

## Big data analytics techniques and their impacts on reducing information asymmetry: Evidence from Jordan

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### CHRONICLE

### ABSTRACT

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This study aimed to demonstrate the impact of big data analytics techniques on reducing information asymmetry in industrial companies listed on the Amman Stock Exchange from the point of view of workers in Jordanian financial intermediation companies. Two approaches have been adopted to achieve the target of this research. The first approach is the analytical descriptive approach through a survey to collect primary data that measures the elements of the independent variable related to big data analytics techniques (Volume, Velocity, Variety, and Veracity). The second approach is an applied approach that measures the dependent variable of information asymmetry based on the financial statements of industrial companies listed on Amman Stock Exchange for the period (2015-2021). The statistical program (SPSS) has been used to analyze data and test the hypotheses through multiple regression testing. Based on the results of the statistical analysis of the data and the opinions of the research community, it was found that the huge volume of big data has become difficult to process using traditional data processing applications. Furthermore, there is a statistically significant relationship between big data analytics techniques and the reduction of information asymmetry from the point of view of employees in intermediation firms in Jordan. Consequently, it is necessary for those in charge of the industrial companies listed on the Amman Stock Exchange to develop modern techniques capable of analyzing big data with high efficiency. It can also assist in providing target groups including investors, stakeholders, and other beneficiaries with reliable and efficient data required to make rational decisions, as well as to reduce the risks of information asymmetry.

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## 1. Introduction

The companies whose shares are traded on financial stock exchanges are characterized by the separation of ownership and management, and by the prevalence of the agency theory hypothesis that explains the causes of interest conflicts among those interested in corporate economics. The cause of information asymmetry between internal parties (management) and external parties (investors) is due to the difference in the ability of each of which to obtain information that meets their decisions (Van et al., 2016). The asymmetry in information leads to a lot of negative effects on dealers in the financial stock exchanges. The most prominent of which is the need to obtain information from other sources which will drive up the cost of information and

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cost of the capital, and accordingly will affect the quality of the investment decision (Korkeamäki et al., 2014). The use of data has increased massively by all parties interested in the economics of companies where big data analytics can explain the characteristics of that data and eliminate ambiguity. Big data techniques can support companies in assessing their financial stands through various evaluation methods and techniques (Otilia & Marian, 2015; Abu-Khashabah, 2022). This necessitates those interested parties to identify data sources and convert them into groups of important, safe, influential, and accurate data, which increases their usefulness and reliability by users and reduces the risks of asymmetry for parties interested in corporate economics, and this enables them to employ the productive data in making financial and non-financial decisions (Salijeni et al., 2019).

Big data analytics assist to uncover and recognize the most essential data for the parties interested in corporate economics inter alia shareholders, investors, and lenders. They also help to determine future decisions, increase revenue capability, improve competence, develop operations and customer services, as well as anticipate danger probability and risk control (Zabihollah & Wang, 2017). Hence, this study was conducted to show the impact of big data analytics techniques on reducing information asymmetry in industrial companies listed on Amman Stock Exchange from the viewpoint of workers in Jordanian financial intermediation companies.

## 2. The problem of the study

The Information Asymmetry phenomenon is a key issue that faces dealers in financial stock exchanges considering the separation of ownership from management in companies nowadays and the asymmetry of information among the dealers. In other words, some investors acquire information about the value of the company while others only have general information. This will negatively affect their capability to take appropriate decisions concerning trading volume and liquidity in the stock exchange (Saad, 2019). Many reasons prevent those who prepare financial statements from disclosing data of interest for beneficiaries or supplying them with information compatible with qualitative characteristics of information in terms of reliability and appropriateness (Alshehadeh & Al-Khawaja, 2022). This will lead to asymmetry in the information provided through the inappropriate distribution of information, as one of the parties has sufficient knowledge that enables them to make decisions in a better way than other parties who do not have such information (Kraft et al., 2014).

