

# The Drivers of Big Data Analytics Adoption and its Impact on Corporate Entrepreneurship

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## Abstract

BD analytics (BDA) has been steadily garnering interest among academicians and users, considering its advantages, drawbacks, and anticipated outcomes. This study investigates the determinants of BDA adoption regarding the impact of BDA adoption on corporate entrepreneurship. Data on pharmaceutical industry corporations were obtained from 219 responses to a questionnaire. SPSS 29 and AMOS 29 were used to analyze data. The findings show that relative advantages, security concerns, top management support, organizational readiness, competitive pressures, and partner pressures positively influence BDA adoption. The results also reveal a positive impact of BDA on corporate entrepreneurship. The results of this study can contribute to practitioners becoming competent in diagnosing the essential factors that inspire or impede corporations in adopting BDA applications. Moreover, this study may offer valuable managerial insights for policymakers to enhance corporate entrepreneurship by efficiently exploiting BDA capabilities.

**Keywords:** Big Data, Entrepreneurship, Technology, Organization, Environment

## 1 Introduction

Entrepreneurship is a vital survival technique for organizations in the new economy. The necessity for entrepreneurship has always existed, but it has become a sine qua non in the current age due to the acceleration of economic shifts and increasing competition (Raymond et al., 2015). Presutti & Odorici, (2019) argue that corporations' ability to perceive and react rapidly to dynamic consumer demands has become a vital enterprise competency. The fundamental entrepreneurial actions derive from an interest in developing unique products or services and guiding the business in investigating customers' varying requirements and expectations (Fraccastoro & Gabrielsson, 2018). Al-Darras & Tanova (2022) argued that the key features of entrepreneurship are innovation, risk-taking, and pro-activeness.

Business intelligence (BI) depicts the tools, tactics, and methods businesses employ to gather, examine, and display data to gain knowledge and make wise business decisions. It entails converting unstructured data into information that can be utilized to inform strategic and operational decision-making processes, utilizing a range of tools and methodologies (Hung et al., 2016). Recently, BDA has caught on in organizations; this refers to data investigation methods facilitated by contemporary technological advances that provide high-velocity data capture, repositories, and examination. Data sources have expanded beyond the conventional corporate database to encompass email, social media,

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and external data (Choi et al., 2022; Ibrahim, 2020). BDA can help corporations shift toward embracing inventive business models and enhance their services. According to (Statista, 2021), the revenue companies generate by exploiting BDA is estimated to be billions of dollars and is increasing. Lutfi et al., (2022) indicated that big data (BD) technology hones companies' competitiveness and facilitates better decisions. Contemporary studies have demonstrated that BDA is an avenue for improving corporate entrepreneurship (Jeong et al., 2019; Ciampi et al., 2021; Dubey et al., 2020). Despite the advantages of BD analytics, corporations have been wary of embracing the technology (Al-Dmour et al., 2021). Many obstacles to BDA adoption deter firms from implementing this technology in their activities (Statista, 2021; Chakma & Chowdhury, 2023). Indeed, scholars have been exploring the drivers of BD adoption since its inception. While existing research reveals that the efforts have focused on examining various factors in organizational, technological, or environmental contexts, the studies also underscore the lack of a comprehensive research model to consider the interplay between these determinants of BD adoption. Al-Sai et al., (2020) affirmed the need to study and comprehend BD adoption determinates, as it is a contemporary subject, and there is a shortage of empirical results. The literature also reveals few empirical studies explaining and enhancing our understanding of how BDA can be integrated into corporate entrepreneurship (Skarmeta et al., 2015).

Furthermore, recent research (Al-Sai et al., 2020; Wahab et al., 2021) emphasizes the necessity for more studies across countries and regions, especially in emerging economies, which may have different considerations in adopting BD. This study attempts to contribute toward filling these gaps by examining a comprehensive framework of BDA adoption drivers. It also empirically investigates the role of BDA adoption in corporate entrepreneurship in emerging markets. To this end, the study tries to answer these two questions:

Q1. What are the determinants of BDA adoption in emerging economies?

Q2. Does BDA adoption positively impact corporations 'entrepreneurship'?

To achieve this study purpose, the researcher used a combination of the Technology–Environment–Organization (TOE) and Diffusion of Innovation (DOI) theories. Previous studies (Lutfi et al., 2022; Oliveira et al., 2014) have confirmed that using TOE and DOI theories could support researchers in studying the adoption of IT in organizations. The technological factors (relative advantages, complexity, security concerns) construct was extracted from DOI theory, which emphasizes the role of technological characteristics as significant for information technology adoption in organizations, while the organizational factors (top management support and organizational readiness) construct and environmental factors (competitive pressures, government support, and service provider support) were extracted from TOE theory which focuses on the internal and external factors that could affect the adoption of novel technology in organizations (Baros, 2020).

## 2 Literature Review

Entrepreneurship is robustly inherent in firms with highly innovative abilities concerning the identification of customers' requirements or market trends (Presutti & Odorici, 2019; Abdullah, 2020). It can be defined as an approach to innovation and utilizing new options. This approach needs the entrepreneurial characteristics of independence, pro-activeness, and risk-taking (Al-Darras & Tanova, 2022; Duhan & Singh, 2014; Hakkaraki, 2023) argue that entrepreneurship sometimes appears as an instrument to build value by employing a distinctive collection of resources to develop and utilize fresh opportunities. Presutti & Odorici, (2019) indicate that the success of entrepreneurship needs the

capability to discover unexplored opportunities to develop more impressive customer value than competitors.

BDA has been considered a critical component for organizations seeking competitive advantage and excellence (Kumar & Garg, 2018). BDA combines two concepts: BD and analytics, which deliver business intelligence science (Ribalta et al., 2021), one of the most vital directions in this era where advanced organizations are putting special kinds of analytics into practice, mainly what is referred to as evolved and predictive analytics (Hung et al., 2016). Predictive analytics is the most essential and helpful technique for utilizing BD to acquire insights into likely future scenarios. It is the process of determining significant data patterns using statistical approaches, artificial intelligence, neural networks, data classification, and data mining (Kumar & Garg, 2018). Today, the capabilities of BDA help organizations forecast customer behavior, make better decisions, and retain high-value customers (Mathur et al., 2024).

Moreover, it has the potential to gather a vast spectrum of data from both present and former clients (Wang, 2019). Indeed, BDA skills define the organization's ability to accumulate, integrate, and utilize BD resources. Accordingly, BDA capability could be defined as the skill of assembling, coordinating, organizing, and exploiting the organization's BD-specific resources. Elgendy & Elragal, (2014) considered BDA a methodology using innovative statistical methods to analyze sizeable organizational data resources. Moreover, it has a predictive ability for the future using pattern recognition techniques, data mining, and artificial intelligence (Kumar & Garg, 2018; Dubey et al., 2020) argued that BDA is an emerging, multidisciplinary science that must include information technology, statistical science, math, sociology, and psychology to explore and understand organizational data sources effectively.

Organizations have recently expanded their adoption of BDA to increase focus on controlling interior and exterior data to seize unique opportunities appropriate to maintain competitive advantage (Dubey et al., 2020) highlight that by focusing on BD generated by customers, companies give themselves a chance, for example, to enforce user-centered and user-driven innovation. A firm can utilize BDA to investigate customers' requirements to improve the development of new products aligned with their aspirations (Hooi et al., 2018). Furthermore, innovation driven by user trends requires an organization to create new products in cooperation with individual clients to initiate and enforce co-creation initiatives (Duhan & Singh, 2014). Utilization of BD provides strategic depth in guaranteeing repeated engagement, thereby developing sustainable value for them (Lutfi et al., 2022). The contemporary entrepreneurial attitude should be open to leveraging and employing BD sources. The considerable success of Google, Facebook, and Netflix can be said to have resulted from their focus on data analytics and how they steer themselves based on data advantage. Therefore, the strategic use of BD can generate a competitive advantage for firms (Presutti & Odorici, 2019).

Many studies have examined the adoption of BDA in corporations. For example, (Nasrollahi et al., 2021) examined the impact of BDA adoption on SMEs' performance in the Iranian context. The conclusions of their investigation showed that the utilization of BDA helps institutions in developing countries to improve performance. Moreover, the study showed that 12 factors significantly impact BDA adoption in developing countries. Skafi et al., (2020) examined the determination of BDA adoption in Lebanese companies using TOE and contextual theory. Their outcomes demonstrated that technological aspects such as security and complexity positively impacted BDA adoption.

Moreover, the findings showed that organizational factors such as prior IT experience and top management support significantly influenced the decision to adopt the BDA. On the other hand, the absence of government support and insufficient infrastructure had a contrary effect on BDA adoption. Al-Dmour et al., (2021) investigated the factors affecting BDA adoption by banks in Jordan. They also

studied the impact of BDA on bank performance. The results reveal that implementing BDA in Jordanian banks has had a marked positive effect on their performance. Additionally, the study findings suggest that nine factors derived from the technology-organization-environment theory are significant predictors of the level of adoption of BD applications in Jordanian banks. Lutfi et al., (2022) studied the drivers for BDA adoption in SMEs in Jordan using DOI and TOE frameworks. Their findings provide enterprise supervisors with worthwhile results that will help them decide to adopt the BDA.

### 3 Research Model and Hypotheses

The study model (Figure 1) suggests that technical, organizational, and environmental factors directly impact corporate BD adoption. Furthermore, the suggested model proposes that BDA adoption significantly impacts corporate entrepreneurship.

