

PERSPECTIVE OF SMALL AND MEDIUM-SIZED ENTERPRISES: UTILIZING BIG DATA AS A RESOURCE TO ENHANCE FIRM PERFORMANCE

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Abstract: The increasing use of big data has transformed the business landscape, providing companies with vast amounts of data to enhance their performance. While large firms have been quick to adopt big data analytics, small and medium-sized enterprises (SMEs) have been slow to follow suit. This systematic literature review aims to explore the current state of knowledge regarding the use of big data by SMEs and how it affects their performance. The study will review relevant literature published between 2011 and 2022, focusing on the benefits and challenges of using big data in SMEs, as well as the factors that influence their adoption. The review also explores the integration of theoretical frameworks, such as the resource-based view (RBV), dynamic capabilities, and contingency view, to provide a comprehensive understanding of how SMEs can effectively harness big data as a valuable resource.

Key words: Big data, firm performance, big data analytics, small and medium-sized enterprises (SMEs).

Introduction

In recent years, there has been a growing interest in the utilization of big data (BD) and business analytics by companies seeking to generate new insights into consumers, competitors, and supply chains (Ghasemaghaeim, 2021). The global BD and business analytics market size was valued at \$198.08 billion in 2020 and is expected to reach \$684.12 billion by 2030 (Borasi et al., 2021). The pervasive nature of big data is evident across industries, from mobile technologies to banking services, cryptocurrencies, public services such as water or electricity, social media, supply chain analytics, and customer analytics. Big data applications are ubiquitous in all industries, including Uber's use of BD to predict spikes in demand and driver availability, airlines optimizing fuel consumption using analytics generated by weather conditions, passengers, and cargo weights, and Netflix predicting the success of future series based on customer interaction with the platform.

Big data analytics (BDA) is producing remarkable results in various industries. Retailing companies use BDA to enhance customer relationship management, while the healthcare industry uses BDA to moderate operational costs and improve the quality of life. Other sectors, such as manufacturing, are using BDA to improve supply-chain management and enrich industrial automation. Furthermore, BDA can optimize prices, increase profits, increase market share, increase return on investment, maximize sales, and improve financial productivity.

Firms have invested significantly in building their capabilities for processing BD, which could have several advantages for them (Ghasemaghaei & Calic, 2020). However, recent research suggests that investing in BD poses many issues and challenges (Tarafdar, Gupta, & Turel, 2013). Challenges in BD implementation include data integration complexity, getting started with the right project, architecting big data systems, lack of skills or staff, data ownership or other political issues, lack of business sponsorship, dealing with real-time data, inability to build a complete business case, poor data quality, and high costs, among others.

The use of big data (BD) in decision-making has received considerable attention in recent years due to the rapid development of digital technologies. However, there is little research on how to use and exploit it effectively, as big data analytics (BDA) is still a rapidly developing technological business practice. Despite the growing interest in BD, the empirical quantification and theoretical grounding of its effects on firm performance are not clear (Obshonka & Audretsch, 2019). The purpose of this paper is to broaden the discussions on big data applications in industry and their implications in management research using a systematic literature review methodology.

The increasing volume, variety, and velocity of data generated from various sources have given rise to the concept of big data (Chen, Chiang, & Storey, 2012). Big data has the potential to provide actionable insights for organizations to improve their decision-making processes and, ultimately, their performance (Gandomi & Haider, 2015). SMEs, in particular, face unique challenges and opportunities when it comes to leveraging big data.

Big data offers SMEs various opportunities, such as better decision-making, improved customer relationship management, increased operational efficiency, and enhanced innovation (Akter, Fosso Wamba, & Gunasekaran, 2016). For instance, SMEs can use big data analytics to uncover customer preferences and trends, allowing them to tailor their products and services accordingly (De Mauro, Greco, & Grimaldi, 2016).

However, SMEs also face several challenges in leveraging big data, including limited resources, lack of expertise, and data privacy concerns (Côrte-Real, Oliveira, & Ruivo, 2017). SMEs often lack the financial and human resources required to invest in big data infrastructure and to hire skilled data analysts. Moreover, data privacy and security issues pose significant challenges, particularly in light of the stringent data protection regulations in many countries (Dutta, 2017).