The flow of big data has become one of the biggest challenges that contemporary companies face because of the difficulty of processing, storing, and managing this data and benefiting from it to meet the needs of beneficiaries. There are many challenges and obstacles that hinder the expanded use of big data (Raguseo, 2018). Big data technology is one of the most essential modern technological tools that can be used to access a wide range of data, information, applications, and tools that can be invested in achieving and improving the cognitive capabilities of decision-makers, and in reducing the discrepancy in information among all users (Yudowati & Alamsyah, 2018). This may help in obtaining the appropriate and reliable information that enables them to make rational investment decisions, as it is expected that this will contribute positively to reducing cases of asymmetry in data, which is considered one of the risks that they may face when making rational economic decisions (Almutairi & Albloshi, 2022). The problem of the study can be summarized by asking the following main question: Does the use of big data analytics techniques (volume, velocity, variety, and veracity) affect the reduction of information asymmetry from the viewpoint of workers in Jordanian financial intermediation companies?

The following sub-questions emerge from this main question:

1. Does the use of the Volume technique affect reducing information asymmetry from the point of view of workers in Jordanian financial intermediation companies?
2. Does the use of the Velocity technique affect the reduction of information asymmetry from the viewpoint of workers in Jordanian financial intermediation companies?
3. Does the technique of Variety in big data analytics affect the reduction of information asymmetry from workers' viewpoint in Jordanian financial intermediation companies?
4. Does the Veracity technique in big data analytics affect the reduction of information asymmetry in the opinion of workers in Jordanian financial intermediation companies?

## 3. Theoretical framework and literature review

### 3.1 Big data analytics

The term "Big Data" came to light in recent years and the attempts to benefit from big data analysis have become a common factor among large institutions and startups. It has also offered many opportunities for establishing specialized companies; helps companies that store huge digital content in organizing, processing, storing their data in an acceptable time, and analyzing that data to help companies and parties in making rational decisions that are compatible with upcoming future events (Günther et al., 2017). As contemporary companies that possess huge data face a great challenge in their ability to control them, as storing, managing, and optimally utilizing this data is a real problem. Big data, on the other hand, provides a competitive feature to companies if they are well utilized and analyzed, and this will help officials make correct and accurate decisions within these companies based on the information extracted from big data. The use of big data analysis techniques

allows these companies to increase their efficiency, rationalize their decision-making significantly, and enhance their competitive stand. Knowing the requirements of the beneficiaries allows contemporary companies to provide services based on those needs and requirements. Consequently, these companies ensure that the beneficiaries are satisfied with the services provided (Janvrin & Watson, 2017).

In fact, it is not possible to give a specific definition of big data as it is a term with multiple contents. Parra and Halgamuge (2018) defined it as a process of analyzing huge data based on technology, which cannot be processed or analyzed using the usual tools and methods, and that this data is managed through a business intelligence system. While Kevin (2014) defined it as a set of complex data packages, and it is difficult to deal with and process with traditional database management methods in terms of searching, saving, analyzing, extracting results, sharing, and transferring in an acceptable period. As it is multi-type source data. Idil et al. (2018) described it as huge amounts of complicated and overlapping data that cannot be processed with traditional database management tools, whether in terms of storage, search, analysis, and extraction of results. It is large in size, with high speed, diverse sources, and multiple formats, and requires innovative ways to process Information to enhance companies' visions and their competitive stand and improve the decision-making process. Big data has also been defined as stocks of information. It is characterized by its huge size, speed, and diversity, which requires innovative and effective ways of processing that differ from the processing of ordinary data. Consequently, it enables its users to improve vision, decision-making, and the automation process (Teets & Goldner, 2013). From the foregoing, a set of features of big data can be summed up:

1. **Velocity:** It means the speed of producing and extracting information from data, as speed is a crucial element in making a decision based on this information. Speed can be expressed by the time it takes to obtain information from the moment this data is obtained to the moment a decision is made based on it (Alshehadeh, et al., 2022a). Big data analytics techniques contribute to the rapid flow of data from its sources such as operational processes, reports, financial statements, networks, social media, databases, etc., as the flow of data is huge and continuous. This speed can help to extract and form the information that is necessary to make rational decisions by those interested (Van, 2016).
2. **Variety:** Data comes from different and multiple sources and in different and varied forms, as well as the diversity of the extracted information, which is essential to analysts in choosing special information in their field of work (O'Leary, 2018). Diversity means that big data includes many types of extracted data forms, which helps users, whether they are internal or external stakeholders, to choose the appropriate data for their decision domain (Alshehadeh et al., 2022d). Where big data includes structured and unstructured data such as Images, clips, audio and video recordings, map data, reports, and financial statements. It requires time and effort to prepare in an appropriate form for processing and analysis. Big data analysis leads to clarifying the content of financial reports and improving forecasting of the risks of corporate work, achieving compatibility among the parties, and showing indirect information in the financial reports, which help to reduce cases of information asymmetry and thus improve the credibility of financial reports.
3. **Volume:** The economics of contemporary companies are featured by the fact that they lead to the generation of large amounts of data that are steadily increasing, which requires a huge space to store them that exceeds the traditional databases (Musa et al., 2019). Volume expresses the amount of data generated by the economics of companies that may reach a huge volume of data, as it is large amounts of structured and unstructured data (Grable & Lyons, 2018).
4. **Veracity:** It means the credibility of the source and procedures of data preparation, and the extent of its accuracy, validity, and novelty of that data, as the analysis of big data contributes to achieving the reliability of the information, and this in turn will lead to an improvement in forecasting future profits and risks related to the work of companies. It also leads to improving forecasting future growth opportunities and their continuity, improving forecasting of future sales, predicting financial fraud, and early detection of weaknesses and strengths of the companies' revenue capacity as well. Furthermore, it drives progress in the objectivity of financial reports and then improves the evaluation of the company's performance generally and the market value of companies in particular (Alshammari, 2022)

These characteristics affect the alleviation of the information asymmetry phenomenon, as big data technologies contribute to the use of data processing software to obtain various types of information that meet the decision inputs of parties interested in corporate economies. Using big data tools, unsolicited activities can be quickly detected, such as accounting and financial fraud (Zabihollah & Wang, 2017). The results of big data analysis can also help in revealing the factors of corporate revenue strength and its continuity and producing financial and non-financial analyses help in making forecasts and in increasing the quality of financial reports (Al-Htaybat & von, 2017). The main importance of big data analytics is represented by the possibility of improving the efficiency and reliability of financial reports for companies in the context of using a large amount of data of different types. If huge data has been analyzed and used properly, companies can have a better vision of their business, and competence in making decisions and thus identifying the current and future positions of parties interested in corporate economies (Van, 2016). The analysis of big data leads to a better understanding and analysis of the content of the information contained in the financial reports more clearly, and then shows the unclear information and provides a better picture of the results of the companies' business, and the analysis of the big data also leads to getting rid of the ambiguity in the information in financial reports, to improve understanding of the company's strategic performance, to elevate understanding of the company's various operations and then improving recognizing of the company's performance as a whole (Alshehadeh, 2021). It is also possible to use analytical techniques for big data collected from various sources effectively and share this data among all users inside and outside the company to facilitate the creation of knowledge and its management towards effective decision-making in companies, providing big data exchange services between varied data systems (Vasarhelyi et al., 2015).

The results of previous studies unanimously agreed that the use of big data analytics techniques can effectively achieve the following advantages (Bieraugel, 2016):

- Developing methods of measurement and presentation of data to suit the different interests of users and mitigate the limitations and risks of agency theory.
- Achieving the qualitative characteristics of information beginning with objectivity and comparability, providing services to beneficiaries right on time, and providing the information required for decision-making processes.
- Providing financial information using clear and accurate language by removing incomprehensible words in financial statements.