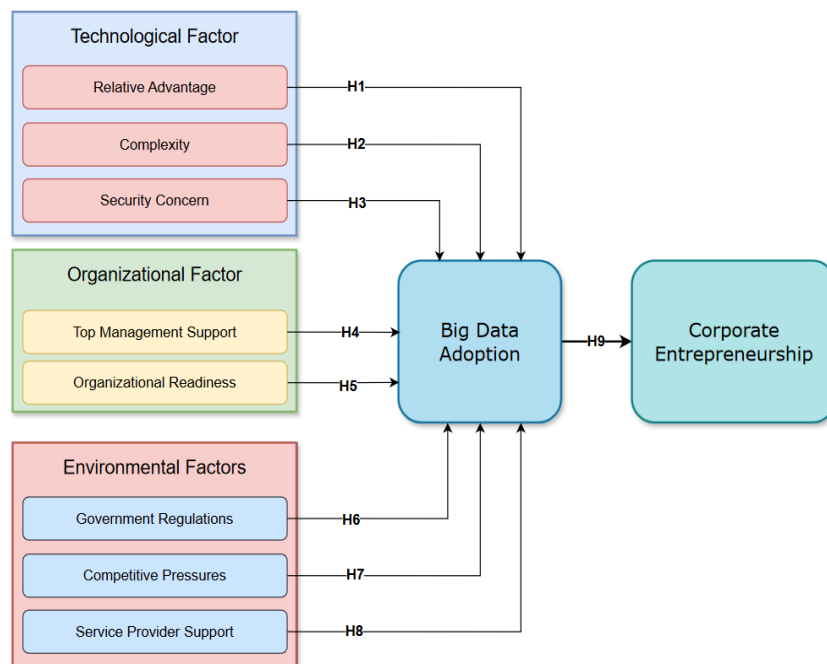


Figure 1: Proposed Model

In the following subsections, the hypothesized relationships between the research constructs are discussed in greater detail, followed by the corresponding hypotheses.

#### 1) BDA Adoption

BD refers to enormous unstructured data collections that common software tools cannot capture, store, analyze, or generally handle (Soon et al., 2016). Many scholars (Fraccastoro & Gabrielsson, 2018; Lutfi et al., 2022) have confirmed that BD has a large mixture of information, increased volume, and high velocity that need novel kinds of processing to permit gaining improved insights, predictions, and decisions to facilitate the process of entrepreneurship. Accordingly, organizations should include BDA in their strategy to develop appropriate systems to handle and analyze the data to achieve their goals efficiently. Artificial intelligence has contributed significantly to BD analytics. It uses complicated algorithms such as deep learning to solve multifaceted problems (Wang, 2019). BDA is considered one of the newest important technology trends due to its ability to investigate large and various

datasets to discover unobserved patterns, knowledge, and other beneficial information (Ren et al., 2019). Global organizations have been exploiting BD in various fields. BDA has been used to analyze market demand based on customer assessment and desires to enhance firms' ability to design novel products and services (Zhang et al., 2019). In the production schedules field, BDA enables statistical analysis methods and smart optimization algorithms to implement efficacious manufacturing plans and schedules under undefined circumstances (Gao et al., 2020). Moreover, it is used to deal with product quality management and security issues. It is estimated that BDA usage will help corporate managers learn and assess the impacts of everything they have done in a specific period and predict what they will do in the future (Zhang et al., 2019).

Although the trend of BD usage is rising rapidly globally, as well as awareness regarding the advantages of employing BDA in all major organizations' functions, there is a gap in their adoption of BDA (Al-Dmour et al., 2021).

## 2) Technological Factors

Technological factors are those features of technology that have the potential to affect enterprises, markets, and communities. These variables include the creation, acceptance, and use of technological advances that can significantly impact many different organizational operations in varying competitive environments and their strategies (Soon et al., 2016). Listed below are some of the essential technological elements:

### ▪ Relative Advantages

The relative advantage of BDA is the degree to which organizations recognize the benefits of adopting BDA (Sayginer & Ercan, 2020; Oliveira et al., 2014) argue that useful innovations that improve strategic performance and organizational effectiveness constitute a strong incentive to adopt these innovations. BDA improves the value of organizations' operations and hones their strategy by decreasing the cost of operations and increasing the efficiency of daily activities. Moreover, the advantages of using BDA will influence invention, business marketing, product design, production scheduling, accuracy, and quality (Zhang et al., 2019). Therefore, the relative advantage of adopting BDA will enhance organizational performance.

Decision-makers have begun to consider BDA vital because it provides valuable insights to help them make the most effective judgments (Elgendy & Elragal, 2014). Enormous quantities of data from diverse origins represent an excellent opportunity to discover valuable insights, allowing decision-makers to exploit the opportunities from the wealth of data generated through BDA mechanisms (Soon et al., 2016; Lutfi et al., 2022) confirmed that the relative advantages of BD influence BD adoption in small and medium enterprises in Jordan. Park & Yun (2021) explained how the relative advantages are an important factor that has a significant role in BD adoption in Korean corporations. Their study revealed that perceived relative advantage is an important factor playing a significant role in BD adoption in Korean organizations (Park & Yun, 2021; Nasrollahi et al., 2021) suggests that using BDA in companies will increase the relative advantage achieved through the development of new products and improve the competitive advantage; this, in turn, will accelerate the adoption of BDA by companies and their reliance on such technology in their operations.

Arising from the above discussion, the following hypothesis is posited:

H1: A relative advantage has a positive impact on BDA adoption.

### ▪ **Complexity**

Complexity is the degree of difficulty in realizing and using an innovation (Kapoor et al., 2014). The literature (Al-Dmour et al., 2021; Al-Sai et al., 2020) affirms that complexity negatively impacts adopting of novel technologies. According to the research, the degree of complexity will affect the organizational decision to adopt innovative technology. Davis (1993) asserted that whenever a new technological system is characterized by ease of use and less complexity, this will boost the likelihood of users accepting and supporting an organization's decision to adopt such a system.

Alsetoohy et al., (2019) point out that the ease of implementation of modern technology depends on its degree of complexity. The authors also showed how complexity is critical in adopting intelligent agent technology. According to (Oliveira et al., 2014), technological complexity negatively affects the adoption of cloud computing. Many scholars (Al-Dmour et al., 2021; Lutfi et al., 2022; Maroufkhani et al., 2022) have concluded that there is a significant relationship between the complexity of technology and BDA adoption.

Based on these arguments, the next hypothesis proposed is as follows:

H2: Complexity has a negative impact on BDA adoption.

### ▪ **Perceived Security Concerns**

Security and privacy are among the major obstacles facing organizations, especially those that outsource data processing and analysis. Precise laws must be established and complied with to protect sensitive and individual data. Many countries have regulations addressing data protection and privacy concerns (Gupta, 2016). According to (Al-Ma'aitah, 2022), organizations' data sources require a high level of security policies and procedures to save them from illegitimate and malicious usage. Recent studies (Al-Ma'aitah, 2022; Gupta, 2016) have confirmed that the spread of BD technology in organizations has become a matter of great concern due to insufficient security and privacy. Moreover, traditional security mechanisms like firewalls and proxies cannot be applied to BD because of its vast expanse, often across boundaries.

Hung et al., (2016) argue that the massive amount of data in organizations creates a major challenge for their protection mechanisms due to the inappropriate use of traditional tools and protection methods. In addition, encrypting BD is a difficult process due to its size and diversity. Organizations may use a third party to analyze data, increasing the challenges and risks facing the protection of BD. Al-Dmour (2021) showed that security and privacy concerns are the technological factors that greatly impact an organization's decision to adopt BD analytics. Maroufkhani et al., (2022) found perceived security concerns to be an important driver of BDA adoption in organizations.

The preceding discussion leads to the next hypothesis, which is posited as follows:

H3: Security and privacy have a positive impact on BDA adoption.

### **3) Organizational Factors**

Organizational factors are the internal components and traits that affect how an organization is structured, functions, and performs (Borgman et al., 2013). The following are some of the important organizational elements.

#### ▪ **Top Management Support**

Top management support is the degree to which management realizes the significance of integrating information technology into the organization's activities (Ragu-Nathan et al., 2004). Previous studies (Maduku et al., 2016; Ragu-Nathan, 2004) have focused on studying the importance of top management support in inventions and technology adoption. Scholars emphasize that top management support contributes substantially to conducive conditions and delivering suitable resources to quicken the adoption of IT innovations. Consequently, the better the top management support is, the better the overall information technology efficacy will be (Maduku et al., 2016).

BD has become a vital driver for organizations' activities today. As such, it should be connected to top management and their essential values. Indeed, adopting new technology in organizations is difficult and requires much time to become an adequately integrated part of the organizational culture (Borgman et al., 2013). Previous studies (Al-Dmour, 2021; Lai et al., 2018; Maduku et al., 2016; Maroufkhani et al., 2022) have shown that top management support is a critical factor in adopting BDA in organizations.

Per this finding, the following hypothesis is proposed.

H4: Top management support has a positive impact on BDA adoption.

#### ▪ **Organizational Readiness**

Maroufkhani et al., (2022) confirmed that organizational readiness includes harmonizing and coordinating persons, procedures, systems, and performance measurement. Regarding BDA adoption, organizational readiness means preparing the necessary resources for the related applications. To this end, many resources should be available (like financial resources, IT resources, and specialist employees) (Choi et al., 2022). Al-Ma'aitah's (2022) study revealed that employees resist adopting new information systems when there is not enough technology readiness to implement the system. In BDA systems, employees need persistent technical support to conduct BDA operations. Furthermore, since the systems could undergo constant change for various reasons, users would be unlikely to adopt them without sufficient resources.