Several studies have proposed frameworks and strategies to help SMEs capitalize on big data for improved performance. For instance, Bharadwaj, El Sawy, Pavlou, and Venkatraman (2013) suggest adopting a dynamic capabilities perspective to manage big data resources effectively. This approach emphasizes the need for SMEs to develop their abilities to sense, seize, and transform opportunities provided by big data.

There is a growing body of literature examining the impact of big data on SMEs' performance. For example, a study by Akter et al. (2016) found that big data analytics capability and business strategy alignment significantly improved firm performance in terms of operational efficiency, customer satisfaction, and financial performance. Similarly, Côrte-Real et al. (2017) found a positive relationship between big data analytics capabilities and business value creation in European firms, including SMEs.

In another study, LaValle, Lesser, Shockley, Hopkins, and Kruschwitz (2011) reported that organizations that adopted big data analytics outperformed their peers in terms of both operational efficiency and financial performance. These findings suggest that the effective utilization of big data has the potential to significantly improve SMEs' performance.

Big data (BD) has experienced rapid development in recent years, garnering significant interest for its potential to inform decision-making processes. Despite this growing attention, there remains a dearth of research on the effective utilization and exploitation of big data analytics (BDA) due to its nascent status as an evolving technological business practice.

It is posited that organizations that enhance their BDA capabilities should be able to optimize their performance. However, empirical investigations of this relationship remain scarce and fragmented, particularly within the social sciences. To analyze the evolution of perspectives on this issue, a systematic literature review serves as an essential first step.

Initially, it is crucial to examine the research conducted on the subject in recent years. The trend of research in big data over the past years is illustrated in Figure 1. The figure indicates that research on big data, as a whole, has been on the rise since 2011. The data was obtained through a SCOPUS search using the keyword "big data".

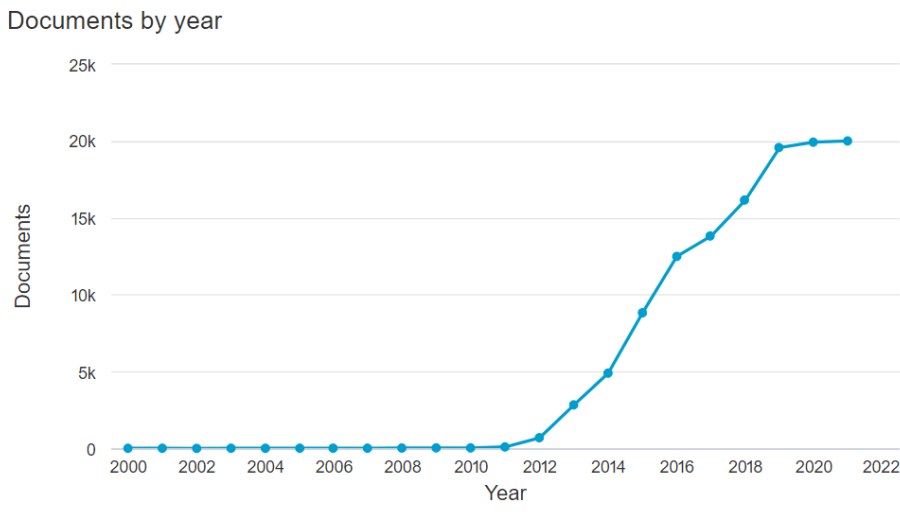


Figure 1. The number of documents published each year pertaining to the topic of big data

Source: own study

In recent years, the growth of big data (BD) has been closely linked to the proliferation of mobile and smart devices. The Internet of Things (IoT) has also contributed to the continuous generation of BD due to its increasing popularity. The interactivity between humans and machines has resulted in abundant BD. Moreover, the cost of acquiring data has been decreasing, which benefits real-time collection and processing and changes the relationship between information and decision-making (Lv, Z., 2017).

