REVIEW

The social implications, risks, challenges and opportunities of big data [version 1; peer review: 2 approved with reservations]

Bayo Olushola Omoyiola

University of the People, Pasadena, California, 91101, United States

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Abstract

The effects of big data in this present age are highly significant, and big data have become more applicable to society. Big data technology has been adopted by many, and its applications are utilized at national, organizational, and industry levels. This transformation of industries due to big data is changing working practice in academia, business, the humanitarian sector, and government, as they offer insights and positive effects across all sectors, making legal, economic, political, social, and ethical impacts in our world and producing innovation, efficiency, better decision-making, and a greater return on investments. This paper reviews the social implications, risks, challenges, and present and future opportunities of big data.

Keywords

Big data, data, risks, challenges, implications, and opportunities.

This article is included in the Responsible Management gateway.

Open Peer Review

Approval Status ? ?

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version 1 13 Jun 2022	?	?

1. **Akintunde Samson Alayande**, University of Lagos, Lagos, Nigeria

2. **Mirela Danubianu**, Stefan cel Mare University of Suceava, Suceava, Romania

Any reports and responses or comments on the article can be found at the end of the article.

Corresponding author: Bayo Olushola Omoyiola (omoyiola@gmail.com)

Author roles: Omoyiola BO: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Project Administration, Resources, Software, Supervision, Validation, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing

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Introduction

Data is increasing in significance on a daily basis throughout the world. Data has become the new oil and new currency. Billions of people are regularly on the internet, and daily web traffic is very huge. Over 79 zettabytes of data have been generated worldwide, and 2.5 quintillion bytes of data are created every 24-hours. Every day, billions of financial transactions are executed (Sun *et al.,* 2020). Every transaction consists of data, and the magnitude has accordingly become large (Omoyiola, 2015). This leads us to the question of what big data are.

The origin of the term "big data" can be traced to deliberations on big datasets held in the 1980s in the industry and academia, but the initial description is the outburst in volume and quality of available and applicable data because of new and remarkable breakthroughs in data science (Diebold, 2000 as cited by Yan, 2013). Big data can be obtained from different sources and can consist of unstructured, semi-structured, or structured data.

Big data can further be explained with the 6 V's as seen in Figure 1:

i. Volume – The capacity of storage and datasets.

ii. Velocity - The speediness of inbound near-time and real-time data.

iii. Value – The Usefulness and correlations of data

iv. Variability – The extent or speed at which the data is changing. It could also be the inconsistency with which data may be available.

v. Veracity – The correctness and integrity of data.

vi. Variety - Data types and sources (Sun *et al.,* 2019).

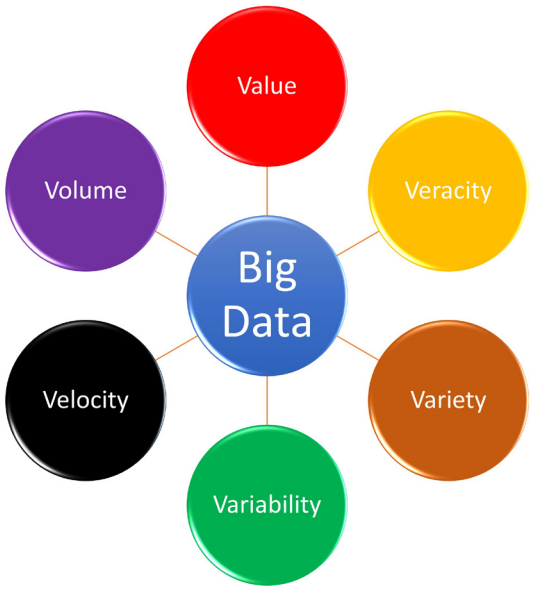

Figure 1. The 6 V's of big data.

Without a doubt, the time for big data is here. Large magnitudes of production data are sought by people (Boyd & Crawford, 2012). Michael and Miller (2013) predicted that big data would transform people's lifestyles in minor and major ways. This has come to pass because big data have evolved into a knowledge system which is transforming spheres of knowledge and significantly impacting society. The impact of big data is economic, societal, and technological, and this is transforming systems throughout the world (Omoyiola, 2015).

