How And When Do Big Data Analytics Pay Off? The Role Of Value Creation And Market Turbulence

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Abstract

Based on the dynamic view, our paper seeks to explore the impact of big data analytics usage (BDA) on the value creation in the supply chain management field. It also explores the moderating role of market turbulence on the relationships between the study factors. We gathered data from supply chain managers in the Egyptian context. We managed to gather data from 489 participants and the data were analyzed through structural equation modelling to test our proposed hypotheses. The analysis revealed that BDA has a significant and positive effect on asset productivity and business growth. Our study also indicated that the links among BDA, asset productivity, and business growth were moderated by market turbulence. Our examination offers meaningful insights for manager to understand the significant impact of BDA on value creation in the supply chain management context.

Keywords:

"Big data analytics, Asset productivity, Business growth, Market turbulence, and Dynamic capabilities theory".

1. Introduction

Firms are showing a growing interest in utilizing big data analytics, with a rising number of both private and public firms developing and implementing strategies to leverage this resource. Big Data Analytics (BDA) is defined as an information asset with a large "volume, velocity, and variety" that necessitates specialized technology and analytical methodologies to convert data into value (Lutfi et al., 2023). The Resource Based View (RBV) provides firms with a framework for investing in BDA as an asset to generate value. BDA solutions can vary greatly and have varying impacts on value (Cirillo et al., 2023). The production domain stands out for its diversity and leading role in utilizing BDA (Bag et al., 2023). Manufacturing is a significant user of BDA, storing more data than any other sector. This data is used for various purposes such as discovering new patterns, conducting simulations, implementing industry 4.0, managing complex systems in real-time, improving production yields, and optimizing supply chains (Shin et al., 2023; Yasmin et al., 2020).

Several research with varying outcomes have been conducted over the past decades on the business usefulness of BDA (Ghasemaghaei and Calic., 2020). While many studies show a direct correlation between BDA and firm performance, some research provides a more detailed view on the circumstances in which BDA can add value to companies. In an attempt to explain the conflicting outcomes of past studies, IS experts have highlighted to the crucial significance of contextual elements, such as a firm's structural readiness, and psychological readiness characteristics, which are needed to create value from BDA (Hallikainen 2020). The benefits of BDA for firms rely on the alignment of various aspects, including BDA tools, data, people, and tasks. Some Information Systems academics have proposed that many factors, including the challenge of measuring the indirect advantages of BDA, methodological limitations, and insufficient attention to environmental influences and delays, are the primary causes for the inconsistent outcomes.

Although there is ample studies on IT adoption among individuals, there is a scarcity of studies on technology adoption behaviour within organisations, despite the crucial importance of understanding this issue (Mikalef et al., 2020). Existing research on organisational IT adoption focuses more on adoption objectives than on postadoption behaviours like usage and value creation (Maroufkhani et al., 2020). Managers and academics need to understand the potential impact on company performance resulting from BDA skills in order to identify the factors influencing BDA adoption

(Hamilton and Sodeman, 2020). An rising number of stories in the mainstream media discuss the use of BDA in specialised fields, particularly in marketing and customer relationship management (Wu et al., 2020). However, a thorough analysis of BDA and its associated capabilities has not been presented. The gaps in the literature limit our current understanding of how organisations use Big Data Analytics at the organisational level and the related processes of value generation (Dubey et al., 2020). Our initiative intends to address the research problems in order to fill the existing gaps. How does the use of BDA by firms affect productivity and business growth? What is the impact of market turbulence on the link between BDA and business value creation? We explore the application of BDA) in supply chain management (SCM) to investigate these research questions. This subject is essential as firms increasingly depend on organizational learning and knowledge growth to achieve success in supply chain management (SCM) (Hult et al., 2006). Information Technology (IT) and BDA are essential for fulfilling the necessary information exchange and educational requirements in the modern interconnected economy.

Yet previous research on the value of investments in information systems (IS) has shown inconsistent outcomes, leading to the "IT productivity paradox". Few studies have debated whether investments in IT always result in improved operational efficiency and effectiveness. Some studies suggest a positive link between IT investments and business value (i.e., Lutfi et al., 2023; Wamba et al., 2017), while others argue the opposite (i.e., Barua et al., 2004). Prior studies did not find a clear positive connection between IT investment and firm performance due to factors such as data availability, time lags among investments and business value, lack of assessment of indirect IT benefits, and the depth of analysis of IS-related benefits (Anand et al., 2013). Within this research field, suggest incorporating a comprehensive perspective of IT resources by including a multidimensional approach in the examination of the business value of IT or IT skills (Bhatt & Grover, 2005). Our study expands on previous studies by investigating the influence of Big Data Analytics (BDA) on the value of companies in emerging nations like Egypt. The project aims to particularly address the following research questions:

i. What is the effect of big data analytics on firm value?

ii. Does market turbulence moderate the link between BDA and firm value?

