has a favorable impact on the flexibility of the supply chain as well. The component of supply chain dexterity has a mediating influence on the link between big data analytic competence and supply chain flexibility, according to the research.

BDAC is subdivided into multiple dimensions for multi-path research and testing, and the corresponding conclusions are drawn. For enterprises, big data analysis ability can sense, capture and transform valuable information contained in massive data in a timely manner, transmit supply chain risk disturbance to enterprises in a timely manner, and then take relevant measures in advance to reduce the probability and loss of supply chain interruption, constantly improve the elasticity of supply chain, maintain and even enhance the competitive advantage of enterprises. The current economic environment is full of uncertainties and challenges, and enterprises are at risk of supply chain disruption at any time. Therefore, enterprises need to improve their BDAC in their daily operations to improve the agility, adaptability and resilience of their supply chains. In daily management, enterprises can start from the following two aspects.

On the one hand, managers should value the intrinsic value of big data. Through training, introduction of advanced talents, purchase of advanced technology and other methods to improve the enterprise's big data analysis ability, form a unique and advantageous ability of the enterprise, so as to easily cope with the daily mass of data facing the enterprise, on the express train of the era of big data. Moreover, existing studies have also proved that big data analysis ability has a positive and beneficial impact on enterprise innovation ability and enterprise performance, so enterprise managers should attach importance to the formation and promotion of big data analysis ability in daily work and strategy formulation. In the strategic phase of supply chain planning, big data analysis ability also plays a crucial role. It has been used to help companies make strategic decisions in sourcing, supply chain network design, and product design and development. During the operational planning phase, big data analytics capabilities have been used to assist management in making supply chain operational decisions, typically including demand planning, purchasing, production, inventory and logistics.

On the other hand, managers should pay attention to the development and cultivation of the core capabilities of their own enterprises. BDAC can be considered as one of the core capabilities. Enterprises have the capacity to recognize dangers and grasp opportunities, and then swiftly reorganize their resource base in order to develop and obtain economic value from these possibilities, which is a kind of dynamic capabilities. If a company has the resources or ability, but the lack of dynamic capabilities, it has the opportunity to gain competitive returns in the short term, but was unable to maintain higher returns for a long time. However, although business leaders have started to recognize the significance and potential benefit of SC-RE, many organizations have yet to establish a development framework that will be effective in the future. According to the dynamic capability viewpoint, this research considers big data analytical capacity and SC-RE to be dynamic capabilities, both of which are very important to supply chain managers, particularly in manufacturing firms. A dynamic strategy may help the core firms in the area of supply chain maintain their long-term viability and boost their own benefits in light of the volatile aspects in the external environment. Such a strategy helps enterprises to recover to the original state in the shortest time and the lowest cost when they are affected by external shocks.

6. Research Limitations and Future Directions

The research in this paper has the following limitations: First, not the dual nature of supply chain agility and adaptability to study separately, this leads the conclusion did not specify the agility of supply chain and supply chain flexibility on the impact of supply chain flexibility, respectively is what kind of, also can't explain the BDAC of perception, capture ability, the ability to reconfigure the impact on the agility and adaptability of size.

Second, the sample size is not large enough. If questionnaires could be distributed to more senior managers, the results would be more convincing and universal.

References

[1] Braunscheidel, M. J., and N. C. Suresh. (2009) The Organizational Antecedents of a Firm's Supply Chain Agility for Risk Mitigation and Response.[J] Journal of Operations Management. 27 (2): 119–140. DOI: 10.1016/j.jom.2008.09.006.

[2] Feng Changli, Zhang Mingyue. (2015) Supply Chain knowledge sharing and firm performance: The Mediating role of Supply chain agility and the moderating role of environmental dynamics [J]. Management review, 27 (11): 181-191. DOI: 10.14120/j.issn.11-5057/f2015.11.018.

[3] Gu Minhao, Huo Baofeng. (2020) Supply Chain resilience: Theory and influence mechanism [J]. Supply Chain Management, 1 (03): 46-56. DOI: CNKI:SUN:GYLG.0.2020-03-006.

[4] Hu Haiwen. (2020) An empirical study on the impact of market perception, coordination and innovation on high adaptability of supply chain [J]. Chinese journal of management, 17 (01): 131-138. DOI: 10.3969/j.issn.1672-884x.2020.01.015.

[5] Liu Weihua. (2020) Global Supply chain restructuring and China's manufacturing response under the pandemic [J]. People's Forum, 18: 61-65. DOI:10.3969/j.issn.1004-3381.2020.18.019.

[6] Liu Jinni. (2022) Supply chain disruptions: causes, consequences and countermeasures - supply chain management under the perspective of the literature review [J]. Zhongnan university of economics journals, 4: 130-144. DOI: 10.19639/j.issn.1003-5230.2022.0040.

[7] Liu Jiaguo. (2015) Research on Supply chain resilience System based on Interpretive Structure Model [J]. Journal of Systems Management, 24 (04): 617-623. DOI: 10.3969/j.issn.1003-5230.2019.03.015.

[8] Pettit, Timothy Croxton, Keely Fiksel, Joseph. (2013) Ensuring Supply Chain Resilience: Development and Implementation of an Assessment Tool. [J] Journal of Business Logistics. 34. DOI: 10.1111/jbl.12009.

[9] Rameshwar Dubey, Angappa Gunasekaran. (2019) Empirical investigation of data analytics capability and organizational flexibility as complements to supply chain resilience. [J] International Journal of Production Research, 59:1, 110-128. DOI: 10.1080/00207543.2019.1582820.

[10] Samuel Fosso Wamba. (2019) The performance effects of big data analytics and supply chain ambidexterity: The moderating effect of environmental dynamism [J]. International Journal of Production Economics, 222, 0925-0976. DOI: 10.1016/j.ijpe.2019.09.01.

[11] Song Hua. (2020) COVID - 19 outbreak revelation for the resilience of supply chain management [J]. China's circulation economy, 3: 11-16. DOI: 10.14089/j.issn.11-3664/f2020.03.002.

[12] Sun Xin-bo, Qian Yu, Zhang Ming-chao, Li Jin-zhu (2019). Big data the mechanism of realizing the enterprise supply chain agility research [J]. Management world, 35 (9): 133-151 + 200. DOI: 10.19744/j.issn.11-1235/f2019.0123.

[13] Xu De 'an, CAO Zhiqiang (2022). The impact of big data analysis capability and supply chain collaboration on retail enterprise performance [J]. Business Economics Research, 01: 38-41. DOI: 10.3969/j.issn.1002-5863.2022.01.009.

[14] Zhu Xinqiu. (2021) How big data analytics affect supply chain performance: An analysis based on supply chain resilience perspective [J]. China's circulation economy, 35 (6): 84-93. The DOI: 10.14089/j.issn.11-3664/f2021.06.008.

[15] Zheng Liyuan, Zhou Haiwei. (2019) Enterprise Big data capability: Research review and future prospect [J]. Science and Technology Progress and Countermeasures, 36 (15): 153-160. DOI: 10.6049/kjjbydc.2018120120.