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Current landscape and influence of big data on finance

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Abstract

Big data is one of the most recent business and technical issues in the age of technology. Hundreds of millions of events occur every day. The financial field is deeply involved in the calculation of big data events. As a result, hundreds of millions of financial transactions occur in the financial world each day. Therefore, financial practitioners and analysts consider it an emerging issue of the data management and analytics of different financial products and services. Also, big data has significant impacts on financial products and services. Therefore, identifying the financial issues where big data has a significant influence is also an important issue to explore with the influences. Based on these concepts, the objective of this paper was to show the current landscape of finance dealing with big data, and also to show how big data influences different financial sectors, more specifically, its impact on financial markets, financial institutions, and the relationship with internet finance, financial management, internet credit service companies, fraud detection, risk analysis, financial application management, and so on. The connection between big data and financial-related components will be revealed in an exploratory literature review of secondary data sources. Since big data in the financial field is an extremely new concept, future research directions will be pointed out at the end of this study.

Keywords: Big data finance, Big data in financial services, Big data in risk management, Data management

Introduction

In the age of technological innovation, various types of data are available with the advance of information technologies, and data is seen as one of the most valuable commodities in managing automation systems [13, 68]. In this sense, financial markets and technological evolution have become related to every human activity in the past few decades. Big data technology has become an integral part of the financial services industry and will continue to drive future innovation [12]. Financial innovations are also considered the fastest emerging issues in financial services. More specifically, they cover a variety of financial businesses such as online peer-to-peer lending, crowd-funding platforms, SME finance, wealth management and asset management platforms, trading management, crypto-currency, money/remittance transfer, mobile payments platforms, and so on. All of these services create thousands of pieces of data every day. Therefore,

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managing this data is also considered the most important factor in these services. Any damage to the data can cause serious problems for that specific financial industry. Nowadays, financial analysts use external and alternative data to make better investment decisions. In addition, financial industries use big data through different predictive analyses and monitor various spending patterns to develop large decision-making models. In this way, the industries can decide which financial products to offer [29, 48]. Millions of data are transmitted among financial companies. That is why big data is receiving more attention in the financial services arena, where information affects important success and production factors. It has been playing increasingly important roles in consolidating our understanding of financial markets [71]. In any case, the financial industry is using trillions of pieces of data constantly in everyday decisions [22]. It plays an important role in changing the financial services sector, particularly in trade and investment, tax reform, fraud detection and investigation, risk analysis, and automation [37]. In addition, it has changed the financial industry by overcoming different challenges and gaining valuable insights to improve customer satisfaction and the overall banking experience [45]. Razin [65] pointed out that big data is also changing finance in five ways: creating transparency, analyzing risk, algorithmic trading, leveraging consumer data and transforming culture. Also, big data has a significant influence in economic analysis and economic modeling [16, 21].

In this study, the views of different researchers, academics, and others related to big data and finance activities have been collected and analysed. This study not only attempts to test the existing theory but also to gain an in-depth understanding of the research from the qualitative data. However, research on *big data in financial services* is not as extensive as other financial areas. Few studies have precisely addressed big data in different financial research contexts. Though some studies have done these for some particular topics, the extensive views of big data in financial services haven't done before with proper explanation of the influence and opportunity of big data on finance. Therefore, the need to identify the finance areas where big data has a significant influence is addressed. Also, the research related to big data and financial issues is extremely new. Therefore, this study presents the emerging issues of finance where big data has a significant influence, which has never been published yet by other researchers. That is why this research explores the influence of big data on financial services and this is the novelty of this study.

This paper seeks to explore the current landscape of big data in financial services. Particularly this study highlights the influence of big data on internet banking, financial markets, and financial service management. This study also presents a framework, which will facilitate the way how big data influence on finance. Some other services relating to finance are also highlighted here to specify the extended area of big data in financial services. These are the contribution of this study in the existing literatures.

This result of the study contribute to the existing literature which will help readers and researchers who are working on this topic and all target readers will obtain an integrated concept of *big data in finance* from this study. Furthermore, this research is also important for researchers who are working on this topic. The issue of big data has been explored here from different financing perspectives to provide a clear understanding for readers. Therefore, this study aims to outline the current state of big data technology

in financial services. More importantly, an attempt has been made to focus on big data finance activities by concentrating on its impact on the finance sector from different dimensions.