Choi et al., (2022) showed that the managers at the tactical level consider organizational readiness to be a driver for enhancing BDA adoption decisions in organizations. Previous studies (Al-Dmour, 2021; Lai et al., 2018; Maduku et al., 2016; Maroufkhani et al., 2022) have confirmed that organizational readiness is a vital factor in the decision to adopt BDA in organizations.

Accordingly, the following hypothesis is proposed:

H5: Organizational readiness has a positive impact on BDA adoption.

#### **4) Environmental Factors**

Environmental factors are the conditions and influences from the outside world that influence organizations and their activities (Oliveira et al., 2014; Stevovic et al., 2023). The following are some of these important elements:

#### ▪ **Government Regulations and Policy**

Park & Yun, (2021) argued that government support and policy will decide how much organizations are affected by government actions for activating an industry. Moreover, they suggested that

government support and policies associated with data protection could motivate decision-makers to adopt BDA in organizations. Previous studies (Oliveira et al., 2014; Park & Yun, 2021) further indicate that government support and policy offer critical resources to support adopting new technology, such as cloud computing and BD applications in organizations.

The growing adoption of BD depends on governments' power to put in place explicit policies and actions that direct organizations and users regarding BD applications (Joseph & Johnson, 2013). These policies and actions should strive to maximize the value of data and minimize possible dilemmas that organizations adopting BD analytical applications may face in their environment (Choi et al., 2022). Other scholars, such as (Al-Dmour et al., 2021; Park & Yun, 2021), emphasize that government support and policy is a crucial environmental factor that has a major impact on BDA adoption in organizations.

Based on the preceding discussion, the following hypothesis is posited:

H6: Government regulations have a positive impact on BDA adoption.

#### ▪ **Competitive Pressures**

Nedev, (2014) discusses competitive pressure, referring to the compulsion to implement new technologies due to competition. In their study, (Hung et al., 2016) showed that many resources, including competitors, customers, and suppliers, contribute to organizational competitive pressure. Often, competitive pressure leads organizations to adopt new technologies, such as BDA, if rivals are adopting this technology (Oliveira et al., 2014). Previous studies (Lai et al., 2018; Lutfi et al., 2022) have indicated that adopting BDA could influence a corporation's competitive advantage by providing significant consumer insights that would affect the organization's dynamic ability and adaptive competence to improve value creation. Karim et al., (2017) point to how global organizations using e-commerce have become dependent on BDA to price, advertise, and store their products.

Many studies have focused on the role of competitive pressure in companies adopting BDA applications (Choi et al., 2022; Lai et al., 2018; Sumbal et al., 2019). Such research reveals that competitive pressure plays a significant role in organizations' decision to adopt BDA applications.

In line with this debate, the following hypothesis is proposed:

H7: Competitive pressures have a positive impact on BDA adoption.

#### ▪ **Partner Pressures**

Partner pressure describes how other businesses behave in joint ventures for product development or marketing. The effects of partner pressure are examined as elements that support the acceptance of IT innovation as a form of social influence. In such cases, the adoption of BD is likely determined by partner pressures (Hyun et al., 2019). For instance, supply chain partners may require organizations to embrace BDA to streamline supply chain procedures. Partners may anticipate real-time data exchange, demand forecasting, inventory optimization, or capabilities for predictive maintenance. Organizations may need to implement BDAs to meet these partner expectations and sustain effective supply chain operations (Lai et al., 2018). In addition, (Hyun et al., 2019) have confirmed that partner pressures impact BDA adoption.

These findings lead to the next hypothesis, which is posited as follows:

H8: Partner pressures have a positive impact on BDA adoption.



## 5) BDA and Corporate Entrepreneurship

Ren et al., (2019) argued that the culture of using BD in organizations would increase opportunities to access knowledge and share information, supporting analytical capabilities in organizations. Therefore, sharpening analytical capabilities by accessing and sharing large volumes of data can improve these organizations' entrepreneurship climate. Sahi et al., (2019) study confirmed that obtaining real-time information on market status enables organizations to forecast their competitors' and customers' present and possible future behavior. Some studies have also underlined BDA's positive impact on entrepreneurial orientation (Ciampi et al., 2021; Dubey et al., 2020). Sahi et al., (2019) found that information technology competencies enhance entrepreneurial orientation by enabling innovation, risk-taking, and proactive decisions in an unstable market environment. Sahi et al., (2019) research reveals how novel technological developments have contributed to improving entrepreneurial efforts in operational response by enhancing the ability to analyze and meet market needs. Hooi et al., (2018) argue that utilizing BDA helps organizations collect and process market information to understand better consumer preferences, which will contribute to raising the effectiveness of innovation in the organization. Elgendy & Elragal, (2014) have shown the benefits of using BDA as a business instrument to support decision-making processes and enhance risk management. According to (Al-Darras & Tanova, 2022), BDA adoption can dramatically improve pro-activeness by allowing businesses to recognize trends, forecast outcomes, monitor real-time data, actively engage customers, reduce risks, and optimize processes. Businesses can use BDA insights to guide their decision-making and take proactive measures to stay ahead in a quickly changing environment.

From the preceding discussion, the following hypothesis is posited:

H9: BDA adoption has a positive impact on corporate entrepreneurship.

## 4 Research Method

A paper-based questionnaire was developed based on (TOE) theory, (DOI) theory, and the related literature. The measurement items were developed using the following related literature, as shown in Table 1.

Table 1: Sources of Construct Measurement

Construct	Code	No. of Items	References
Relative Advantage	RA	3	(Hung et al., 2016; Maroufkhani et al., 2022)
Complexity	CX	3	(Maduku et al., 2016; Lai et al., 2018)
Perceived security concerns	PS	3	(Al-Dmour et al., 2021)
Top management support	TM	3	(Maroufkhani et al., 2022; Lutfi et al., 2022)
Organizational Readiness	OR	3	(Maroufkhani et al., 2022; Maduku et al., 2016)
Government regulations and policy	GR	3	(Lai et al., 2018)
Competitive pressures	CP	3	(Lai et al., 2018)
Partner pressures	PR	3	(Hyun et al., 2019)
BDA adoption	BDAA	7	(Maroufkhani et al., 2022; Al-Dmour et al., 2021)
Corporate Entrepreneurship	CE	9	(Al-Darras & Tanova, 2022).

A 5-point Likert scale ranging from “1=strongly disagree” to “5=strongly agree ” was used to score answers for the study sample. Since this study was to be conducted in Jordan, a professional translator translated the questionnaire into Arabic. Once the questionnaire was prepared, it was assessed for validity. The questionnaire items were evaluated and tested by six experts in the information system and entrepreneurship fields, and their guidance was taken to update some of the questionnaire items. In addition, for further reliability and clarity regarding the wording of the questions, a pilot study was

undertaken with 30 respondents. Based on the pilot study feedback, the questionnaire was adjusted suitably, as shown in Table 3.

## 5 Sampling and Questionnaire Administration

It has recently been noted that the economy has become heavily dependent on BD. Data has become the new oil for the current economy. BDA has become a major support for the competitive advantage and sustainability of pharmaceutical companies by providing these companies with consumer patterns and behaviors. These analyses also enable companies to improve their work, discover medicines more effectively, and provide solutions for personalized health care. However, pharmaceutical companies in emerging countries still adopt outdated strategies to achieve a competitive advantage. The vast majority of these companies also face many obstacles to adopting a modern strategy that adopts BDA to support entrepreneurship (Hassanin & Hamada, 2022). This study attempted to determine the drivers of BD adoption and its impact on corporate entrepreneurship. The study was applied to a sector that uses BD applications, where entrepreneurship and creativity must be applied as a methodology for survival and achieving the research objectives. Accordingly, this study was carried out among Jordanian pharmaceutical industry corporations. Based on the data available at the Amman Chamber of Commerce, six companies were selected that met the requirements of the study.

Respondents were selected from top and middle management. The reasons for selecting these managers were that they had the required information to answer the study questionnaire, having thoroughly perceived and studied the BD strategies their corporations applied. Moreover, middle managers have a growing role in encouraging or inhibiting entrepreneurial efforts (Duhan & Singh, 2014). Of the 250 paper-based questionnaires distributed, 219 valid responses were received, giving a response rate of 87%. According to (Hair et al., 2009), the suitable sample size for an SEM analysis is five responses per study instrument item. This study instrument included 40 items. As such, 200 valid responses were required. The number of responses received and included in this study (219) exceeded the minimum threshold of 200. The demographic profiles are shown in Table 2.

Table 2: Demographic Profile

Demographic variables	Description	Frequency	Percent
Gender	M	161	73.5
	F	58	26.5
	Total	219	100%
Age	25-35	70	31.9
	36-45	42	19.2
	>45	107	48.9
	Total	219	100%
Education	BCS	163	74.4
	MSC	37	16.9
	PHD	19	8.7
	Total	219	100%
Years of Experience	1-5	48	21.9
	6-10	70	32
	11-15	72	32.9
	>15	29	13.2
	Total	219	100%

## 6 Measurement of Model Validity and Reliability

SPSS 29 and AMOS 29.0 were used to analyze the data. AMOS is a widespread instrument for empirical studies in several fields. It allows researchers to examine intricate hypothetical models and get insights into the associations among variables. Moreover, it has a range of fit indices and statistics

to assess how well the given model fits the empirical data (Collier, 2020). Table 3 presents the composite reliability (CR) values, descriptive statistics, average variance (AVE), Cronbach's alpha, and factor loading. Cronbach's alpha and composite reliability were utilized to analyze the internal consistency reliability (Hair et al., 2009). Table 3 demonstrates that all constructs have adequate internal consistency and reliability values above the suggested cutoff of 0.70. Factor loadings, composite reliability, and average variance (AVE) were used to evaluate convergent validity. Table 3 shows that the composite reliability, average variance, and factor loading satisfy the suggested cutoff (CA>0.7 and AVE>0.5, factor loading>50) (Hair et al., 2009). Table 4 shows that the square root of AVE values exceeds the inter-correlations between the constructs, suggesting adequate discriminant validity (Fornell & Larcker, 1981).