### 3.2 Information Asymmetry

The problem of information asymmetry occurs when one party has more information than the other party. The results of studies have proven that disclosing more data can be better, because it assists in more accurate predictions, and meets the largest number of stakeholders' requirements for qualitative data and information (Yudowati & Alamsyah, 2018). In the shade of the separation of ownership from management, the information asymmetry between management and investors increases due to the determinants and obstacles to disclosing internal information, and thus the management achieves an informational advantage over external parties, which affects the efficiency of investors' decisions, whether by speculating on inside information or by leaking inside information to some investors through unofficial channels. Several reasons lead to information asymmetry between the management of the economic unit and the parties that use the information, such as shareholders. These factors have been divided into two types. The first type is internal factors, which are represented in the management's willingness to maximize its self-interests in obtaining financial rewards and increasing the Competitiveness value of the company, and of the investors in obtaining the largest returns for their shares. On the other hand, the second type is represented in external factors, which are the insufficiency of regulations and laws and the failure to follow the criteria of professional behavior by accountants (Subhia, 2016). Positive accounting theory identifies the motive of management behavior in issues concerning financial measurement and disclosure; the management is the one responsible for preparing the financial information, therefore it measures all the expected effects of the information that has been disclosed. Many studies have shown management's motives for its intervention in the processes of measurement, disclosure, and profit management, as per the study of (Alshehadeh et al., 2022c). These motives are:

1. Contractual motives: to achieve management's interests and to confirm its ability to manage the company's assets. Besides achieving its incentive plans represented by cash rewards, increased wages, and job security.
2. The motives of borrowing: to reduce the borrowing costs imposed on the company by the lenders.
3. Tax motives: to influence tax payments within the limits desired by the administration.
4. Legislative and political motives: to reduce the political costs resulting from the trade unions' claims of the legislative authorities and the government to increase workers' salaries and improve their working conditions.
5. The motives of the financial market: to preserve the company's reputation in front of its competitors. Furthermore, to maintain and continuously increase the company's share prices, as well as to meet the expectations of financial analysts. (Alshehadeh et al., 2022b)

The inequality in obtaining information by dealers can negatively affect the decisions of investors on one hand, and the efficiency of the stock market on the other hand (Alshehadeh & Al-Khawaja, 2022). In other words, the asymmetry of information in the sense that some dealers have information that others do not own, such as senior employees of companies who acquire certain information that is withheld from investors to achieve an extraordinary return, before publishing it in the reports and financial statements. Inequality in obtaining information about certain financial securities drives investors to avoid trading with them. Consequently, that drives a decrease in the volume of operations and a decrease in the size of the market because of the decline in the number of securities traded in the capital markets (Lu et al, 2010). In addition, the asymmetry of information in the stock market can be reflected in the form of a widening of the price range, which leads to an increase in the cost of operations and a decrease in liquidity and thus a decrease in the number of dealers in the market, i.e. the unavailability of information or its unfair availability in front of all investors, or the unavailability of people. Those who can analyze it will turn the stock market into an inefficient market from the point of view of its dealers, which ultimately leads to inefficient allocation of available financial resources (Al-Zaqeba et al., 2022).

The impacts of information asymmetry on the level of capital can be limited to two points: the first is the reduction of liquidity in the market, and the second is the reduction of investment efficiency. Thus, information asymmetry can be represented in the following effects: (Martinez, 2016)

1. Low efficiency of the money market through the wrong direction of investments on the part of the investor, due to the asymmetry of the information between them, and the lack of proper allocation of the invested funds on the part of the market dealers.
2. Achieving an unfair return through early knowledge of information for some parties at the expense of others, which leads to a negative impact on all market participants.

3. Creating a gap between management and stakeholders because the information between management and stakeholders is not equal.