Literature review

The concept of big data in finance has taken from the previous literatures, where some studies have been published by some good academic journals. At present, most of the areas of business are linked to big data. It has significant influence on various perspectives of business such as *business process management,* human resources management, R&D management [8, 63], business analytics [19, 26, 42, 59, 63], B2B business process, marketing, and sales [30, 39, 53, 58], industrial manufacturing process [7, 15, 40], enterprise's operational performance measurement [20, 69, 81], policy making [2], supply chain management, decision, and performance [4, 38, 64], and so other business arenas.

Particularly, Rabhi et al. [63] mentioned big data as a significant factor of *business process management& HR process* to support the decision making. This study also talked about three sophisticated types of analytics techniques such as descriptive analytics, predictive analytics, and prescriptive analytics in order to improve the traditional data analytics process. Duan and Xiong [19], Grover and Kar [26], Ji et al. [42], and Pappas et al. [59] also explored the significance of big data in business analytics. Big data helps to solve business problems and data management through system infrastructure, which includes any technique to capture, store, transfer, and process data. Duan and Xiong [19] found that top-performing organizations use analytics as opposed to intuition almost five times more than do the lower performers. Business analytics and business strategy must be closely linked together to gain better analytics-driven insights. Grover and Kar [26] mentioned about firms, like Apple, Facebook, Google, Amazon, and eBay, that regularly use digitized transaction data such as storing the transaction time, purchase quantities, product prices, and customer credentials on regular basis to estimate the condition of their market for improving their business operations [61, 76]. Holland et al. [39] showed the theoretical and empirical contributions of big data in business. This study inferred that B2B relationships from consumer search patterns, which used to evaluate and measure the online performance of competitors in the US airline market. Moreover, big data also help to foster B2B sales with customer data analytics. The use of customer's big datasets significantly improve sales growth (monetary performance outcomes), and enhances the customer relationship performance (non-monetary performance outcomes) [30]. It also relates to market innovation with diversified opportunities.

Big data and its analytics and applications work as indicators of organizations' ability to innovate to respond to market opportunities [78]. Also, big data impact on industrial manufacturing process to gain competitive advantages. After analyzing a case study of two company, Belhadi et al. [7] stated *'NAPC aims for a qualitative leap with digital and big-data analytics to enable industrial teams to develop or even duplicate models of turnkey factories in Africa.'* This study also identified an *Overall framework of BDA capabilities in manufacturing process*, and mentioned some values of Big Data Analytics for manufacturing process, such as enhancing transparency, improving performance, supporting decision-making and increasing knowledge. Also, Cui et al. [15] mentioned four most frequently big data applications (Monitoring, prediction, ICT framework, and

data analytics) used in manufacturing. These are essential to realize the smart manufacturing process. Shamim et al. [69] argued that employee ambidexterity is important because employees' big data management capabilities and ambidexterity are crucial for EMMNEs to manage the demands of global users. Also big data appeared as a frontier of the opportunity in improving firm performance. Yadegaridehkordi et al. [81] hypothesized that big data adoption has positive effect on firm performance. That study also mentioned that the policy makers, governments, and businesses can take well-informed decisions in adopting big data. According to Hofmann [38], velocity, variety, and volume significantly influence on supply chain management. For example, at first, velocity offers the biggest opportunity to intensification the efficiency of the processes in the supply chain. Next to this, variety supports different types of data volume in the supply chains is mostly new. After that, the volume is also a bigger interest for the multistage supply chains than to two-staged supply chains. Raman et al. [64] provided a new model, *Supply Chain Operations Reference (SCOR),* by incorporating SCM with big data. This model exposes the adoption of big data technology adds significant value as well as creates financial gain for the industry. This model is apt for the evaluation of the financial performance of supply chains. Also it works as a practical decision support means for examining competing decision alternatives along the chain as well as environmental assessment. Lamba and Singh [50] focused on decision making aspect of supply chain process and mentioned that data-driven decision-making is gaining noteworthy importance in managing logistics activities, process improvement, cost optimization, and better inventory management. Sahal et al. [67] and Xu and Duan [80] showed the relation of cyber physical systems and stream processing platform for Industry 4.0. Big data and IoT are considering as much influential forces for the era of Industry 4.0. These are also helping to achieve the two most important goals of Industry 4.0 applications (to increase productivity while reducing production cost & to maximum uptime throughout the production chain). Belhadi et al. [7] identified manufacturing process challenges, such as quality & process control (Q&PC), energy & environment efficiency (E&EE), proactive diagnosis and maintenance (PD&M), and safety & risk analysis (S&RA). Hofmann [38] also mentioned that one of the greatest challenges in the field of big data is to find new ways for storing and processing the different types of data. In addition, Duan and Xiong [19] mentioned that big data encompass more unstructured data such as text, graph, and time-series data compared to structured data for both data storage techniques and data analytics techniques. Zhao et al. [86] identified two major challenges for integrating both internal and external data for big data analytics. These are connecting datasets across the data sources, and selecting relevant data for analysis. Huang et al. [40] raised four challenges, first, the accuracy and applicability of the small data-based PSM paradigms is one kind of challenge; second, the traditional static-oriented PSM paradigms difficult to adapt to the dynamic changes of complex production systems; third, it is urgent to carry out research that focuses on forecasting-based PSM paradigms; and fourth, the determining the causal relationship quickly, economically and effectively is difficult, which affects safety predictions and safety decision-making.