Nowadays, data technology is widely accepted as an optimization tool. Correlation, recognition, updates, and data collection are becoming more automatic. Countries are starting to adopt new data security technologies and data protection laws, making BD supervision stricter. Data from countries are particularly relevant since they cover resources, finance, food, environment, medical care, security, transportation, and other areas. New applications for BD are released every day, providing solutions for various industries.

BD has business value that enables managers to explore new process, product, and service innovation. To profit from BD, firms need to use it in combination with other existing capabilities or assets. These assets could be human assets, which create the need for investment in human resources, particularly high-skilled data scientists. The right balance between available BD technology and human IT assets is the foundation for creating business value.

Summary

To gain a comprehensive understanding of the current state of research on big data as a resource for firm performance enhancement, a systematic search was conducted in the SCOPUS database. The search employed phrase keywords such as “big data” and “firm performance,” and the truncation technique with an asterisk (*) was utilized. The search aimed to identify articles containing these keywords in their titles, abstracts, and keywords using the following search query: TITLE-ABS-KEY (“firm performance”, “big data”).

To further refine the search, the boolean search query “TITLE-ABS-KEY (“firm* performance”, “big data”) AND (LIMIT-TO (DOCTYPE , “ar”))” was employed, resulting in a total of 101 documents. As the quality of the journals is crucial in evaluating the impact and relevance of the research, the selection process focused on articles published in FT50 or ABS 3, 4, or 4* journals. The FT50 list comprises the Financial Times' top 50 journals, which are considered leading academic publications in business and management. The ABS Guide ranks journals based on research quality and impact. The selected journals with publications featuring the relevant keywords and meeting the FT50 or ABS 3, 4, or 4* criteria were included in the review.

- Journal of Business Research
- Industrial Marketing Management
- International Journal of Production Research
- Annals of Operation Research

Applying the filter of the journals above, the number of articles is reduced to 12 papers.

Table 1. Articles identified using the keywords “firm* performance” and “big data” in SCOPUS and listed in ABS 3, 4, or 4*

	Article Title
1	Effect of eco-innovation on green supply chain management, circular economy capability, and performance of small and medium enterprises
2	Big data analytics capability and market performance: The roles of disruptive business models and competitive intensity
3	Exploring the relationship between supplier development, big data analytics capability, and firm performance
4	An integrated artificial intelligence framework for knowledge creation and B2B marketing rational decision making for improving firm performance
5	Big data analytics business value and firm performance: linking with environmental context
6	Big data analytics capabilities and firm performance: An integrated MCDM approach
7	Assessing the impact of big data on firm innovation performance: Big data is not always better data
8	Big data analytics and firm performance: Findings from a mixed-method approach
9	Investments in big data analytics and firm performance: an empirical investigation of direct and mediating effects
10	Modelling quality dynamics, business value and firm performance in a big data analytics environment
11	Big data and predictive analytics for supply chain and organizational performance
12	Big data analytics and firm performance: Effects of dynamic capabilities

Source: Own study

Linking Theories with Big Data and Firm Performance:

The examination and evaluation of the articles enumerated earlier facilitated the creation of Figure 2, which encapsulates the frequency of various management theories employed in the literature review articles.

The resource-based view (RBV) posits that a firm's competitive advantage is derived from its unique resources and capabilities, which are valuable, rare, inimitable, and non-substitutable (Barney, 2001). Big data can be considered a valuable and rare resource for SMEs, as it enables them to gain insights into customer behavior, market trends, and operational efficiency (Aker, Wamba, & Gunasekaran, 2017). By leveraging big data, SMEs can create a competitive advantage by improving decision-making processes, enhancing customer satisfaction, and increasing efficiency (Chen, Chiang, & Storey, 2012).