We base the conceptual model on the theory of dynamic capacities (Teece, 2014). We argue that when a firm implements BDA in various supply chain areas, it enhances the ability to process information dynamically. This, in turn, provides decision-makers with valuable knowledge to develop superior resource configurations and adjustments, leading to competitive advantages. This capacity is expected to be particularly beneficial in rapidly changing contexts with high degrees of unpredictability. Therefore, our paper seeks to achieve the following research objectives:

(1) To explore the significant impact of BDA on firm value creation in the Egyptian supply chain industry?

(2) To explore the moderating impact of market turbulence on the link between BDA and firm value creation?

The remaining of this exploration is categorized as follow: the second section concerns the theoretical foundations of our study factors. The third section explains the research conceptual framework and hypotheses development. The fourth section demonstrates the study methodology and data collection process. The fifth section shows the analysis and the research results. The six section explains the main findings and discussion. The last section demonstrates the limitations and future examinations directions.

2. Literature review

2.1. Big data analytics

Chen (2012) introduced the term BDA as a subset of business intelligence and analytics (BI &A), focusing on technology linked to data mining and statistical analysis. Authors describe BDA as a modern set of tools and structures created to efficiently derive value from extensive amounts of diverse data through enabling rapid capture, discovery, and analysis (Chen et al., 2015). BDA technologies allow companies to enhance current applications through business-focused processes and methodologies that deliver a competitive edge (Chen et al., 2015). Recent literature suggests that there is ample opportunity for additional research on BDA (Del Giudice et al., 2021). Several academic studies have been conducted on the adoption and utilization of BDA (e.g., Ciampi et al., 2021; Kamble and Gunasekaran, 2020).

Most academic studies on BDA concentrate on examining the commercial value from a data or system viewpoint. Only one conceptual work from a strategic management perspective examines the impact of BDA on various marketing activities (Martínez-Caro et al., 2020). The existing literature mostly focuses on the industry (Mikalef and Gupta, 2021; Pham and Tran, 2020; Varadarajan, 2020). Some researchers claim that research on the value of BDA is limited and should expand beyond post-adoption stages to focus on competitiveness, as firms struggle to understand how to extract commercial value. This study expands IT business value research by experimentally evaluating the BDA business value chain in Egyptian enterprises, focusing on the strategic management perspective.

2.2 "Dynamic capability perspective (DC)"

Over the last ten years, the DC perspective has emerged as a highly effective theoretical framework in the strategic management field, garnering attention from scholars in both business and IT management. Based on Resource-Based View (RBV) and Knowledge-Based View (KBV), Dynamic Capabilities (DC) theory suggests that enterprises may adjust their resources quickly to respond to changing circumstances, allowing them to maintain a competitive edge over time (Teece, 2014). DC, as defined by Teece et al. (1997), is the capacity to combine, develop, and adjust internal and external skills to adapt to quickly evolving circumstances. Digital capabilities break down into the ability to detect and influence opportunities and threats, exploit opportunities, and sustain competitiveness by improving, merging, safeguarding, and, if needed, restructuring the business's intangible and tangible assets. Some scholars contend that agility is a dynamic capability inside organizations (Cavusgil et al., 2007; Gremme and Wohlgemuth, 2017; Matarazzo et al., 2021).

There is a scarcity of empirical studies utilising this idea in the IT management arena. Researchers have determined that IT serves as a facilitator of Digital Competence (DC) within firms, based on a generic analysis (Ranjan and Foropon, 2021; Sheng et al., 2021). Only a few qualitative studies in business analytics have utilised DC theory to examine the utility of big data analytics, along with some conceptual articles. Firms who fail to acquire the resources and skills needed to utilize Big Data Analytics applications will find it challenging to establish a lasting competitive edge (Benzidia et al., 2021; Côrte-Real et al., 2020). This study addresses the academic gap by empirically connecting the two notions.

2.3. "BDA as a dynamic capability"

Previous examinations have introduced the concept of dynamic capabilities to explain how companies adapt to fast and unpredictable changes by combining, developing, and adjusting their internal and external skills (Mikalef et al., 2020). Dynamic capacities refer to distinctive organizational processes that involve integrating, reconfiguring, acquiring, and releasing resources to adapt to and potentially shape market changes. Dynamic capabilities refer to the organizational and strategic routines that enable enterprises to create new resource configurations in response to changing market conditions (Wamba et al., 2020).

We view the utilisation of Big Data Analytics by organisations as a means to develop dynamic capabilities for two specific reasons. Initially, employing Business Data Analytics (BDA) assists organisations in developing procedures for creating knowledge, especially in highly dynamic markets. Knowledge generation routines are crucial dynamic capabilities as outlined in the literature (Dubey et al., 2020). The application of BDA can be seen as an organisational competence for processing information that decreases uncertainty, stimulates insights and knowledge generation, and enhances the organization's potential for strategic decision making. Furthermore, this perspective on BDA utilisation aligns with the fundamental attributes of dynamic capacities as proposed in the literature: similarities in essential aspects, together with uniqueness in specific elements (Khan et al., 2020; Matarazzo et al., 2021). Early in development, industry studies detail aspects of several BDA solutions and consultancy methods guide organisations on using BDA prospects. Simply put, there are numerous established methods that companies can use to choose and put into operation standard BDA applications for different objectives.