The above discussion based on different area of business. Whatever, some studies (such as [6, 11, 14, 22, 23, 41, 45, 54, 68, 71, 73, 75, 83, 85] focused different perspectives of financial services. Still, the contribution on this area is not expanded. Based

on those researches, the current trends of big data in finance have specified in finding section.

Methodology

The purpose of this study is to locate academic research focusing on the related studies of big data and finance. To accomplish this research, secondary data sources were used to collect related data [31, 32, 34]. To collect secondary data, the study used the electronic database Scopus, the web of science, and Google scholar [33]. The keywords of this study are big data finance, finance and big data, big data and the stock market, big data in banking, big data management, and big data and FinTech. The search mainly focused only on academic and peer-reviewed journals, but in some cases, the researcher studied some articles on the Internet which were not published in academic and peer-reviewed journals. Sometimes, information from search engines helps understand the topic. The research area of big data has already been explored but data on big data in finance is not so extensive; this is why we did not limit the search to a certain time period because a time limitation may reduce the scope of the area of this research. Here, a structured and systematic data collection process was followed. Figure 1 presents the structured and systematic data collection process of this study. Certain renowned publishers, for example, Elsevier, Springer, Taylor & Francis, Wiley, Emerald, and Sage, among others, were prioritized when collecting the data for this study [35, 36].

The number of related articles collected from those databases is only 180. Following this, the collected articles were screened and a shortlist was created, featuring only 100 articles. Finally, data was used from 86 articles, of which 34 articles were directly related to '*Big data in Finance*'. Table 1 presents the list of those journals which will help to contribute to future research.

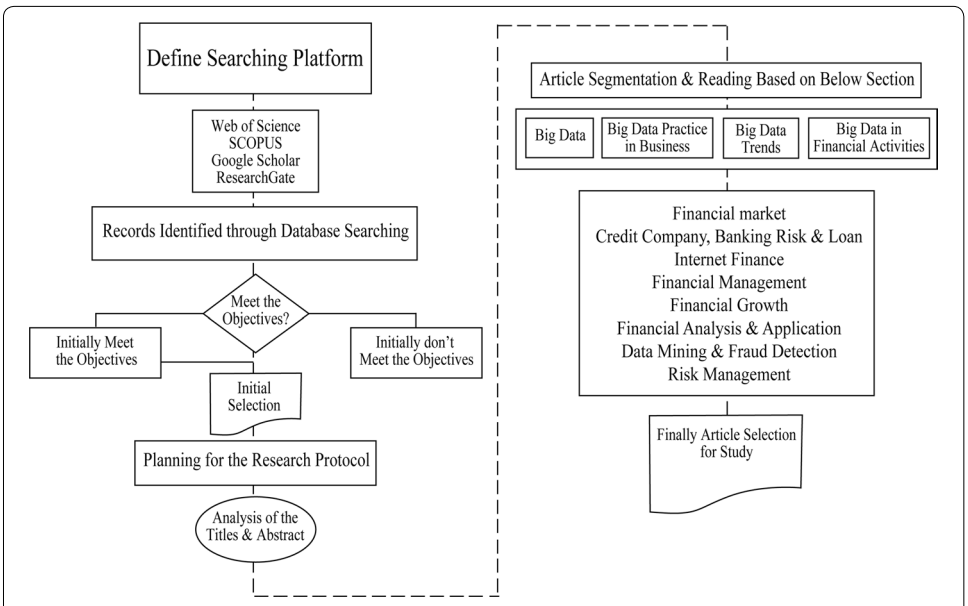

Fig. 1 Systematic framework of the research structure. (Source: Author's illustration)