The proposed model's fitness was calculated using confirmatory factor analysis (CFA) with the latent construct. The results shown in Table 5 demonstrate that all the variable indices ( $\chi^2 / df < 3$ , comparative fit index (CFI), normed fit index (NFI), Tucker Lewis index, and goodness of fit index (GFI) > 0.9, and root mean square error of approximation (RMSEA) < 0.08) are in the adequate range (Hair et al., 2009), showing an acceptable fit of the sample data with the hypothetical model and providing evidence supporting the validity of the measures.

Table 3: Descriptive Statistics, Explanatory Factor Analysis (EFA) of Study Variables

	Construct	Mean	SD	Factor Loadings	CR	AVE
RA1	Adopting BDA can enhance operations effectively	3.082	1.366	0.698	0.724	0.551
RA2	Adopting BDA can improve productivity, accuracy, and quality.	3.114	1.408	0.666		
RA3	BDA is used to find new markets and customers.	3.064	1.353	0.686		
<b>Relative Advantage (Cronbach's alpha = 0.778)</b>		3.087	0.950	NA		
CX1	The utilization of BDA requires a very large intellectual effort.	2.858	0.719	0.793	0.729	0.580
CX2	Implementing BDA in our company will require complex skills	2.918	0.750	0.792		
CX3	BD is perceived as being hard to realize and utilize	2.950	0.725	0.510		
<b>Complexity (Cronbach's alpha = 0.726)</b>		2.693	0.445	NA		
PS1	The company believes that it will be safe to adopt BD	3.457	0.568	0.815	0.739	0.691
PS2	I believe BDA adoption will not transfer critical organizations' data to a third party.	3.210	0.841	0.841		
PS3	The privacy of business data is safe when using BDA services	3.237	0.716	0.575		
<b>Perceived Security (Cronbach's alpha = 0.771)</b>		3.301	0.472	NA		
TM1	Our top management supports the use of BDA in the organization.	3.388	0.635	0.799	0.846	0.781
TM2	Our company introduces the initiatives for adopting BDA applications.	3.461	0.560	0.765		
TM3	The company considers embracing BDA as a strategic priority.	3.388	0.613	0.848		
<b>Top Management Support (Cronbach's alpha = 0.768)</b>		3.412	0.429	NA		
OR1	The high costs of adopting BDA are an obstacle to its full exploitation.	3.516	1.068	0.825	0.807	0.713
OR2	The weakness of my company's IT infrastructure prevented BD from being properly exploited	3.662	1.077	0.840		
OR3	Lacking analytics ability prevents the business from fully exploiting BD analytics.	3.621	1.061	0.610		
<b>Organizational Readiness (Cronbach's alpha = 0.804)</b>		3.600	0.827	NA		
GR1	The governmental regulations encourage our company to adopt BD applications	3.594	1.020	0.795	0.768	0.638
GR2	Government regulations provide dedicated laws to deal with the	3.612	1.045	0.633		

	security anxieties over BD applications.					
CP3	Our company would adopt BD in reply to what competitors are act	3.425	1.039	0.740		
<b>Government Regulations and policy (Cronbach's alpha = 0.783)</b>		3.543	0.780	NA		
CP1	The company's decision to use BD is impacted by what competitors are doing in the same domain.	2.575	0.514	0.673	0.754	0.610
CP2	Our company is under squeeze from competitors to embrace BD applications.	2.516	0.519	0.788		
CP3	Our company would adopt BD in reply to what competitors are doing.	2.525	0.519	0.668		
<b>Competitive Pressures (Cronbach's alpha = 0.736)</b>		2.539	0.375	NA		
PR1	The adoption of BDA systems needs support from trading partners.	3.434	1.013	0.755	0.827	0.747
PR2	The adoption of BDA would be affected by the marketing actions of trading partners.	3.384	0.908	0.840		
PR3	The adoption of BDA would be affected by the level of trading partners' support.	3.598	1.029	0.756		
<b>Partner Pressures (Cronbach's alpha = 0.798)</b>		3.472	0.801	NA		
BDAA1	The company uses BDA in the process of customer segmentation and description.	2.776	0.550	0.891	0.934	0.905
BDAA2	The company uses BDA in the process of analyzing customer feedback effectively.	2.813	0.564	0.782		
BDAA3	The company uses BDA in business procedure enhancement and automation.	2.699	0.621	0.836		
BDAA4	The company uses BDA to improve customer relationship management.	2.685	0.588	0.875		
BDAA5	The company uses BDA in the prediction of market and customer demands.	2.685	0.618	0.794		
BDAA6	The company uses BDA to develop risk management processes.	2.694	0.623	0.911		
BDAA7	The company uses BDA to increase savings in supply chain management.	2.680	0.612	0.604		
<b>BDA Adoption (Cronbach's alpha = 0.846)</b>		2.719	0.395	NA		
INO1	Our company always provides novel ideas for products in marketplaces.	3.329	0.599	0.792	0.817	0.729
INO2	Our company always strives to adopt innovative initiatives to exploit opportunities in the market.	3.283	0.535	0.818		
INO3	Our company is ready to try uncommon solutions in its work.	3.247	0.666	0.709		
<b>Innovativeness (Cronbach's alpha = 0.756)</b>		3.286	0.481	NA		
PR1	Our company seeks to invest in new projects and opportunities before competitors do so.	2.785	1.386	0.798	0.745	0.597
PR2	The company always strives to provide new ideas and products that precede its competitors	2.776	1.375	0.726		
PR3	Our company always succeeds in predicting future changes in the work environment	2.703	1.414	0.574		
<b>Pro-activeness (Cronbach's alpha = 0.735)</b>		2.755	1.011	NA		
RT1	The company prefers to invest in high-risk projects	3.137	0.856	0.752	0.768	0.647
RT2	The company adopts risky procedures to achieve its goals	3.347	1.306	0.870		
RT3	The company adopts the idea of venturing into the unknown without fear or hesitation	3.543	1.097	0.529		
<b>Risk-Taking (Cronbach's alpha = 0.789)</b>		3.342	0.756	NA		

Table 4: Correlation matrix (Discriminant Validity of the study constructs)

	<b>RA</b>	<b>CX</b>	<b>PS</b>	<b>TMS</b>	<b>OR</b>	<b>GR</b>	<b>CP</b>	<b>PR</b>	<b>BDAA</b>	<b>CE</b>
<b>RA</b>	<b>0.899</b>									
<b>CX</b>	<b>0.183</b>	<b>0.173</b>								
<b>PS</b>	<b>- 0.059</b>	<b>- 0.016</b>	<b>0.222</b>							
<b>TMS</b>	<b>- 0.061</b>	<b>- 0.027</b>	<b>0.098</b>	<b>0.183</b>						
<b>OR</b>	<b>0.303</b>	<b>0.023</b>	<b>0.011</b>	<b>0.041</b>	<b>0.681</b>					
<b>GR</b>	<b>0.300</b>	<b>0.021</b>	<b>0.028</b>	<b>0.019</b>	<b>0.411</b>	<b>0.606</b>				
<b>CP</b>	<b>- 0.120</b>	<b>- 0.038</b>	<b>0.043</b>	<b>0.028</b>	<b>- 0.086</b>	<b>- 0.076</b>	<b>0.140</b>			
<b>PR</b>	<b>0.270</b>	<b>0.038</b>	<b>- 0.015</b>	<b>0.008</b>	<b>0.245</b>	<b>0.253</b>	<b>- 0.068</b>	<b>0.639</b>		
<b>BDAA</b>	<b>- 0.171</b>	<b>- 0.018</b>	<b>- 0.020</b>	<b>- 0.023</b>	<b>- 0.177</b>	<b>- 0.144</b>	<b>0.051</b>	<b>- 0.166</b>	<b>0.155</b>	
<b>CE</b>	<b>- 0.006</b>	<b>- 0.014</b>	<b>0.044</b>	<b>0.041</b>	<b>0.037</b>	<b>0.017</b>	<b>0.022</b>	<b>0.001</b>	<b>- 0.014</b>	<b>0.155</b>

Table 5: Results of conformity analysis

<b>Construct</b>	<b>Criteria</b>	<b>CMIN/DF</b>	<b>GFI</b>	<b>NFI</b>	<b>TLI</b>	<b>CFI</b>	<b>RMSEA</b>
	<b>Threshold values</b>	<b>&lt;3</b>	<b>&gt;0.90</b>	<b>&gt;0.90</b>	<b>&gt;0.90</b>	<b>&gt;0.90</b>	<b>&lt;0.080</b>
Technical factors (relative advantages, complexity, and security)		<b>2.327</b>	<b>0.948</b>	<b>0.914</b>	<b>0.922</b>	<b>0.948</b>	<b>0.078</b>
Organizational Factors (TM and OR)		<b>1.607</b>	<b>0.979</b>	<b>0.978</b>	<b>0.984</b>	<b>0.991</b>	<b>0.053</b>
Environmental factors (competitive pressures, government regulations, and partner pressures)		<b>1.914</b>	<b>0.971</b>	<b>0.958</b>	<b>0.952</b>	<b>0.979</b>	<b>0.065</b>
BDA adoption		<b>1.764</b>	<b>0.982</b>	<b>0.958</b>	<b>0.946</b>	<b>0.986</b>	<b>0.059</b>
Entrepreneurship (innovativeness, pro-activeness, and risk-taking)		<b>1.725</b>	<b>0.973</b>	<b>0.930</b>	<b>0.932</b>	<b>0.968</b>	<b>0.058</b>

### 1) Hypothesis Testing

The hypothesized model helped investigate the paths accurately and realize the cause-and-effect association between the research variables. Table 6 shows the hypothesized paths, standardized path coefficients, critical ratios of the model, and results.