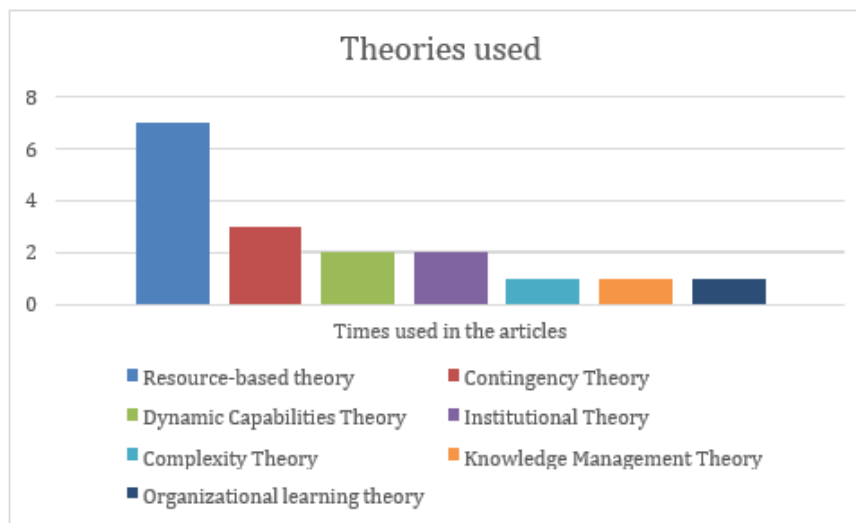


Figure 2. Theoretical Frameworks Explored in the Listed Articles

Source: Own study

Dynamic capabilities theory suggests that a firm's ability to integrate, build, and reconfigure its internal and external resources is essential for achieving and sustaining a competitive advantage in rapidly changing environments (Teece, Pisano, & Shuen, 1997). In the context of big data, SMEs need to develop dynamic capabilities to effectively utilize the vast amounts of data generated from various sources. By doing so, they can adapt to market changes, identify new opportunities, and respond to competitive pressures (LaValle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011).

The contingency view posits that the effectiveness of an organization's strategies, processes, and structures is contingent upon the organization's alignment with the specific characteristics of its environment (Donaldson, 2001). In the context of big data as a resource for enhanced firm performance, the contingency view can help explain how SMEs can successfully adopt big data analytics by considering the unique characteristics of their specific environments.

According to the contingency view, there is no one-size-fits-all solution for incorporating big data analytics into an SME's operations. Instead, firms must carefully evaluate the specific conditions of their industry, market, and competitive landscape to tailor their big data strategies accordingly (Donaldson, 2001). In doing so, SMEs can ensure that their big data initiatives are optimally aligned with their unique contexts, thereby enhancing their potential for improving firm performance.

For instance, SMEs operating in highly dynamic markets may prioritize the use of big data analytics for real-time decision-making and trend forecasting to stay ahead of the competition (LaValle et al., 2011). In contrast, SMEs in more stable industries may focus on leveraging big data for optimizing internal processes and enhancing customer satisfaction (Chen et al., 2012).

By adopting a contingency view, SMEs can better understand the role of big data in their specific contexts and develop tailored strategies for effectively harnessing big data as a resource for enhanced firm performance.

In general, the resource-based view (RBV), dynamic capabilities, and contingency view theories provide valuable insights into the ways in which small and medium-sized enterprises (SMEs) can harness big data as a resource for enhancing firm performance. By understanding and integrating these theoretical frameworks, SMEs can develop a comprehensive approach to leveraging big data that accounts for their unique contexts and environments, ultimately driving competitive advantage and improved performance.

Conclusion

In conclusion, the systematic literature review on big data as a resource for enhanced firm performance from the perspective of small and medium-sized enterprises (SMEs) has shed light on the critical role big data plays in today's business landscape. The review highlights the potential benefits and challenges that SMEs face in leveraging big data to improve their performance and competitive advantage.

The review also demonstrates the importance of considering various theoretical frameworks, such as the resource-based view (RBV), dynamic capabilities, and contingency view, in understanding the implications of big data for SMEs. By linking these theories, we gain a comprehensive understanding of how SMEs can effectively harness big data as a valuable resource to bolster their performance.

Also, it includes exploring the role of big data in specific industries, developing scalable big data solutions for SMEs, and examining the interplay between the various theoretical frameworks and big data in the context of SMEs. Such research endeavors will contribute to a deeper understanding of how SMEs can best utilize big data as a resource to enhance firm performance, ultimately driving growth and success in an increasingly data-driven world.

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