Table 1 List of journals publish research related to big data and finance. Source: Author's explanation

Name of Journals	Number of articles located (n = 34)	Publisher
Computational Social Sciences (Book)	1	Springer
Decision Support Systems	3	Elsevier
Emerging Markets Finance and Trade	1	Taylor & Francis
Expert Systems with Applications	1	Elsevier
Financial Innovation	1	Springer
International Journal of Accounting Information Systems	1	Elsevier
International Journal of Electronic Commerce	2	Taylor & Francis
International Journal of Information Management	2	Elsevier
Journal of Big Data	1	Springer
Journal of Business Research	1	Elsevier
Journal of Computational Science	1	Elsevier
Journal of Economics and International Finance	1	Academic Journal
Journal of Monetary Economics	1	Elsevier
New Political Economy	1	Taylor & Francis
North American Journal of Economics and Finance	1	Elsevier
Revista de La Facultad de Ingeniería	1	SciElo
Risk Analysis	1	Wiley
Sustainability	1	MDPI
The Journal of Corporate Accounting & Finance	1	Wiley
Wireless Personal Communications	1	Springer
Journal of Econometrics	4	Elsevier
North American Journal of Economics and Finance	1	Elsevier
Law And Economics Research Paper	1	Michigan University
Electronic Commerce Research	1	Springer
Big Data Concepts, Theories, and Applications (Book)	1	Springer
New Horizons for a Data-Driven Economy: A Roadmap for Usage and Exploitation of Big Data in Europe (Book)	1	Springer
Others	3	–

This literature study suggests that some major factors are related to big data and finance. In this context, it has been found that these specific factors also have a deep relationship with big data, such as financial markets, banking risk and lending, internet finance, financial management, financial growth, financial analysis and application, data mining and fraud detection, risk management, and other financial practices. Table 2 describes the focuses within the literature on the financial sector relating to big data.

Theoretical framework

After studying the literature, this study has found that big data is mostly linked to financial market, Internet finance. Credit Service Company, financial service management, financial applications and so forth. Mainly data relates with four types of financial industry such as financial market, online marketplace, lending company, and bank. These companies produce billions of data each day from their daily transaction, user account, data updating, accounts modification, and so other activities. Those companies process the billions of data and take the help to predict the preference of each consumer given his/her previous activities, and the level of credit risk for each user. Based on those data,

Table 2 Emerging financial factors relating to big data. Source: Author's explanation

Major studies	Financial market	Credit company, banking risk and loans	Internet Finance	Financial management	Financial growth	Financial analysis and application	Data mining and fraud detection	Risk management	Other financial practices
Choi and Lambert [13]	–	–	–	–	–	Yes		Yes	–
Fanning and Grant [23]	–	–	–	Yes	–	–	–	Yes	–
Cerchiello and Giudici [11]	–	–	–	Yes	Yes	–	–	Yes	–
Sun et al. [74]	Yes	–	–	Yes	–	–	–	–	–
Campbell-verduyn et al. [10]	–	–	–	–	–	–	–	–	Yes
Shen and Chen [71]	Yes	–	–	–	–	–	–	–	–
Begenau et al. [6]	–	–	–	–	Yes	–	–	–	Yes
Corporation [14]	–	Yes	–	–	–	–	–	–	–
Pérez-Martín et al. [62]	–	Yes	–	–	–	Yes	–	–	Yes
Niu [57]	–	–	Yes	–	–	–	Yes	Yes	–
Sun et al. [73]	–	–	–	Yes		Yes	–	Yes	–
Baak and Hensbergen [3]	–	Yes	–	–	Yes	–	–	Yes	–
Tang et al. [75]	Yes	–	–	–	–	–	–	–	Yes
Kshetri [49]	Yes	–	–	–	–	–	–	–	Yes
Khadjeh Nassirtoussi et al [47]	–	–	–	–	–	–	Yes	–	Yes
Yang et al. [82]	–	–	Yes	–	–	–	–	–	–
Lien [51]	–	–	–	Yes	–	–	–	–	–
Yu et al. [84]	–	Yes	–	–	–	–	–	–	–
Retail banks and big data: Big data as the key to better risk management [66]	–	Yes	–	–	–	–	–	Yes	Yes
Yu Shen, n.d. [70]	–	–	Yes	–	–	–	–	Yes	–
Bollen et al. [9]	Yes	–	–	–	–	–	–	–	Yes
Zhang et al. [85]	–	Yes	Yes		–	–	–	–	
Glancy and Yadav [24]	–	–	–	–	–	–	–	Yes	Yes
Gray and Debreceny [25]	–	–	–	–	–	–	Yes	Yes	–