The greater the degree of asymmetry in information in the market, the lower the liquidity of these markets because of the decrease in the number of transactions that take place in it. The degree of liquidity of the capital markets depends primarily on the state of information asymmetry in that market, it seems that the negative impact on liquidity is a reasonable result. Due to the decrease in the number of dealers in the market and the decrease in trading volume according to the following reasons (Atieh et al., 2022):

1. The disparity in the ability to estimate market risks.
2. The withdrawal of small investors because of the asymmetry of information between them and the large investors.

In order for the information related to any information system to achieve the intended outcomes, it must reduce the degree of uncertainty and increase the knowledge of the decision-maker (Cui et al., 2018). Despite the importance of annual financial reports for companies, the timing of their publication and the length of period for preparing and presenting them to their users is considered a drawback on these reports, which often leads to a reduction in the usefulness of these reports by contributing to the inequality in possessing certain information between the internal parties (management) in companies from one hand, and external parties (investors) on the other hand. Thus, internal parties can achieve self-benefits from the company's economics as a result of having an informational advantage resulting from the asymmetry of information between internal and external parties interested in corporate economics (Cho et al., 2013).

#### 4. Methodology

The study population consisted of two categories:

The first category: includes workers in financial intermediation companies licensed in Jordan, and they are (53) companies, in addition to the analysis unit that is consisted of (120) individuals working in the higher administrative levels (managers and their deputies), and it also includes the middle administrative levels (director of the investment with shares department, Financial broker, Operations Officer). (212) electronic questionnaires were distributed, and (153) questionnaires were retrieved. It was found that (12) questionnaires were not valid for analysis because the information was not completed. Hence, the final study sample consisted of (141) respondents. The second category: is the industrial companies listed in the Amman Stock exchange, and there are (53) companies. A sample of 22 companies whose financial statements have data on the dependent variable during the years of the study was selected (from 2015 to 2021).

The research is based on two approaches: the first is the analytical descriptive approach through developing a questionnaire to collect primary data for measuring the elements of the independent variable, where the questionnaire consisted of two parts, the first includes general data about the respondent, while the second part consists of (20) paragraphs related to the characteristics of big data (volume, velocity, variety, and veracity). The second approach is the applied approach that measures the dependent variable depending on the financial statements of the industrial companies listed on the Amman Stock Exchange for the year (2015-2021). The dependent variable related to information asymmetry was measured using the share price ratio to the book value for shares. The study of Ruhland (2006) and Nuryaman (2014) explained that the ratio of the share price to the book value of the share is one of the traditional and most common measures used to measure information asymmetry. The greater the difference between the market value and the book value, and the greater the ratio of the share price to the share's book value, the more this indicates an increase in the information gap between the management and the investors, and it was evidence of the high asymmetry of information in the market. The book value of the company is the value of the company based on the published financial reports that the management prepares and publishes. As for the market value, it is the value of the company from the point of view of investors. It reflects the investment opportunities available now and in the future. The statistical program (SPSS) was used to analyze the data and test the hypotheses through the multiple regression test. The accumulated model of the multiple regression test is formed through the following equation:

$$IA_{i,t} = \alpha + \beta_0 + \beta_1 Volume_{i,t} + \beta_2 Velocity_{i,t} + \beta_3 Variety_{i,t} + \beta_4 Veracity_{i,t} + \epsilon_{i,t}$$

#### 5. Presentation of data and testing of hypotheses

**Table 1**

The average of arithmetic mean and standard deviations for the independent and dependent study variables

No.	Variable	Symbol	Arithmetic Mean	Standard Deviation	Rank
1	Volume	Volume	3.81	0.76	2
2	Velocity	Velocity	3.96	0.83	1
3	Variety	Variety	3.75	0.89	3
4	Veracity	Veracity	3.71	0.81	4
5	Information Asymmetry	Information Asymmetry	3.65	0.77	5