Table 6: Results of the Hypothesized Model

<b>Hypothesis</b>	<b>Paths</b>	<b>S.E.</b>	<b>C.R.</b>	<b>Estimate</b>	<b>P values</b>	<b>Decision</b>
H1	RA → BDAA	0.044	8.477	0.373	***	Supported
H2	CX → BDAA	0.062	1.468	0.091	0.246	Not Supported
H3	PS → BDAA	0.047	4.404	0.207	0.002	Supported
H4	TMS → BDAA	0.057	4.667	0.266	0.002	Supported
H5	OR → BDAA	0.054	4.370	0.236	0.002	Supported
H6	GR → BDAA	0.055	2.109	0.116	0.111	Not Supported
H7	CP → BDAA	0.058	6.759	0.392	***	Supported
H8	PR → BDAA	0.043	5.209	0.224	***	Supported
H9	BDAA → CE	0.046	13.957	0.642	***	Supported
Note(s): *Significance at p < 0.10. **Significance at p < 0.05. ***Significance at p < 0.01						

All the fit indices of the variables (CFI, GFI, NFI, RMSEA, and  $\chi^2 /df$ ) had satisfactory values, as shown in Table 7. Consequently, except for H2 and H6, the other suggested hypotheses (H1, H3, H4, H5, H7, H8, and H9) were found to be impacted, as shown in Figure 2.

Table 7: Model fit indices

<b>Criteria</b>	<b>Threshold values</b>	<b>Model Fit Indices</b>
CMIN/DF	<3	1.853
GFI	>0.90	0.969
AGFI	>0.90	0.914
NFI	>0.90	0.931
TLI	>0.90	0.922
CFI	>0.90	0.966
RMSEA	<0.080	0.063

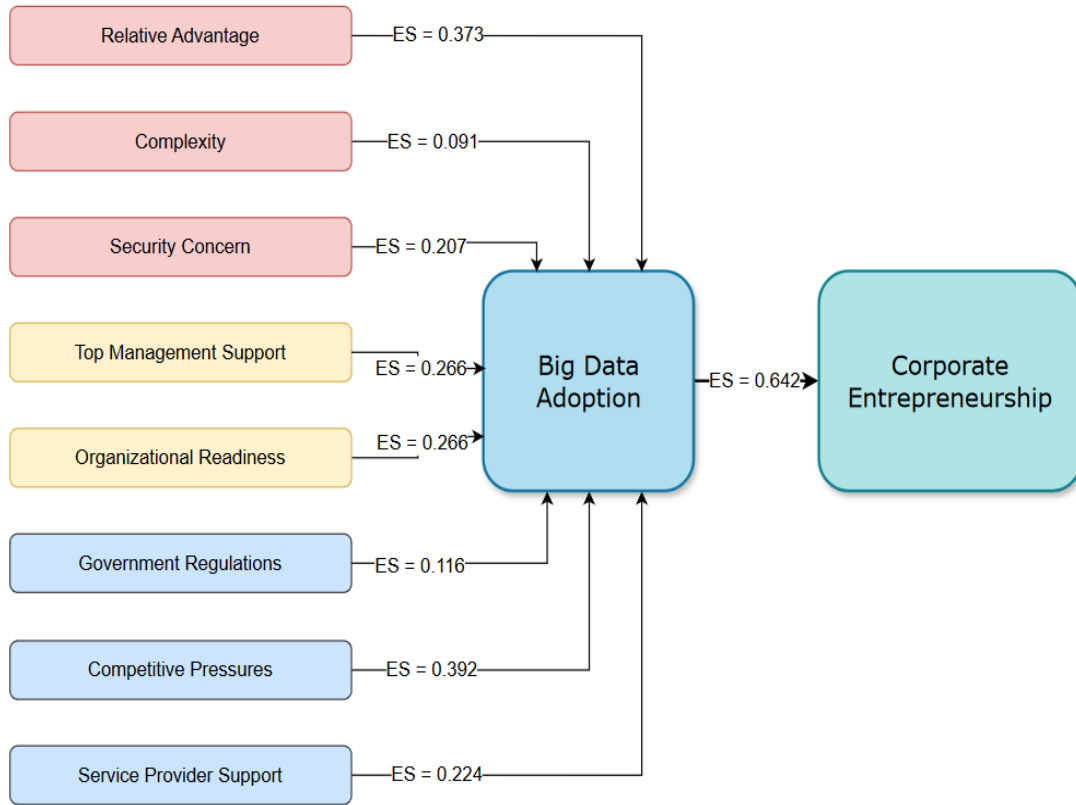


Figure 2: The results of the structural model

## 7 Discussion

BD capabilities can facilitate business functions and generate competitive advantages. Although many businesses have invested in BDA to increase their competitiveness level, several limitations still hinder the adoption of this technology (Al-Darras & Tanova, 2022; Maroufkhani et al., 2022). Empirical research has revealed some conflicting viewpoints regarding the drivers of BD adoption in organizations (Al-Dmour et al., 2021; Asiaei & Rahim, 2019). Moreover, empirically studying the role of BDA in corporate entrepreneurship is necessary. In this context, this study explored the drivers of BD adoption and its impact on corporate entrepreneurship (Belás et al., 2015).

The results confirm that a relative advantage significantly and positively impacts BDA adoption. In addition, the results revealed that the relative advantages factor is the most important technological factor that has impacted BDA adoption. Prior research (Elgendy & Elragal, 2014; Soon et al., 2016) has shown that BDA has relative benefits in enhancing operational efficiency, providing businesses with competitive advantages, reducing costs, and enabling customization. These benefits encourage firms to adopt BDA to use data-driven insights to enhance business operations. These results also align with other researchers (Lutfi et al., 2022; Zhang et al., 2019), who have confirmed that BD analytics perceived relative advantage as an important factor and significantly affected its adoption. Furthermore, Lai et al., (2018) asserted that relative advantage is important in adopting ICT innovations. We emphasize the importance of showing and explaining the relative benefit of using BDA to all employees and officials of a corporation before adopting it.

One finding is that complexity has no negative impact on BDA adoption. Indeed, the complexity connected with BDA applications can positively and negatively affect its adoption. This result is

consistent with (Lai et al., 2018), who confirmed that technological complexity does not affect BD analytics' adoption. These results also contradict the opinion of (Maroufkhani et al., 2022), who indicated that complexity negatively affects BDA adoption in corporations. We can attribute this result to corporations' interest in attracting employees with distinguished technological expertise and continuous training in modern technology. Notwithstanding this result, corporations need to evaluate technological complexities carefully and formulate plans to overcome technological challenges to achieve the advantages that BD applications can offer.

The results show that security and privacy controls determine the extent of adoption of BDA applications. Despite BDA's enormous potential for helping businesses gain insights and make data-driven choices, adoption may be hampered by security and control concerns. These conclusions are consistent with those of other studies (Al-Dmour et al., 2021; Maroufkhani et al., 2022), underscoring the importance of security perceptions in BDA adoption. According to that, for BDA to be widely used, security and control issues must be resolved. Corporations must recruit qualified cyber security staff, apply best practices for protecting BD environments, and set up adequate governance frameworks. We emphasize the importance of showing and clarifying the procedures used and the protocols for protecting BD to all employees and officials of the corporation.

The results indicate that top management support positively impacted BDA adoption. Also, the findings demonstrated that top management support is the most important organizational factor that has impacted BDA adoption. These results are compatible with (Maduku et al., 2016) and (Lai et al., 2018) findings emphasizing the importance of top management support in BDA adoption. Thus, senior management support is essential to adopting and integrating BDA successfully within a business. This support can comprise the resources, strategic guidance, culture, and assistance for change management required to utilize BDA and generate business value fully.

Our study's findings support the idea that adopting BDA depends on organizational readiness. These results align with prior studies (Choi et al., 2022; Maduku et al., 2016; Maroufkhani et al., 2022), asserting that organizational readiness is essential for adopting BDA applications and getting high benefits. Organizational preparation creates the conditions for successfully adopting BDA by putting the required infrastructure, data governance procedures, culture, and goals in place.

The results of the current study validate the hypothesized impact between competitive pressures and BDA adoption. Moreover, the results confirmed that competitive pressures are the most important environmental factor that has impacted BDA adoption. Previous studies (Lai et al., 2018; Sumbal et al., 2019) have shown that competitive pressures may accelerate the adoption of BDA by corporations. Indeed, by supplying the business with important consumer insights that would affect its dynamic ability, BDA applications' adoption could enhance a corporation's competitive advantage.