Although there are similarities in the concept and application of Big Data Analytics (BDA), it does not guarantee that certain BDA technologies will be utilised in identical ways by all companies. BDA must be integrated and included into SCM procedures, similar to how other organisational technologies are deployed (Bag et al., 2021). Organisations employ common Big Data Analytics technologies differently in supply chain management due to the complexity of SCM activities such as sourcing, purchasing, network architecture, inventory optimisation, and customer services (Ghosh et al., 2022). Considering BDA use as a dynamic capability is theoretically sound and this conceptualization aids in comprehending the effects of BDA utilization on organisational value creation (Solem et al., 2023).

3. Conceptual framework and hypotheses development

According to the dynamic capabilities perspective, we developed an integrated model to explore the association among BDA and firm value creation in the Egyptian supply chain industry. It also examines the moderating impact of the market turbulence on the association among BDA and firm value creation. Figure 1 explains the links between the study variables.

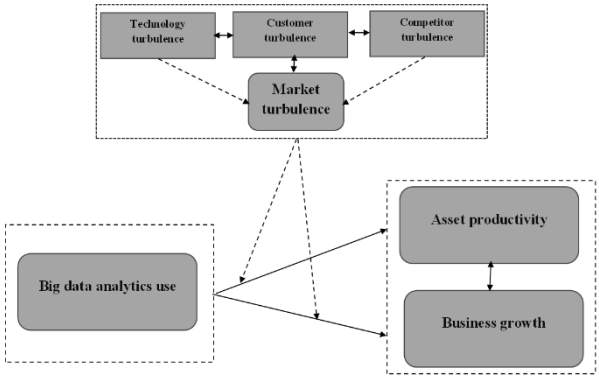

Fig. 1. Structural model results

3.1. "BAD and firm value creation"

Historically associated with operations management, SCM has gained significant interest from Information Systems (IS) experts due to its potential as a network of digitally enhanced processes (Robertson et al., 2023). Studies show that IT-driven SCM systems allow a company to synchronise information, resources, and funds with its supply chain collaborators, leading to positive organizational results (Jiang et al., 2023). Consequently, we argue that the SCM field offers a valuable setting to explore the utilization.

The current study focuses on BDA tools used to handle data from different SCM systems, not on the SCM systems themselves. Past IS research has classified SCM systems as either transactional (e.g., purchase ordering systems, online bidding) or relational (e.g., "private B2B exchange, customer relationship management") systems (Sheehan et al., 2023). Yet, the performance effects of BDA that handle transactional and relational information from different SCM systems have not been extensively studied. Due to the extensive exchange of operational, tactical, and strategic information within the supply chain, firms must analyse the transactional and relational data from SCM systems to achieve supply chain success (Liu et al., 2023). Big data analytics, which can transform data into insights and knowledge, has the potential to impact supply chain performance. We

evaluate the effects of Big Data Analytics (BDA) usage on business processes, in line with previous IT management research (Cooper et al., 2023). BDA utilisation is defined as the degree to which BDA has been utilised to produce business insights in key supply chain functions such as sourcing, purchasing, production, distribution, and customer support. Based on the dynamic capabilities perspective (Laguir et al., 2023), we argue that utilising BDA is crucial for gaining organisational competitive advantage. We specifically analyse how the application of Big Data Analytics affects supply chain performance in two main areas of SCM (i.e., "asset productivity and business growth").

According to the dynamic capabilities perspective, organisations can use BDA to enhance their ability to process and interpret information from different sources and deliver this synthesised information to relevant decision makers in supply chain departments (Bag et al., 2023). By utilising Big Data Analytics (BDA), valuable information can be obtained to help minimise uncertainties related to needs, capacity, and supply availability. The lack of these capacities necessitates the use of expensive asset-heavy reserves, like cash, inventories, and surplus capacity (Kähkönen et al., 2023). These assets serve as safeguards against uncertainty and their ability to forecast future resource needs. A commonly cited principle in supply chain management is that "information serves as a substitute for inventory" (Acciarin et al., 2023). This concept can also be applied to other safety stocks, such as inventory retained as a buffer or planned underutilization of equipment, which are established to manage uncertain fluctuations in resource demand and supply. We propose that insights gained from utilising Big Data Analytics can help organisations realign their resources to better match changes in demand and supply markets. BDA allows for quicker and more thorough information processing, resulting in more precise forecasts that provide asset managers with increased prior warning to adjust asset resources as needed. These findings have the potential to improve asset utilisation in the long run. Moreover, widespread application of BDA in various aspects of supply chain management can promote interorganizational learning between a company and its supply chain collaborators (Bi et al., 2023; Ogutu et al., 2023). Analysing data on procurement and delivery trends can help optimise transportation resources to maximise the utilisation of transportation assets. Production schedules can be improved to maximise the utilisation of production assets. Together, these enhancements may result in increased asset rotation rates and other measures of asset efficiency.