Table 2 (continued)

Major studies	Financial market	Credit company, banking risk and loans	Internet Finance	Financial management	Financial growth	Financial analysis and application	Data mining and fraud detection	Risk management	Other financial practices
Hajizadeh et al.[28]	Yes	–	–	–	–	–	Yes	–	–
Jin et al.[44]	–	–	–	–	–	–	Yes	Yes	–
Hagenau et al. [27]	Yes	–	–	–	–	–	–	–	Yes
Oracle [58]	–	–	–	–	–	–	Yes	Yes	–
Peji [60]	–	–	–	–	–	–	Yes	–	Yes
Ngai et al. [56]	–	–	–	Yes	–	–	Yes	–	–
Andreasen et al.[1]	Yes	–	–	–	–	–	–	–	Yes
Barr et al. [5]				Yes		Yes	Yes	Yes	Yes
Liu et al. [52]	–	–	–	–	–	Yes	Yes		Yes
Yu and Guo [82]	Yes	Yes				Yes	Yes	Yes	Yes
Mulla and Van Vliet [55]	–	–	–	–	–	Yes	Yes		Yes
Hussain and Prieto [41]	Yes	–	–	–	–	–	–	–	Yes
Hale and Lopez[29]	Yes	Yes	–	–	–	Yes	–	–	Yes

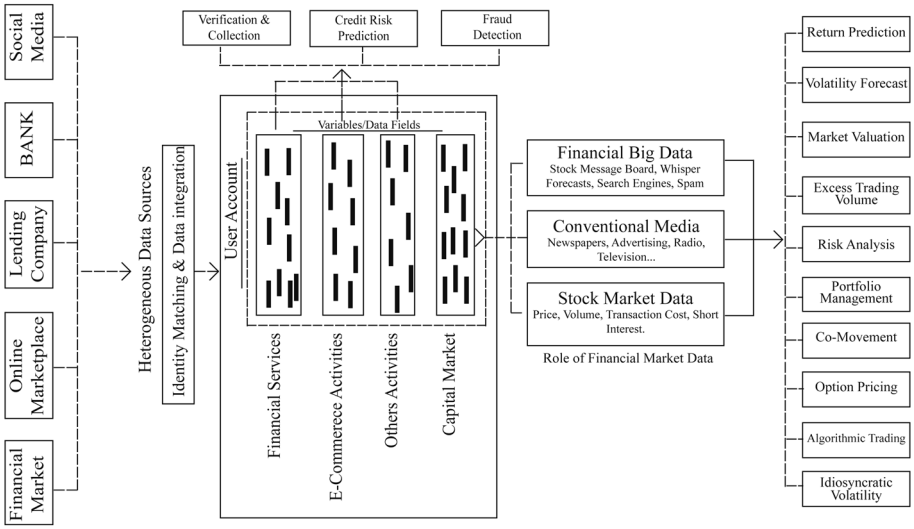

Fig. 2 Theoretical framework of big data in financial services. Source: Author's explanation. (This concept of this framework has been taken from Shen and Chen [71] and Zhang et al. [85])

financial institutions help in taking decisions [84]. However, different financial companies processing big data and getting help for verification and collection, credit risk prediction, and fraud detection. As the billions of data are producing from heterogeneous sources, missing data is a big concern as well as data quality and data reliability is also significant matter. Whatever, the concept of role of financial big data has taken form [71], where that study mention the sources of financial market information include the information assembled from stock market data (e.g., stock prices, stock trading volume, interest rates, and so on), social media (e.g., Facebook, twitter, newspapers, advertising, television, and so on). These data has significant roles in financial market such as predicting the market return, forecasting market volatility, valuing market position, identifying excess trading volume, analyzing the market risk, movement of the stock, option pricing, algorithmic trading, idiosyncratic volatility, and so on. Based on these discussions, a theoretical framework is illustrated in Fig. 2.