According to the results of this study, government support does not play a role in BDA adoption. This contradicts (Al-Dmour et al., 2021; Park & Yun, 2021), who showed that government regulations may facilitate BDA adoption. We can attribute this result to a lack of laws and regulations governing or dealing with BD, with most laws directed toward government institutions. Indeed, the government must balance support for innovation with preserving privacy and security. Excessive or too stringent rules may make it more difficult for businesses to utilize BDA. Governments must, therefore, collaborate with industry leaders and academia to create efficient, reasonable, and flexible rules to accommodate changing technologies and societal demands.

The findings confirm that partner pressures are important in whether corporations use BD analytics. These results are compatible with emphasizing that partner pressures affect BDA adoption.

Nevertheless, companies should consider the viability, value, and impact of implementing BDA based on their unique requirements, resources, and objectives. Rushing into BDA adoption entirely under the influence of partners without careful planning and consideration could result in less-than-ideal results.

The study's results indicate that BDA adoption significantly and positively impacts corporate entrepreneurship. These findings agree with earlier research (Ciampi et al., 2021; Dubey et al., 2020), showing that BDA adoption positively impacts entrepreneurial orientations. According to (Hooi et al., 2018), using BDA enables businesses to gather and process market data to better understand consumer preferences, increasing innovation's effectiveness. The adoption of BDA encourages corporate entrepreneurship by providing access to valuable information, encouraging innovation, and enhancing the capacity for decision-making. Moreover, corporations may support entrepreneurial activities, respond to shifting market dynamics, and foster an innovative culture within the workplace by utilizing data-driven insights.

## 1) Theoretical and Practical Implications

### ▪ Theoretical Implications

This study's results could significantly contribute to BD literature based on the empirical evidence provided of the factors determining BDA adoption. The study utilized technological factors and environmental and organizational perspectives through a validated measurement model that combines TEO and DIO theories. The study focuses on the technological aspects associated with BDA adoption, such as the availability of innovative analytics tools, perceived relative advantages of these tools, complexity, and perceived security concerns. By enabling an understanding of the role of these technological factors, the study may contribute to the literature by providing insights into how organizations can effectively harness the BDA applications for corporate entrepreneurship. It is crucial to convey and articulate the greater advantages of BDA over existing options, as suggested by the theoretical implications of comparative advantages on the depth of BDA adoption. Organizations can improve users' perceptions of the benefits of BDA, align BDA initiatives with strategic goals, and leverage their comparative advantages to drive innovation, efficiency, and competitive advantage by leveraging theoretical insights from DOI theory. If companies believe that BDA technologies pose security threats such as data breaches, illegal access, or privacy violations, they can be reluctant to implement them. In theory, organizations can reduce perceived risk and encourage BDA adoption by resolving security issues and enhancing trust through strong security measures, encryption techniques, and access controls.

The results show the importance of organizational factors, including top management support and organizational readiness. This result highlights the importance of the top management role in communication, resource allocation, business modeling, change management, and organizational culture in promoting deeper adoption and integration of BDA within organizations. Organizations can accelerate BDA adoption, foster cultural change, and fully realize BDA's promise of driving innovation, performance, and competitive advantage by leveraging the support and influence of senior management. Moreover, the study emphasized the significance of readiness for change, resource readiness, and specialized expertise in driving more in-depth adoption of BDA within organizations. In studying these elements, the study advances knowledge of the mandatory organizational dynamics for effective BDA adoption.

Furthermore, this study analyzes the role of environmental factors, including government regulations, competitive pressures, and partner pressures. The study emphasizes the role that partner



requirements, competitive pressures, and government requirements play in influencing how companies adopt BDA. Organizations can promote deeper adoption of BDA and improve its potential impact on innovation, performance, and competitive advantage by understanding and mitigating these contextual aspects. The attempt to understand these components and their impact can also enrich the literature on the role of environmental factors needed to adopt BDA applications. Given the dynamic nature of BD applications, constant research into the factors influencing their acceptance is necessary, and this study may provide impetus to that effort.

The study investigates the relationship between corporate entrepreneurship and BDA adoption. It explores how corporate entrepreneurship is impacted by BDA adoption, illuminating the connection between these two key ideas by studying how utilizing BDA may encourage entrepreneurship within corporations, including innovation, risk-taking, and pro-activeness. A clear understanding of this relationship will contribute to increasing awareness of the role of adopting BDA in improving corporate entrepreneurship. Indeed, the theoretical implications of BDA regarding the depth of corporate entrepreneurship show how organizations can be transformed by using data-driven insights, developing an innovative, collaborative, and experimental culture, and encouraging depth in entrepreneurial endeavors. Organizations can leverage the power of BDA to enhance the depth of corporate entrepreneurship and achieve a sustainable corporate environment in today's dynamic business conditions by leveraging insights from TOE and DOI theories.

#### ▪ **Practical Implications**

The study offers information on the factors that determine the adoption of BDA in corporations. Managers can use this knowledge to improve their decision-making regarding implementing BDA applications in their processes. Additionally, the findings offer insights for corporate decision-makers when it comes to identifying and evaluating the many risks and opportunities related to the use of BD analytics. This study's results may also enhance practitioners' competence in diagnosing the important factors that inspire or hinder corporations when adopting BDA. This research offers worthwhile managerial implications for policymakers to enhance corporate entrepreneurship (innovation, pro-activeness, and risk-taking) by efficiently utilizing BD analytical capabilities. Indeed, BDA provides insights into possible risks, uncertainties, and market dynamics to assist organizations in managing innovation threats. BDA helps companies assess competitive threats, market directions, and regulatory shifts. This information helps companies predict risks and create proactive risk mitigation plans that will save their investments in innovation and build stability. Unfortunately, top management is often hesitant to invest in data-driven procedures despite the boom in BD technologies over the past ten years due to a lack of relevant knowledge, the high cost of BDA implementation, and the lack of clarity regarding the near-term benefits. The outcomes from this study offer proof that decisions that rely on BDA can improve corporate entrepreneurship, including opportunity identification, quick experimentation, customer-centric innovation, data-driven decision-making, agility, collaboration, resource optimization, and risk reduction.

Identifying factors influencing the adoption of BDA and how it affects corporate entrepreneurship contributes to organizations' efforts to obtain a competitive advantage by developing novel products, improving customer relationship management, predicting market and customer demands, risk management processes, and supply chain management. The study emphasized the technical aspects of BDA adoption in the pharmaceutical sector, such as solving problems related to data management and integration, developing scalable infrastructure, using advanced artificial intelligence capabilities, securing data, and providing user training.

By addressing these technical issues, pharmaceutical companies may improve the benefits of BDA adoption, stimulate innovation, and boost competitiveness in the changing healthcare market. The study also emphasized the necessity to enlist senior executives and stakeholders to support BDA activities, convey the strategic significance of BDA, and coordinate BDA goals with organizational objectives. Develop an innovative and data-driven decision-making culture by encouraging cooperation, openness, and responsibility between departments and functions. Pharmaceutical firms can enable a BDA adoption environment and ensure a thorough implementation by obtaining organizational alignment and executives. In addition, environmental factors have an important role. Therefore, pharmaceutical companies should address industry standards and best practices, embrace ecosystem integration and technology innovation, monitor market trends and competitive intelligence, and strongly emphasize centeredness value-based care.

Finally, this study confirms that the environmental, organizational and technological factors adopted from DOI and TOE theories interact with each other and support the adoption of big data analytics, which improves corporate entrepreneurship with all its elements: creativity, pro-activeness, and risk-taking. By acknowledging the factors determining the adoption of BDA, BDA application providers can make additional decisions to improve BD services or make required changes to encourage corporations to adopt BD approaches. Accordingly, provider companies may provide trial versions and training programs that reduce corporations' concerns about organizational and technological readiness to adopt BDA (Baldi et al., 2020).

## **8 Conclusions and Limitations**

Given the veritable explosion of corporate data, adopting BDA has become crucial. However, companies that undergo such processes must adhere to guidelines, including evaluating all factors affecting the adoption process. This is because using BDA applications in business has benefited corporations and business holders in terms of better decision-making, more innovation, and product price optimization. While previous research has focused on examining various factors in organizational, technological, or environmental contexts, a comprehensive research model has not considered the interplay between these determinants of BD adoption. The literature reviews also revealed the paucity of empirical studies that can explain and enhance our understanding of how BDA can be integrated into corporate entrepreneurship.

Furthermore, recent research has emphasized the need for more studies across countries and regions, especially in emerging economies, which may have different considerations in adopting BD. Filling some of these gaps, this study examines a comprehensive framework of the drivers of BDA adoption based on the TOE and DOI theories. It also empirically investigates the role of BDA adoption in corporate entrepreneurship in emerging markets.

The results confirm that technological factors, including relative advantage and perceived security, significantly and positively impact BDA adoption. BDA can accelerate drug discovery, enhance post-market surveillance, improve market access methods, and help manage population health. These are the relative benefits of implementing BDA in the pharmaceutical sector. Companies that understand and use these comparative advantages correctly have a greater chance of successfully implementing and integrating BDA into their operations, giving them a competitive advantage in the rapidly changing healthcare market. Regarding security concerns, patient health information and intellectual property are sensitive, and data security and privacy are critical in the pharmaceutical industry. Pharmaceutical companies benefit from technological advances in data anonymization, access control, authentication, encryption, and authentication. These advances help them obey governing necessities

such as the General Data Protection Regulation, maintain data privacy, and reduce cybersecurity risks associated with BDA programs. They also indicate a significant and positive impact of organizational factors, including top management support and organizational readiness, on BDA adoption.