We will now assess the significance of Big Data Analytics for organisational expansion prospects. Business expansion in a fluctuating market depends on the ability to generate a sequence of temporary advantages. It is challenging to achieve a lasting competitive edge by just improving current resource setups in constantly changing marketplaces (Andronie et al., 2023). The utilisation of BDA provides organisations with fresh perspectives in consumer insights, marketing, operations, inventory management, and other areas, hence improving innovation opportunities to create a sequence of transitory advantages in supply chain processes (Heubeck, 2023). Analyzing point of sale (POS) data might result in creating more appealing price or service options for particular client groups (Yang and Wang, 2023). Examining inventory and shipping data can lead to reduced lead times and improved product availability, ultimately boosting sales. Firms frequently analyse operational data to enhance supply chain processes, as evidenced by existing research (Sadreddin and Chan, 2023). Prior research showed that managers significantly link the study of demand and inventory data with increased responsiveness in the supply chain (Mihailova, 2023). Managers stated that this information processing power can help their organisations foresee and take advantage of quickly emerging commercial possibilities. Moreover, multiple research papers argue that increased information accessibility and processing capabilities lead to enhanced supply chain responsiveness. These competencies have the ability to enhance managers' awareness of opportunities to stimulate business success (Jiang et al., 2023; Zhang et al., 2023). Therefore, we propose:

H1: "BDA has a positive influence on asset productivity".

H2: "BDA has a positive influence on business growth".

3.2. "The moderating role of market turbulence"

The contingency perspective is based on aligning an organization's qualities, including its resources, with uncertainties that mirror the organization's environment (Kalubanga and Gudergan, 2022). According to the notion, an organisation needs resources to effectively deal with external influences in order to thrive in a volatile environment (Buccieri et al., 2021). It is crucial to proactively address market turbulence issues due to the impact of external environments on market possibilities and difficulties (Haarhaus and Liening, 2020). Penrose (1959) suggests that environmental changes might alter the importance of resources for a company. Randhawa et al. (2021) discusses how situational opportunities and limitations impact organisational behaviour and the functional linkages between constructs.

Researchers contend that external factors impact the marketing process of value development, delivery, and communication (Weaven et al., 2021). Aligning internal operations with external factors can improve business performance. The degree of alignment can influence internal processes and impact performance metrics (Li, 2022).

Market turbulence is the speed at which external factors in an industry impact marketing activities (Li et al., 2022). Managers perceive a higher level of unpredictability in their external market environment during periods of increased market turbulence (Sheng et al., 2021). Market turbulence refers to the unpredictable nature of the external marketing environment, including factors like technology, customers, and competitors (e.g., Martin et al., 2020). Coreynen, et al. (2020) contends that competitors and customers play crucial roles in an industrial setting, impacting a firm's strategic decisions and ultimately its success. Penrose (1959) suggests that the market environment is shaped by rivals' behaviour and consumers' preferences or psychology. The following literature discusses how technology, as demonstrated by Mikalef et a (2021), impacts marketing strategies by contributing to the creation and capture of value. Baden-Fuller and Teece (2020, p.105) suggest that a resource or market position that was once valuable can become outdated when customer needs and technology change, and competitors come up with new ways to meet new demands, as seen in the decline of Kodak and Nokia. Market turbulence can impact BDAC and value creation through changes in technology, customer preferences, and competition intensity. Although the effects of market turbulence on the industrial marketing environment are well-documented, few research have examined its impact on the association among BDA and value creation.

Market volatility is recognised as a factor that affects the link between BDAC and value generation. Market turbulence pertains to the speed and unpredictability of change in three external factors: technology advancement, competitive pressure, and customer preferences (Ojha et al., 2021). For a dynamic or constantly changing cloud sharing environment, a robust analytics platform may be necessary to handle high levels of uncertainty (Chen et al., 2014). In this context, Business Data Analytics (BDA) is increasingly important as a dynamic capability for efficiently using different analytics resources. Business data analytics assist in adjusting different resources to align with opportunities and dangers in dynamic contexts by providing up-to-date information to internal and external stakeholders

(Ahmed et al., 2021). Therefore, increased market volatility would significantly affect the utilisation of marketing data, necessitating an advanced Big Data Analytics system to facilitate efficient market activities and value generation. Identifying technical change, rivals' actions, and changes in customer demand collectively as market turbulence, we propose:

H3: "Market turbulence moderates the link between BDA and asset productivity".

H4: "Market turbulence moderates the link between BDA and business growth".

4. Research method

4.1. Sample and data collection

Our study employed a marketing firm to collect the required data from supply chain executives in Egypt. Data were collected from various industries (i.e., "Building Material & Construction, Chemicals, Electrical Equipment & Engineering, Food & Beverage, Housing & Real Estate, Textiles & Clothing") through online survey between August and September 2023. Our study employed a purposive sampling method to target the proper participants in the manufacturing firms which are listed in the Egyptian stock market.

We received 489 valid responses for the final analysis purposes, with 308 from males (63%), and 181 (37%) from women. Among the participants, 42% were among the ages of 18 and 45, 74% had obtained at least an undergraduate level. Moreover, a significant 49% of the firms indicated that they have employees between 50 and above. In addition, most of the firms came from chemicals (36%), building material & construction (23%), and housing & real estate (19%). Table 1 demonstrates the main features of the respondents.