Results and discussion

Massive data and increasingly sophisticated technologies are changing the way industries operate and compete. The financial world is also operating with these big data sets. It has not only influenced many fields of science and society, but has had an important impact on the finance industry [6, 13, 23, 41, 45, 54, 62, 68, 71–73, 82, 85]. After reviewing the literature, this study found some financial areas directly linked to big data, such as financial markets, internet credit service-companies and internet finance, financial management, analysis, and applications, credit banking risk analysis, risk management, and so forth. These areas are divided here into three groups; first, big data implications for financial markets and the financial growth of companies; second, big data implications for internet finance and value creation in internet credit-service companies; and third, big data in financial management, risk management, financial analysis, and applications. The discussion of big data in these specified

financial areas is the contribution made by this study. Also, these are regarded as emerging landscape of big data in finance in this study.

Big data implications on financial markets

Financial markets always seek technological innovation for different activities, especially technological innovations that are always positively accepted, and which have a great impact on financial markets, and which have truly transforming effects on them. Shen and Chen [71] explain that the efficiency of financial markets is mostly attributed to the amount of information and its diffusion process. In this sense, social media undoubtedly plays a crucial role in financial markets. In this sense, it is considered one of the most influential forces acting on them. It generates millions of pieces of information every day in financial markets globally [9]. Big data mainly influences financial markets through return predictions, volatility forecasts, market valuations, excess trading volumes, risk analyses, portfolio management, index performance, comovement, option pricing, idiosyncratic volatility, and algorithmic trading.

Shen and Chen [71] focus on the *medium effect of big data* on the financial market. This effect has two elements, effects on the efficient market hypothesis, and effects on market dynamics. The effect on the efficient market hypothesis refers to the number of times certain stock names are mentioned, the extracted sentiment from the content, and the search frequency of different keywords. *Yahoo Finance* is a common example of the effect on the efficient market hypothesis. On the other hand, the effect of financial big data usually relies on certain financial theories. Bollen et al. [9] emphasize that it also helps in sentiment analysis in financial markets, which represents the familiar machine learning technique with big datasets.

In another prospect, Begenau et al. [6] explore the assumption that big data strangely benefits big firms because of their extended economic activity and longer firm history. Even large firms typically produce more data compared to small firms. Big data also relates corporate finance in different ways such as attracting more financial analysis, as well as reducing equity uncertainty, cutting a firm's cost of capital, and the costs of investors forecasting related to a financial decision. It cuts the cost of capital as investors process more data to enable large firms to grow larger. In pervasive and transformative information technology, financial markets can process more data, earnings statements, macro announcements, export market demand data, competitors' performance metrics, and predictions of future returns. By predicting future returns, investors can reduce uncertainty about investment outcomes. In this sense Begenau et al. [6] stated that *"More data processing lowers uncertainty, which reduces risk premia and the cost of capital, making investments more attractive."*

Big data implications on internet finance and value creation at an internet credit service company

Technological advancements have caused a revolutionary transformation in financial services; especially the way banks and FinTech enterprises provide their services. Thinking about the influence of big data on the financial sector and its services, the process can be highlighted as a modern upgrade to financial access. In particular, online transactions,

banking applications, and internet banking produce millions of pieces of data in a single day. Therefore, managing these millions of data is a subject to important [46]. Because managing these internet financing services has major impacts on financial markets [57]. Here, Zhang et al. [85] and Xie et al. [79] focus on data volume, service variety, information protection, and predictive correctness to show the relationship between information technologies and e-commerce and finance. Big data improves the efficiency of risk-based pricing and risk management while significantly alleviating information asymmetry problems. Also, it helps to verify and collect the data, predict credit risk status, and detect fraud [24, 25, 56]. Jin et al. [44], [47], Peji [60], and Hajizadeh et al. [28] identified that data mining technology plays vital roles in risk managing and fraud detection.