Table 1 indicates that the average arithmetic means of the items related to the big data analytics variable ranged between (3.71-3.96). The velocity variable came first, with an arithmetic mean (3.96) and a standard deviation of (0.83). The variable related to veracity came in the last rank with an arithmetic mean (3.71) and a standard deviation of (0.81). Thus, the arithmetic mean of the information asymmetry variable was (3.65) with a standard deviation of (0.77). There is no statistically significant effect at the level of significance ( $50.0 \geq \alpha$ ) for the use of big data analytics techniques (Volume, Velocity, Variety, and Veracity) on reducing information asymmetry from the employees' viewpoint in Jordanian financial intermediation companies. To test this hypothesis, multiple linear regression analysis was used through the Stepwise method, to reveal the impact of big data analytics techniques (Volume, Velocity, Variety, and Veracity) on reducing information asymmetry from Jordanian financial intermediation companies' viewpoint. Multiple linear regression analysis was used, illustrated in Table 2.

**Table 2**

Testing multiple linear regression analysis between big data analytics techniques (Volume, Velocity, Variety, and Veracity) and reducing information asymmetry from the point of view of Jordanian financial intermediation firms

Dependent Variable	Multiple Correlation Coefficient R	Correlation Coefficient Square R <sup>2</sup>	F Value	Statistical Indication	Independent Variables	Non-Standard (B)Transactions	Standard Coefficients (Beta)	T-Value	Statistical Indication
Information Asymmetry	0.581	0.576	1241.328	0.000**	Constant	0.054		1.421	0.142
					Volume	1.921	0.834	38.355	0.002**
					Velocity	0.415	0.329	4.215	0.001**
					Variety	0.652	0.478	21.246	0.000**
					Veracity	0.824	0.384	25.271	0.001**

\*\*Statistically significant at the level of significance ( $\alpha = 0.05$ )

The results indicated that the absolute value of the multiple correlation coefficient between big data analytics techniques (Volume, Velocity, Variety, and Veracity) and the reduction of information asymmetry from the point of view of Jordanian financial brokerage firms reached (0.581), and the square of the correlation coefficient was ( $R^2 = 0.576$ ). This means that big data analytics techniques (Volume, Velocity, Variety, and Veracity) have explained 57.6% of the variation in information asymmetry, and the value of (F) was (1241.328), which is statistically significant at the significance level ( $\alpha \leq 0.05$ ), and this indicates the acceptance of the alternative hypothesis, which states that: "There is a statistically significant effect at the level of significance ( $50.0 \geq \alpha$ ) for using big data analytics techniques (Volume, Velocity, Variety, and Veracity) on reducing the asymmetry of information from the point of view of workers in Jordanian financial intermediation companies", which indicates the significance of the multiple linear regression, which means that (the use of big data analytics techniques related to (Volume, Velocity, Variety, and Veracity) affects the reduction of information asymmetry from Jordan finance intermediation companies' viewpoint.

## 6. Conclusion

This study is a serious attempt to identify the impact of big data analytics techniques on reducing information asymmetry for those who are interested in the economies of companies currently and prospectively, as it became obvious by the results of this study that big data can develop and form multiple types of information through its characteristics of (Volume, Velocity, Variety, and Veracity). where big data analytics techniques can support the internal and external parties interested in the economies of companies by providing information fairly to them to be capable to analyze it and thus alleviate and control cases of information asymmetry between them, this matter necessitates those to use big data analytics techniques to mine data and convert it into groups of essential, safe, influential and accurate information and use it in making financial and non-financial decision-making processes. Based on the results of the statistical analysis of the data and the opinions of the research community, we conclude that the massive volume of big data has become difficult to process using traditional data processing applications. As it was found that there is a statistically significant relationship between the analytics techniques of big data and the reduction of information asymmetry from the point of view of workers in Jordanian financial intermediation companies. Therefore, those in charge of the companies must develop new technologies capable to analyze big data with high efficiency through which can assist in identifying the most critical data required by investors, stakeholders, and other beneficiaries, and analyzing that big data which allows them to be acquainted of their requirements of information to increase the capacity and efficiency of information to make rational decisions, as decisions are based on accurate and logical processed data that will greatly contribute to reducing information asymmetry between interested parties.

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