Table 1. Sample profile

Demographics		Percentage
Gender	Male	63
	Female	37
Age	18-25	19
	25-34	38
	35-44	31
	Over 45	12
Experience	< 5 years	34
	5-10	46
	10-15	16
	>10 years	4
Number of employees (firm size)	Less than 20	13
	20-99	21
	101-249	23
	250-999	22
	1000-2449	7
	2500-4999	10
	5000+	4
Industry type	Building Material & Construction	23
	Chemicals	36
	Electrical Equipment & Engineering	11
	Food & Beverage	8
	Housing & Real Estate	19
	Textiles & Clothing	3

4.2. Measures

We employed valid and well-established scales from the previous examinations to assess our study constructs. In our research, BDA usage refers to "the extent to which organizations use BDA to process information generated across key supply chain processes". Big data analytics usage was assessed using 10 items adopted from Chen et al. (2015). Asset productivity was evaluated using 4 items adopted from Chen and Paulraj (2004). Business growth was assessed utilizing 3 items adopted from Chen and Paulraj (2004). Finally, in line with Akter et al. (2022), our study measured market turbulence as a second-order variables includes three first-order variables (i.e., technology turbulence, customer turbulence, and competitor turbulence). We

performed a pilot exploration on a sample of 30 managers to assess our questionnaire validity and reliability. Some minor changes were made based on their feedback. The analysis also revealed that the Cronbach Alpha for all study factors were above the cut-off value of 0.70.

4.3. Common method variance (CMV)

It is widely acknowledged among scholars that social desirability poses a significant risk of bias in social science studies, particularly when using single informant surveys to collect data within each organization (Podsakoff et al., 2003). This paper employed various empirical approaches to ascertain whether the interpretation of the data was compromised by common method bias. Initially, we employed factor analysis, which is the preferred method for examining the existence of bias. They thoroughly examined all factors to confirm that only one significant component was present. The findings indicated that the construct with the greatest influence accounted for 29.2% of the findings. Additionally, this study included a confirmatory factor-analytic method to the Harman one-factor test as a more advanced assessment (Podsakoff, et al., 2003). A poorer fit for the one variable model would indicate that common technique difference is not a significant concern. The one- variable model produced a Satorra-Bentler $\chi 2$ (147) of 490.31, with a $\chi 2$ /d.f ratio of 3.336. This is in comparison to the Satorra-Bentler $\chi 2$ (131) of 368.76, with a $\chi 2$ /d.f ratio of 2.819. The fit of the one-dimensional variable is significantly inferior compared to the measurement model, indicating the absence of any significant common technique bias. These two tests indicate that “social desirability bias” was not deemed problematic in this paper (Podsakoff, et al., 2003).

4.4. Regarding our sample representative

The samples' characteristics align with previous research conducted in the context of supply chain management (e.g., Abdelaziz et al., 2023; Wahdan and Emam, 2017; Youssef and El-Nakib, 2015). In addition, the acquired sample size (n=489) is greater than the suggested minimum of 10 times the maximum number of connections pointing to any latent factor in the proposed model, regardless of whether they are inner or outside model connections (Bentler and Chou, 1987; Hair et al., 2017). The Kaiser-Meyer-Olkin assess the sample size adequacy produced a score of 0.89, which above the suggested threshold of 0.60. The Bartlett's test of sphericity produced a statistically significant result ($\chi 2 = 396$, $p < 0.01$), suggesting that utilizing a data compression method such as structural equation modelling can lead to positive results.

5. Analysis and results

Descriptive examination were performed using SPSS to obtain a comprehensive profile of the participants. These analyses included exploring the "frequency, means, and standard deviation". In order to evaluate the accuracy of the suggested model and investigate the proposed links, "confirmatory factor analysis" (CFA) and "structural equation modelling" (SEM) were conducted employing "Mplus". The analytical findings are succinctly demonstrated in the subsequent section.

5.1. "Measurement model"

SmartPLS 3.3 to assess both the "measurement and structural model" (Ringle et al., 2015). Table 2 shows the "Cronbach's alpha values" for all the first-order factors in our model (i.e., big data analytics use, asset productivity, and business growth), all of which exceeded 0.7. The range of these values was from 0.92 to 0.95 (Table 2). The "composite reliability" (CR) values for each construct varied among 0.94 and 0.97, meeting the data reliability requirements of 0.70 and suggesting strong internal reliability for all variables (Hair et al., 2017). The factor loadings of all questions ranged from 0.89 to 0.94, which is over the threshold of 0.50. These loadings were statistically significant, indicating strong evidence for "convergent validity" (Anderson and Gerbing, 1988). Furthermore, the factors exhibited an average "variance extracted" (AVE) that above 0.50 in all instances (range from 0.510 to 0.627, as shown in Table 2). This indicates strong convergent validity. The discriminant validity was evaluated using Fornell and Larcker's (1981) approach, which involves comparing the correlation coefficient among two factors with the square root of the "AVE" value of each factor. The findings (Table 3) indicated that the AVE for each factor was greater than the correlations among factors. Consequently, we have established a satisfactory level of discrimination validity. In addition, an exploration of the "heterotrait-monotrait (HTMT) criterion" affirms further discriminant validity as all the study variables values are below 0.90 (Henseler, et al., 2015). Finally, in line with Sarstedt et al. (2019), Table 4 shows the measurements and weights of the second-order variable (i.e., market turbulence).