Big data also has a significant impact on Internet credit service companies. The first impact is to be able to assess more borrowers, even those without a good financial status. Big data also plays a vital role in credit rating bureaus. For example, the two public credit bureaus in China only have 0.3 billion individual's 'financial records. For other people, they at most have identity and demographic information (such as ID, name, age, marriage status, and education level), and it is not plausible to obtain reliable credit risk predictions using traditional models. This situation significantly limits financial institutions from approaching new consumers [85]. In this case, big data benefits by giving the opportunity for unlimited data access. In order to deal with credit risk effectively, financial systems take advantage of transparent information mechanisms. Big data can influence the market-based credit system of both enterprises and individuals by integrating the advantages of cloud computing and information technology. Cloud computing is another motivating factor; by using this cloud computing and big data services, mobile internet technology has opened a crystal price formation process in non-internet-based traditional financial transactions. Besides providing information to both the lenders and borrowers, it creates a positive relationship between the regulatory bodies of both banking and securities sectors. If a company has a large data set from different sources, it leads to multi-dimensional variables. However, managing these big datasets is difficult; sometimes if these datasets are not managed appropriately they may even seem a burden rather than an advantage. In this sense, the concept of data mining technology described in Hajizadeh et al. [28] to manage a huge volume of data regarding financial markets can contribute to reducing these difficulties. Managing the huge sets of data, the FinTech companies can process their information reliably, efficiently, effectively, and at a comparatively lower cost than the traditional financial institutions. They can analyze and provide services to more customers at greater depth. In addition, they can benefit from the analysis and prediction of systemic financial risks [82]. However, one critical issue is that individuals or small companies may not be able to afford to access big data directly. In this case, they can take advantage of big data through different information companies such as professional consulting companies, relevant government agencies, relevant private agencies, and so forth.

Big data in managing financial services

Big data is an emerging issue in almost all areas of business. Especially in finance, it effects with a variety of facility, such as financial management, risk management, financial analysis, and managing the data of financial applications. Big data is expressively

changing the business models of financial companies and financial management. Also, it is considered a fascinating area nowadays. In this fascinating area, scientists and experts are trying to propose novel finance business models by considering big data methods, particularly, methods for risk control, financial market analysis, creating new finance sentiment indexes from social networks, and setting up information-based tools in different creative ways [58]. Sun et al. [73] mentioned the 4 V features of big data. These are volume (large data scale), variety (different data formats), velocity (real-time data streaming), and veracity (data uncertainty). These characteristics comprise different challenges for management, analytics, finance, and different applications. These challenges consist of organizing and managing the financial sector in effective and efficient ways, finding novel business models and handling traditional financial issues. The traditional financial issues are defined as high-frequency trading, credit risk, sentiments, financial analysis, financial regulation, risk management, and so on [73].

Every financial company receives billions of pieces of data every day but they do not use all of them in one moment. The data helps firms analyze their risk, which is considered the most influential factor affecting their profit maximization. Cerchiello and Giudici [11] specified systemic risk modelling as one of the most important areas of financial risk management. It mainly, emphasizes the estimation of the interrelationships between financial institutions. It also helps to control both the operational and integrated risk. Choi and Lambert [13] stated that 'Big data are becoming more important for risk analysis'. It influences risk management by enhancing the quality of models, especially using the application and behavior scorecards. It also elaborates and interprets the risk analysis information comparatively faster than traditional systems. In addition, it also helps in detecting fraud [25, 56] by reducing manual efforts by relating internal as well as external data in issues such as money laundering, credit card fraud, and so on. It also helps in enhancing computational efficiency, handling data storage, creating a visualization toolbox, and developing a sanity-check toolbox by enabling risk analysts to make initial data checks and develop a market-risk-specific remediation plan. Campbell-verduyn et al. [10] state *"Finance is a technology of control, a point illustrated by the use of financial documents, data, models and measures in management, ownership claims, planning, accountability, and resource allocation"*.