Top management support is essential to drive the adoption of BDA in the pharmaceutical business. This provision can be provided through allocating resources, aligning goals, driving change, managing risk, collaborating, engaging stakeholders, and measuring success. Robust management support at the highest level enhances an organization's chances of overcoming challenges, achieving positive outcomes, and realizing the full potential of BDA to drive innovation, improve patient outcomes, and enhance the competitiveness of the pharmaceutical sector. In addition, Organizations ought to have a strong data infrastructure to support BDA ambitions. Institutions that want to adopt BDA have created and sustained a dedicated data infrastructure to help the analysis of enormous and complicated datasets in pharmaceutical corporations.

Regarding the environmental factors, the findings show that competitive and partner pressures significantly and positively impact BDA adoption. In the context of competitive pressures, BDA gives companies a competitive advantage in the highly competitive pharmaceutical sector by helping them stay ahead of the curve, provide cutting-edge treatments, and drive development and profitability. In addition, in a dynamic and connected pharmaceutical ecosystem, pharmaceutical companies can enhance collaboration, entrepreneurship, efficiency, compliance, and competitiveness by implementing BDA in reaction to partner pressures. Furthermore, this study reveals that BDA adoption has a significant positive impact on corporate entrepreneurship. The study emphasized that adopting BDA enhances corporate entrepreneurship by encouraging innovation and thought generation, delivering market intelligence and consumer insights, and enabling cooperative ecosystems. In today's speedily shifting business environment, companies that embrace BDA as a strategic enabler of corporate entrepreneurship can reveal new opportunities, stimulate novelty, and build long-term competitive advantages.

However, it is crucial to understand that more than just data and technology are needed to implement BDA systems successfully. Developing a data-driven attitude, creating special BD governance standards, understanding and learning about the BDA applications used by business partners and competitors, and ensuring data security are all aspects that merit consideration. Organizations should invest in training for staff to be proficient in data analytics and interpretation. Organizations must also coordinate their strategic goals with insights derivative of BDA to promote fruitful outcomes and corporate expansion.

Although businesses from all sectors are investing in BD applications, the body of empirical data supporting BDA's positive effects on corporate entrepreneurship is still in its infancy. Considering this, the study seeks to significantly expand the body of knowledge on the value of business IT and business analytics tools by supplying extensive, trustworthy, empirical proof of the beneficial impact of BDA adoption on corporate entrepreneurship. Moreover, the results enhance our knowledge of the factors influencing businesses' adoption of BDA. The study's findings give managers a useful foundation for adopting BD analytical applications. The research also offers useful information for future empirical studies. This study has advanced the field of BD literature and may be helpful for upcoming studies in this area.

Despite this study's significance to scholars and practitioners, several shortcomings merit consideration. First, because BDA utilization is still in the early stages, various organizations may have different opinions about the business advantages of BDA, leading to varying interpretations of BDA. This could have an impact on the validity and reliability of this study. Second, the data used in

this research was gathered through questionnaires, the majority of which were answered by managers. This approach could present some challenges because, in some instances, individual decisions or impressions about a new technology do not accurately reflect those of the organizations. This may also explain the rejection of the hypotheses regarding the impact of complexity and government regulation on DDA adoption. Finally, employing a mixed-methods approach to research the variables influencing BDA adoption may result in deeper comprehension and justification of the studied phenomenon.

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## References

- [1] Abdullah, D. (2020). A Linear Antenna Array for Wireless Communications. *National Journal of Antennas and Propagation (NJAP)*, 2(1), 19-24.
- [2] Al-Darras, O.M.A., & Tanova, C. (2022). From big data analytics to organizational agility: What is the mechanism? *SAGE Open*, 12(2), <https://doi.org/10.1177/21582440221106170>
- [3] Al-Dmour, H., Saad, N., Basheer Amin, E., Al-Dmour, R., & Al-Dmour, A. (2021). The influence of the practices of big data analytics applications on bank performance: Filed study. *VINE Journal of Information and Knowledge Management Systems*, 53(1), 119-141. <https://doi.org/10.1108/VJKMS-08-2020-0151>
- [4] Al-ma'aitah, M. (2022). The impact of employees' resistance to change on e-government innovation and value creation. *International Journal of eBusiness and eGovernment Studies*, 14(2), 166-198.
- [5] Al-ma'aitah, M.A. (2022). Investigating the drivers of cybersecurity enhancement in public organizations: The case of Jordan. *The Electronic Journal of Information Systems in Developing Countries*, 88(5), e12223. <https://doi.org/10.1002/isd2.12223>
- [6] Al-Sai, Z.A., Abdullah, R., & Husin, M.H. (2020). Critical success factors for big data: A systematic literature review. *IEEE Access*, 8, 118940-118956. <https://doi.org/10.1109/ACCESS.2020.3005461>
- [7] Alsetoohy, O., Ayoun, B., Arous, S., Megahed, F., & Nabil, G. (2019), Intelligent agent technology: What affects its adoption in hotel food supply chain management? *Journal of Hospitality and Tourism Technology*, 10(3), 286-310. <https://doi.org/10.1108/JHTT-01-2018-0005>
- [8] Asiaei, A., & Rahim, N.Z.A. (2019). A multifaceted framework for adoption of cloud computing in Malaysian SMEs. *Journal of Science and Technology Policy Management*, 10(3), 708-750. <https://doi.org/10.1108/JSTPM-05-2018-0053>
- [9] Baldi, G., Diaz-Tellez, Y., Dimitrakos, T., Martinelli, F., Michailidou, C., Mori, P., & Saracino, A. (2020). Session-dependent Usage Control for Big Data. *Journal of Internet Services and Information Security*, 10(3), 76-92.
- [10] Baros, D. (2020). Evaluating the Efficacy of Using Computerized Shifting Information Systems (NCSIS) in organizations—Towards Effective and Computer Technology-Based Administration. *International Journal of Communication and Computer Technologies (IJCCTS)*, 8(1), 21-24.
- [11] Belás, J., Bilan, Y., Demjan, V., & Sipko, J. (2015). Entrepreneurship in SME segment: Case study from the Czech Republic and Slovakia. *Amfiteatru Economic Journal*, 17(38), 308-326. <http://hdl.handle.net/10419/168918>

- [12] Borgman, H.P., Bahli, B., Heier, H., & Schewski, F. (2013). Cloudrise: Exploring cloud computing adoption and governance with the TOE framework *In 46<sup>th</sup> HI International Conference on System Sciences*, pp. 4425-4435. <https://doi.org/10.1109/HICSS.2013.132>
- [13] Chakma, K.S., & Chowdhury, M.S.U. (2023). CSA Implementation Using Novel Methodology: RTL Development. *Journal of VLSI Circuits and Systems*, 5(2), 22-28.
- [14] Choi, H.S., Hung, S.Y., Peng, C.Y., & Chen, C. (2022). Different perspectives on big data analytics usage by management levels. *Journal of Computer Information Systems*, 62(3), 503-515. <https://doi.org/10.1080/08874417.2020.1858729>
- [15] Ciampi, F., Demi, S., Magrini, A., Marzi, G., & Papa, A. (2021). Exploring the impact of big data analytics capabilities on business model innovation: The mediating role of entrepreneurial orientation. *Journal of Business Research*, 123, 1-13. <https://doi.org/10.1016/j.jbusres.2020.09.023>
- [16] Collier, J. (2020). *Applied structural equation modeling using AMOS: Basic to advanced techniques*. Routledge.
- [17] Davis, F.D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, 38(3), 475-487. <https://doi.org/10.1006/imms.1993.1022>
- [18] Dubey, R., Gunasekaran, A., Childe, S.J., Bryde, D.J., Giannakis, M., Foropon, C., & Hazen, B.T. (2020). Big data analytics and artificial intelligence pathway to operational performance under the effects of entrepreneurial orientation and environmental dynamism: A study of manufacturing organizations. *International Journal of Production Economics*, 226, 107599. <https://doi.org/10.1016/j.ijpe.2019.107599>
- [19] Duhan, P., & Singh, A. (2014). Enterprise 2.0: A boon or bane for entrepreneurial and innovative expenditures?. *Journal of Innovation and Entrepreneurship*, 3(1), 1-19. <https://doi.org/10.1186/s13731-014-0015-z>
- [20] Elgendy, N., & Elragal, A. (2014). BD analytics: A literature review paper. In P. Perner (Ed.), *Advances in Data Mining. Applications and Theoretical Aspects. ICDM 2014. Lecture Notes in Computer Science*, 214–227. [https://doi.org/10.1007/978-3-319-08976-8\\_16](https://doi.org/10.1007/978-3-319-08976-8_16)
- [21] Fornell, C., & Larcker, D.F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50. <https://doi.org/10.1177/002224378101800104>
- [22] Fraccastoro, S., & Gabrielsson, M. (2018). Effects of social media usage on the speed of international growth of an international new venture. *In Proceedings of the 51<sup>st</sup> Hawaii International Conference on System Sciences*, 4309-4316.
- [23] Gao, D., Wang, G.G., & Pedrycz, W. (2020). Solving fuzzy job-shop scheduling problems using DE algorithm improved by a selection mechanism. *IEEE Transactions on Fuzzy Systems*, 28(12), 3265-3275. <https://doi.org/10.1109/TFUZZ.2020.3003506>
- [24] Gupta, A. (2016). Review on big data promises for information security. *Journal of Data Mining and Management*, 1(1), 1-8.
- [25] Hair, J.F., Black, W.C., Babin, B.J., & Anderson, R.E. (2009). *Multivariate data analysis*. Pearson.
- [26] Hakkaraki, V. (2023). A Bibliometric Analysis of Journal of Scientometric Research Based on Dimensions Database. *Indian Journal of Information Sources and Services*, 13(1), 26–31.
- [27] Hassanin, M.E., & Hamada, M.A. (2022). A big data strategy to reinforce self-sustainability for pharmaceutical companies in the digital transformation era: A case study of Egyptian pharmaceutical companies. *African Journal of Science, Technology, Innovation and Development*, 14(7), 1870-1882. <http://dx.doi.org/10.1080/20421338.2021.1988409>
- [28] Hooi, T.K., Abu, N.H.B., & Rahim, M.K. I.A. (2018). Relationship of big data analytics capability and product innovation performance using smart PLS 3.2.6: Hierarchical component modeling in PLS-SEM. *International Journal of Supply Chain Management*, 7(1), 51–64.