Table 2. Assessment of first-order, reflective model

Construct/Indicators	Standard Loading	CR	VIF	Cronbach's α	AVE	Mean	SD	t-statistic	Skewness	Kurtosis
Big data analytics usage (BDA)		0.95	1.289	0.93	0.582					
BDA1	0.96					2.23	0.89	21.20	-1.35	2.34
BDA2	0.93					2.82	0.82	17.20	-1.29	2.31
BDA3	0.96					3.00	0.84	25.30	-1.34	2.39
BDA4	0.92					2.92	0.82	10.35	-1.92	1.20
BDA5	0.90					2.12	0.79	25.12	-1.23	2.12
BDA6	0.89					2.34	0.78	22.34	-1.92	2.37
BDA7	0.90					2.10	0.77	27.49	-2.12	2.18
BDA8	0.94					2.00	0.92	31.23	-1.27	1.84
BDA9	0.91					2.35	0.83	28.30	-2.36	1.34
BDA10	0.90					2.73	0.82	16.82	-2.20	2.08
Asset productivity (ASP)		0.97	1.292	0.95	0.510					
ASP1	0.98					2.37	0.82	26.20	-1.09	2.18
ASP2	0.93					2.30	0.85	18.23	-2.12	2.80
ASP3	0.95					3.10	0.84	20.42	-1.54	1.34
ASP4	0.97					2.54	0.86	26.31	-2.23	1.02
Business growth (BSG)		0.94	1.367	0.92	0.627					
BSG1	0.93					2.02	0.82	20.56	-2.43	1.23
BSG2	0.95					3.13	0.84	19.23	-2.12	2.02
BSG3	0.96					2.24	0.81	29.13	-2.56	1.84

Table 3. Correlation matrix

	BDA	**ASP**	**BSG**	**TCT**	**CMT**	**CST**
BDA	**0.763**	0.420	0.224	0.520	0.410	0.219
ASP	0.390	**0.714**	0.532	0.349	0.239	0.230
BSG	0.428	0.428	**0.792**	0.234	0.231	0.354
TCT	0.439	0.320	0.329	**0.731**	0.302	0.243
CMT	0.237	0.421	0.378	0.498	**0.788**	0.467
CST	0.419	0.429	0.290	0.420	0.543	**0.801**

***** The diagonal is the square root of the AVE of the latent variables and indicates the highest in any column or row.

* Elements above the diagonal represent the constructs' HTMT ratios.

* TCT= Technology turbulence; CMT= Competitor turbulence ; CST= Customer turbulence

Table 4. Assessment of the higher-order model

Models	**Second-order**	**First-order**	**β**	**t-statistic**
Hierarchical, reflective-formative	Market turbulence (MAT)	Technology turbulence (TCT) Competitor turbulence (CMT) Customer turbulence (CST)	0.510 0.629 0.323	22.190 29.164 18.241

5.2. "Structural model"

We performed path analyses through SmartPLS 3.3 to test the research hypotheses. Table 5 provides a comprehensive breakdown of the outcomes obtained from performing hypothesis testing. Table 5 shows that BDA has a significant and positive influence on asset productivity ($\beta = 0.791$, $p < 0.001$). BAD was found to have a significant and positive influence on business growth ($\beta = 0.482$, $p < 0.001$). Therefore, H1 and H2, H3 were supported.

Table 5. Results of the structural model

Paths	β
BDA ⟶ ASP	0.791***
BDA ⟶ BSG	0.482***
R2	
Asset productivity	**0.814**
Business growth	**0.491**
Size Effect	
Asset productivity	**.692**
Business Growth	**.408**

5.3. Testing the moderating effect

Our study utilized the recommendations suggested by Hayes' (2012) PROCESS macro to test the moderating effect of market turbulence. Table 6 demonstrates the analysis results. The analysis demonstrates that market turbulence moderates the association among BDA and asset productivity (β = -0.208, t = 3.102, $p < 0.001$), thereby supporting H3. The results also indicated that market turbulence moderated the influence of BDA on business growth (β = -0.236, t = 4.389, $p < 0.001$), thereby supporting H4. In line with Cohen (1998) suggestions, we measured the effect sizes of the study factors. The analysis revealed that both asset productivity (0.692) and business growth (0.408) have a large effect size. Our analysis controlled for firm size, age, and industry type. The results revealed no significant influence of these variables.

Table 6. Model coefficients for the conditional process models.