Moreover, big data techniques help to measure credit banking risk in home equity loans. Every day millions of financial operations lead to growth in companies' databases. Managing these big databases sometimes creates problems. To resolve those problems, an automatic evaluation of credit status and risk measurements is necessary within a reasonable period of time [62]. Nowadays, bankers are facing problems in measuring the risks of credit and managing their financial databases. Big data practices are applied to manage financial databases in order to segment different risk groups. Also big data is very helpful for banks to comply with both the legal and the regulatory requirements in the credit risk and integrity risk domains [12]. A large dataset always needs to be managed with big data techniques to provide faster and unbiased estimators. Financial institutions benefit from improved and accurate credit risk evaluation. This helps to reduce the risks for financial companies in predicting a client's loan repayment ability. In this way, more and more people get access to credit loans and at the same time banks reduce their credit risks [62].

Big data and other financial issues

One of the largest data platforms is the Internet, which is clearly playing ever-increasing roles in both the financial markets and personal finance. Information from the Internet always matters. Tumarkin and Whitelaw [77] examine the relationship between Internet message board activity and abnormal stock returns and trading volume. The study found that abnormal message activity of the stock of the Internet sector changes investors' opinions in correlation with abnormal industry-adjusted returns, as well as causing trading volume to become abnormally high, since the Internet is the most common channel for information dissemination to investors. As a result, investors are always seeking information from the Internet and other sources. This information is mostly obtained by searching on different search engines. Drake et al. [18] found that abnormal information searches on search engines increase about two weeks prior to the earnings announcement. This study also suggests that information diffusion is not instantaneous with the release of the earnings information, but rather is spread over a period surrounding the announcement. One more significant correlation identified in this study is that information demand is positively associated with media attention and news, but negatively associated with investor distraction. Dimpfl and Jank [17] specified that search queries help predict future volatility, and their volatility will exceed the information contained in the lag volatility itself, and the volatility of the search volume will have an impact on volatility, which will last a considerable period of time. Jin et al. [43] identified that micro blogging also has a significant influence on changing the information environment, which in turn influences changes in stock market behavior.

Conclusions

Big data, machine learning, AI, and the cloud computing are fueling the finance industry toward digitalization. Large companies are embracing these technologies to implement digital transformation, bolster profit and loss, and meet consumer demand. While most companies are storing new and valuable data, the question is the implication and influence of these stored data in finance industry. In this prospect, every financial service is technologically innovative and treats data as blood circulation. Therefore, the findings of this study are reasonable to conclude that big data has revolutionized finance industry mainly with the real time stock market insights by changing trade and investments, fraud detection and prevention, and accurate risk analysis by machine learning process. These services are influencing by increasing revenue and customer satisfaction, speeding up manual processes, improving path to purchase, streamlined workflow and reliable system processing, analyze financial performance, and control growth. Despite these revolutionary service transmissions, several critical issues of big data exist in the finance world. Privacy and protection of data is one the biggest critical issue of big data services. As well as data quality of data and regulatory requirements also considered as significant issues. Even though every financial products and services are fully dependent on data and producing data in every second, still the research on big data and finance hasn't reached its peak stage. In this perspectives, the discussion of this study reasonable to settle the future research directions. In future, varied research efforts will be important for financial data management systems to address technical challenges in order to realize the

promised benefits of big data; in particular, the challenges of managing large data sets should be explored by researchers and financial analysts in order to drive transformative solutions. The common problem is that the larger the industry, the larger the database; therefore, it is important to emphasize the importance of managing large data sets for large companies compared to small firms. Managing such large data sets is expensive, and in some cases very difficult to access. In most cases, individuals or small companies do not have direct access to big data. Therefore, future research may focus on the creation of smooth access for small firms to large data sets. Also, the focus should be on exploring the impact of big data on financial products and services, and financial markets. Research is also essential into the security risks of big data in financial services. In addition, there is a need to expand the formal and integrated process of implementing big data strategies in financial institutions. In particular, the impact of big data on the stock market should continue to be explored. Finally, the emerging issues of big data in finance discussed in this study should be empirically emphasized in future research.

Abbreviations

SME: Small and medium enterprise; R&D: Research & Development; HR: Human resource; B2B: Business to Business; BDA: Big data analytics; SCM: Supply chain management; IoT: Internet of things; PSM: Production safety management; FinTech: Financial Technology.

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Availability of data and materials

Our data will be available on request.

Competing interests

There is no competing interests.

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