- [29] Hung, S.Y., Huang, Y.W., Lin, C.C., Chen, K.C. & Tarn, M. (2016). Factors influencing business intelligence systems implementation. *In PACIS 2016 Proceedings 297*. <https://aisel.aisnet.org/pacis2016/297>
- [30] Hyun, Y., Hosoya, R., & Kamioka, T. (2019). The moderating role of democratization culture: Improving agility through the use of big data analytics. *In PACIS 2019 Proceedings. 181*. <https://aisel.aisnet.org/pacis2019/181/>
- [31] Ibrahim, R. (2020). Workstation Cluster's Hadoop Distributed File System Simulation and Modeling. *International Journal of Communication and Computer Technologies (IJCCTS)*, 8(1), 1-4.
- [32] Jeong, H.L., Ahn, S.K., Baek, S.H., & Park, K.W. (2019). Anomaly Detection Technology Using Potential Difference Displacement Detection of Data Bus. *Journal of Internet Services and Information Security*, 9(4), 68-77.
- [33] Joseph, R.C., & Johnson, N.A. (2013), Big data and transformational government, *IT Professional*, 15(6), 43-48. <https://doi.org/10.1109/MITP.2013.61>
- [34] Kapoor, K.K., Dwivedi, Y.K., & Williams, M.D. (2014), Rogers' innovation adoption attributes: a systematic review and synthesis of existing research, *Information Systems Management*, 31(1), 74-91. <https://doi.org/10.1080/10580530.2014.854103>
- [35] Karim, S., Al-Tawara, A., Gide, E., & Sandu, R. (2017). Is big data too big for SMEs in Jordan? *In 8<sup>th</sup> International Conference on Information Technology (ICIT)*, 914-922.
- [36] Kumar, V., & Garg, M.L. (2018). Predictive analytics: A review of trends and techniques. *International Journal of Computer Applications*, 182(1), 31-37.
- [37] Lai, Y., Sun, H., & Ren, J. (2018), Understanding the determinants of big data analytics (BDA) adoption in logistics and supply chain management: An empirical investigation, *The International Journal of Logistics Management*, 29(2), 676-703. <https://doi.org/10.1108/IJLM-06-2017-0153>
- [38] Lutfi, A., Alsyouf, A., Almaiah, M.A., Alrawad, M., Abdo, A.A.K., Al-Khasawneh, A.L., & Saad, M. (2022). Factors influencing the adoption of big data analytics in the digital transformation era: Case study of Jordanian SMEs. *Sustainability*, 14(3), 1802. <https://doi.org/10.3390/su14031802>
- [39] Maduku, D.K., Mpinganjira, M., & Duh, H. (2016), Understanding mobile marketing adoption intention by South African SEMs: A multi-perspective framework. *International Journal of Information Management*, 36(5), 711-723. <https://doi.org/10.1016/j.ijinfomgt.2016.04.018>
- [40] Maroufkhani, P., Iranmanesh, M., & Ghobakhloo, M. (2022). Determinants of adoption in small and medium-sized enterprises (SMEs). *Industrial Management & Data Systems*, 123(1), 278-301. <https://doi.org/10.1108/IMDS-11-2021-0695>
- [41] Mathur, G., Nathani, N., Chauhan, A.S., Kushwah, S.V., & Quttainah, M.A. (2024). Students' Satisfaction and Learning: Assessment of Teaching-Learning Process in Knowledge Organization. *Indian Journal of Information Sources and Services*, 14(1), 1-8.
- [42] Nasrollahi, M., Ramezani, J., & Sadraei, M. (2021). The impact of big data adoption on SMEs' performance. *Big Data and Cognitive Computing*, 5(4), 68. <https://doi.org/10.3390/bdcc5040068>
- [43] Nedev, S. (2014). Exploring the factors influencing the adoption of cloud computing and the challenges faced by the business, *Enquiry-The ACES Journal of Undergraduate Research*, 5(1), 1-45.
- [44] Oliveira, T, Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. *Information & Management*, 51(5), 497-510. <https://doi.org/10.1016/j.im.2014.03.006>
- [45] Park, J.H., & Kim, Y.B. (2021). Factors activating BD adoption by Korean firms. *Journal of Computer Information Systems*, 61(3), 285-293. <https://doi.org/10.1080/08874417.2019.1631133>

- [46] Presutti, M., & Odorici, V. (2019). Linking entrepreneurial and market orientation to the SME's performance growth: The moderating role of entrepreneurial experience and networks. *International Entrepreneurship and Management Journal*, 15(3), 697–720. <https://doi.org/10.1007/s11365-018-0533-4>
- [47] Ragu-Nathan, B.S., Apigian, C.H., Ragu-Nathan, T.S., & Tu, Q. (2004). A path analytic study of the effect of top management support for information systems performance. *Omega*, 32(6), 459-471. <https://doi.org/10.1016/j.omega.2004.03.001>
- [48] Raymond, L., Bergeron, F., Croteau, A.M., & St-Pierre, J. (2015). Entrepreneurial orientation and e-business capabilities of manufacturing SMEs: An absorptive capacity lens. In *IEEE 48<sup>th</sup> Hawaii International Conference on System Sciences (HICSS)*, 3740–3749. <https://doi.org/10.1109/HICSS.2015.450>
- [49] Ren, S., Zhang, Y., Liu, Y., Sakao, T., Huisingh, D., & Almeida, C.M. (2019). A comprehensive review of Bad throughout product lifecycle to support sustainable smart manufacturing: A framework, challenges and future research directions. *Journal of Cleaner Production*, 210, 1343-1365. <https://doi.org/10.1016/j.jclepro.2018.11.025>
- [50] Ribalta, C.N., Lombard-Platet, M., Salinesi, C., & Lafourcade, P. (2021). Blockchain Mirage or Silver Bullet? A Requirements-driven Comparative Analysis of Business and Developers' Perceptions in the Accountancy Domain. *Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications*, 12(1), 85-110.
- [51] Sahi, G.K., Gupta, M.C., Cheng, T.C.E., & Lonial, S.C. (2019). Relating entrepreneurial orientation with operational responsiveness: Roles of competitive intensity and technological turbulence. *International Journal of Operations and Production Management*, 39(5), 739–766. <https://doi.org/10.1108/IJOPM-07-2018-0411>
- [52] Sayginer, C., & Ercan, T. (2020). Understanding determinants of cloud computing adoption using an integrated diffusion of innovation (DOI)-technological, organizational and environmental (TOE) model. *Humanities & Social Sciences Reviews*, 8(1), 91-102. <https://doi.org/10.18510/hssr.2020.8115>
- [53] Skafi, M., Yunis, M.M., & Zekri, A. (2020). Factors influencing SMEs' adoption of cloud computing services in Lebanon: An empirical analysis using TOE and contextual theory. *IEEE Access* 2020, 8, 79169–79181. <https://doi.org/10.1109/ACCESS.2020.2987331>
- [54] Skarmeta, A.F., Cano, M.V.M., & Iera, A. (2015). Guest Editorial: Smart Things, Big Data Technology and Ubiquitous Computing solutions for the future Internet of Things. *Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications*, 6(1), 1-3
- [55] Soon, K.W.K., Lee, C.A., & Boursier, P. (2016). A study of the determinants affecting the adoption of BD using integrated Technology Acceptance Model (TAM) and diffusion of innovation (DOI) in Malaysia. *International Journal of Applied Business and Economic Research*, 14(1), 17-47.
- [56] Statista. (2021). Revenue from big data and business analytics worldwide 2015-2022. <https://www.statista.com/statistics/551501/worldwide-big-data-business-analytics-revenue>
- [57] Stevovic, I., Hadrović, S., & Jovanović, J. (2023). Environmental, social and other non-profit impacts of mountain streams usage as Renewable energy resources. *Arhiv za tehničke nauke*, 2(29), 57-64.
- [58] Sumbal, M.S., Tsui, E., Irfan, I., Shujahat, M., Mosconi, E., & Ali, M. (2019), Value creation through big data application process management: The case of the oil and gas industry, *Journal of Knowledge Management*, 23(8), 1566-1585. <https://doi.org/10.1108/JKM-02-2019-0084>
- [59] Wahab, S.N., Hamzah, M.I., Sayuti, N.M., Lee, W.C., & Tan, S.Y. (2021). Big data analytics adoption: An empirical study in the Malaysian warehousing sector. *International Journal of Logistics Systems and Management*, 40(1), 121-144. <https://doi.org/10.1504/IJLSM.2021.117703>

- [60] Wang, L. (2019). From intelligence science to intelligent manufacturing. *Engineering*, 5(4), 615–618. <https://doi.org/10.1016/j.eng.2019.04.011>.
- [61] Zhang, J., Wang, J., Lyu, Y., & Bao, J. (2019). Big data driven intelligent manufacturing. *China Mechanical Engineering*, 30(2), 127.

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