Predictor	β	SE	t	CI
Market turbulence (BDA ⟶ ASP)				
Constant	1.028	0.043	-0.429	-0.06, 0.34
Firm size	-0.02	0.14	-0.324	-0.05, 0.18
Firm age	0.04	0.19	-0.135	-0.24, 0.05
BDA	1.389**	0.03	4.390	0.27, 0.03
ASP	1.430**	0.04	3.235	0.18, 1.13
MAT	-0.561**	0.08	4.420	0.10, 1.02
INTER	-0.208**	0.01	3.102	0.21, 0.63
Market turbulence (BDA ⟶ BSG)				
Constant	1.42	0.16	-0.320	-0.03, 0.07
Firm size	-0.05	0.23	-0.403	-0.02, 0.04
Firm age	0.03	0.17	-0.128	-0.01, 0.02
BDA	1.21***	0.04	3.930	0.53, 0.093
BSG	0.508**	0.03	3.230	0.28, 1.34
MAT	-0.346*	0.06	2.278	0.19, 1.309
INTER	-0.236**	0.01	4.389	0.03, 0.328

Note:,CI = 95% confidence interval. Unstandardized regression coefficients were reported. Bootstrap samples = 5000. One tail t-test was used for interaction terms. *** p < .001. ** p < .01. * p < .05.

6. Discussion and conclusion

6.1. Key findings

This paper examines how the usage of new enterprise-wide technologies, specifically BDA, contributes to creating value at an organizational level and results in significant organizational benefits, instead of focusing on predicting individual IT adoption intent as seen in existing literature. We have examined how the usage of Big Data Analytics (BDA) might impact organisational performance at the organisational level. Furthermore, our research contributes to the theoretical comprehension of the mechanisms that underpin this phenomenon. The main aim of this study was to investigate the impact of BDA usage on asset productivity and business growth in supply chain industry in Egypt. It also examined the moderating impact of market turbulence on these links. Based on dynamic capabilities view, our study developed an integrated model to test the paper hypotheses.

The big data revolution is powerful due to the merging of enormous data sets with improved analytics for problem-solving (Wamba et al., 2017). This capacity to identify patterns and address issues surpassing human cognitive capacities has resulted in two primary types of knowledge obtained from big data. Initially, extensive and multidimensional datasets can be

analysed to identify previously undisclosed patterns and relationships (Mikalef et al., 2019). At times, this can confirm viewpoints that were previously endorsed by common sense, practical experience, or traditional knowledge. At times, this type of analysis might provide fresh perspectives on the fundamental dynamics of a population, market, or organisation (Müller et al., 2018). Furthermore, large data allows for accurate predictive analytics. By analysing the connections within extensive data sets, it is feasible to develop a new set of models that depict the probable future evolution of objects. Organisations are turning to big data to enhance several aspects of performance (Akter et al., 2016). This article empirically demonstrates that organisations need to have Big Data Analytics (BDA) capabilities in order to fully leverage the benefits of big data. This could improve the decision-making process by consolidating information and decision levels in one location (Ferraris et al., 2019; Gopal et al., 2024). In the era of big data, information is generated and shared, and expertise is frequently found in different places than before. A proficient leader can establish an organisation that is adaptable enough to reduce the "not invented here" stigma and enhance cross-functional collaboration (Fosso Wamba et al., 2024). Individuals knowledgeable about the issues must be connected with the appropriate data and individuals possessing problem-solving skills to properly address them.

Our research indicates that utilizing Big Data Analytics (BDA) in organizations leads to the generation of value within the supply chain management sector. Our research shows that utilizing Big Data Analytics (BDA) as a crucial organizational information processing capability positively impacts asset productivity and business growth. This supports our hypothesis and validates the potential of BDA for modern enterprises. The results align with existing research indicating that information processing capacity is a crucial aspect of organizational management, especially in the context of supply chain management (Chen et al., 2015; Dubey et al., 2020; Mikalef and Gupta, 2021). Moreover, we consider information processing as a dynamic competence that provides transient competitive advantage to organizations (Matarazzo et al., 2021; Wamba et al., 2020). According to the dynamic capabilities perspective, market volatility affects how the application of big data analytics impacts asset productivity and corporate growth. Our observation indicates that the adoption of BDA has a more significant impact on business growth in dynamic situations, as hypothesized.

Overall, the analysis of this paper demonstrates that using big data analytics plays a critical role in improving asset productivity and business growth in the supply chain management field. Consequently, supply chain managers should pay close attention to the use of big data analytics to enhance their value creation and organizational performance.

6.2. Practical implication

This paper's results also carry significant implications for managerial practice. We first offer evidence that the usage of BDA can have a direct impact on organizational performance. There has been extensive industry discussion on the potential benefits of big data analytics. Many firms are hesitant to make commitments due to a lack of expertise on how to proceed effectively and uncertainty regarding the payout. Our results should demonstrate the feasibility of using BDA and its potential benefits for the firm. Our results offer guidance to managers on evaluating the potential influence of external factors, such as volatility, on specific performance results. Our paper shows that utilizing of BDA has a favourable impact on business expansion, especially in a dynamic setting. BDA affects asset productivity; however its impact is reduced in a very dynamic environment. Organisational decision makers should be mindful that the environmental context can significantly impact how BDA affects specific organizational results.

The present research also pinpoints crucial mechanisms by which management can impact BDA utilisation. Many firms are labelled "big data laggards" as they struggle to engage in BDA projects due to a lack of understanding of the path to success. Organisational managers should recognise that technical variables play a crucial role and have a clear connection to the utilisation of BDA. Our work argues that TMT support is a crucial component of the equation. The importance of top management team support in strategic initiatives, such utilising big data analytics, is occasionally disregarded. Firms need to recognise the significance of top management team (TMT) in utilising BDA, particularly concerning organisational aspects and the interaction between the environment and the firm. Thus, implementing a technological requirement for BDA is just one aspect of the situation. Championship of BDA by senior management is crucial for integrating organisational and environmental variables into practical utilisation of BDA.

The findings demonstrate the significant impact of market turbulence as a contingency factor in the realm of supply chain management. Comprehending technology advancements, competitive pressure, and consumer behavior can help guide practitioners' decisions, despite their external and uncontrollable nature. The analysis indicates that managers should develop a strong BDA system to handle market instability. High competitive intensity among companies can be improved by better BDA to enhance asset productivity and business growth. Our paper's results can assist marketing managers in effectively navigating market instability by utilising a dynamic analytics-business growth model to detect, capture, and enhance product offers. Due to the highly dynamic market conditions in supply chain management, it is essential for BDA to be in sync with the company's overarching strategy.

6.3. Theoretical implication

This paper expands the current knowledge on IT adoption at the organizational level. The paper approach, based on theoretical frameworks such as dynamic capacities theory, is easily transferable and may be generalised to further examinations on how enterprises create value through knowledge creation systems. We concentrate on utilising Big Data Analytics as a dynamic capability for processing organisational information that might impact many areas of organisational performance. Further explorations should investigate how the use of BDA at the firm level affects various aspects of organizational performance that were not explored in the present examination. We offer further understanding of how the application of BDA relates to the performance of organisations, influenced by the volatility of the external environment. Our paper discovered varying impacts of environmental volatility on internal (productivity) and external (growth) performance. It is recommended that further explorations replicate our paper to verify if these effects of market turbulence persist when utilizing different performance measures. Further examination should investigate additional contextual factors that may impact the extent to which the utilization of BDA (or similar knowledge generation systems) affects organizational results, such as technology maturity and BDA adoption stage.

This paper has addressed the research gap regarding the primary factors influencing organizational performance through the use of Big Data Analytics. Further development of the nomological network is needed in further exploration to further the knowledge of this phenomena. Further exploration should investigate possible intervening factors that could be present among organisational IT practices and performance outcomes. For instance, the correlation among BDA utilisation and business unit plans is a crucial variable that could serve as a significant factor connecting BDA consumption to organizational performance.

A thorough comprehension of how market instability affects the relationship between BDA and business growth sheds light on the ongoing discussion on the negative aspects of BDA in the supply chain management sector. Applying the dynamic capabilities approach, we offer a compatible and complementary viewpoint to enhance the BDA-business growth literature by modelling the comprehensive effects of market instability. Our research indicates that corporate Development Activities (BDA) act as a powerful dynamic skill that is essential in driving corporate growth throughout periods of low to moderate market instability.

7. Limitations and future studies directions

This investigation, like any explorations, has specific limitations that researchers need to consider. We used a non-random purposive sampling technique, raising concerns about the sample's representativeness. To enhance the theoretical underpinning of this study, future research could utilise a probability sampling strategy to ensure generalizability. Our study specifically examines supply chain management in Egypt. The study provides a narrow view of how BDA affects corporate growth, missing international, cross-cultural, and global viewpoints that could enhance our understanding in a more comprehensive way. Future research efforts could conduct comparative studies in various countries or validate the suggested model in diverse societies, such the United Kingdom, to broaden the scope of our analysis. Our paper focuses on investigating the results of BDA. Future research could investigate the primary factors that lead to BDA in the supply chain management sector. Our study used subjective methods to evaluate the study variables. Future explorations could use objective data to quantify our assessment methods.

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كيف ومتى تؤتي تحليلات البيانات الضخمة ثمارها؟ دور خلق القيمة واضطرابات السوق

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ملخص البحث

بناءً على المنظور الديناميكي، تسعى هذه الدراسة إلى دراسة تأثير استخدام تحليلات البيانات الضخمة (Big Data Analytics) على خلق القيمة في مجال إدارة سلسلة التوريد. كما تسعي أيضا الي دراسة الدور الوسيط لاضطرابات السوق في العلاقات بين عوامل الدراسة. لتحقيق أهداف الدراسة، تم تجميع البيانات من ٤٨٩ مديري سلسلة التوريد بالتطبيق على السوق المصري وتم تحليل البيانات من خلال نمذجة المعادلات الهيكلية لاختبار فرضياتنا المقترحة. وقد توصلت الدراسة الي أن استخدام BDA له تأثير إيجابي ومعنوي على إنتاجية الأصول وكذلك نمو الأعمال. أشارت دراستنا أيضًا إلى أن العلاقة بين استخدام BDAوانتاجية الأصول ونمو الأعمال تتأثر باضطرابات السوق. تقدم تلك الدراسة رؤى مفيدة للمديرين لفهم التأثير الكبير لـ BDA على خلق القيمة للمنظمات في مجال إدارة سلسلة التوريد.

الكلمات المفتاحية:

تحليلات البيانات الضخمة، إنتاجية الأصول، نمو الأعمال، اضطرابات السوق، ونظرية القدرات الديناميكية.