Social implications

Big data have many implications for society. They are utilized to enhance decision-making and effectiveness in companies, industries, and nations. More than 97.2% of successful organizations are now investing in artificial intelligence (AI) and big data. The USA, UK, Australia, and several other nations have adopted big data technology. Industries such as banking and other financial services, insurance, telecoms, information technology (IT), healthcare, automotive, oil, energy, and utilities, and others engage heavily in data-driven decision-making.

Big data have also been used to forecast market trends and weather, enhance gains, stop disasters, mitigate fraud, and scan the environment to identify the latest market and market trends. In addition, big data are utilized for business transactions and the security of nations (Bollier, 2010). Big data applications also include enterprise resource planning (ERP) and customer relationship management applications which are utilized for the purposes of payroll, the sales pipeline, inventory, contacts, payables, authorizing requests, and deal tracking. In addition, big data applications also include web apps used for advertising, collaboration, e-commerce, digital marketing, recommendation, weblogs, and mobile. Big data are also utilised by internet of things (IoT) applications such as log files, sensors, devices, radio-frequency identification, text, images, weather, audio, video, spatial and GPS coordinates, eGov feeds, clickstreams, social sentiments, and data market feeds.

Big data also have a significant effect on supply management (Bag *et al.,* 2020) and on management processes (Grover & Kar, 2017), such as distributed process planning (Ji *et al.,* 2019). They are also applied in the manufacturing industry, e.g., for mechanical assembling (Belhadi *et al.,* 2019), for production safety management (Huang *et al.,* 2019).) and also for improving operational performance (Dubey *et al.,* 2020). Big data are also utilized for customer insight-driven design innovation based on its impact on marketing, advertising, and business-to-business processes (Liu *et al.,* 2020). Big data have helped organizations to monitor and evaluate the satisfaction of customers and has enhanced customer care in the finance and banking industry (Hasan *et al.,* 2020).

Big data have a significant impact on research and development, human resource management and aid in managing business performance and decision making (Rabhi *et al.,* 2019). Big data have also enhanced the precision and levels of economic models (Diebold *et al.,* 2019). With the adoption of big data, companies can generate more revenue (Cockcroft & Russell, 2018).

Big Data has been a highly profitable and valuable business; its market may be worth $274.3 billion by now (Sun, 2021) and, by 2025, the global big data analytics market's annual revenue could be as high as $68.09 billion (Palvia *et al.,* 2021).

Risks and challenges

Big data also have some risks and challenges. There has been a significant increase in privacy issues (Omoyiola, 2015). In addition, there are also data ownership issues, a lack of standardization, legal issues, and policy issues (Garoufallou & Gaitanou, 2021). There are also risks, for example, in automated decision-making resulting in choice narrowing and discrimination. The fact that some end-users and firms have insufficient access to big data has also formed a digital divide. Some are overdependent on data, some are threatened by cybersecurity risks, while some others are at risk of big data issues that outweigh their merits. In addition, there is a risk that big data applications of the future could have some analyses which are unpredictable in nature because data scientists plan to release hidden patterns (Michael & Miller, 2013).

In the finance sector, the big data challenge includes integrated data, unclear data strategy, extremely high goals, and unreliable data (Sun *et al.,* 2020). There is also the challenge of data, computation, and system complexity (Mishra & Sharma, 2015). Khan *et al.* (2014) opined that the challenges of the analysis of big data also include the inconsistency, timeliness, incompleteness, and scalability of data because of the rapid growth of the size of datasets, largeness of data, speed of transfer, and diverse data. Big data are developed using, and known for utilising, large systems; hence they cannot be harnessed individually (Khan *et al.,* 2014).

Error handling is another challenging issue of big data (Labrinidis & Jagadish, 2012). Partitioning and delivery of extreme data distribution could be challenging (Zhou *et al.,* 2014). Lastly, big data also introduces challenges such as difficulty in data capture, searching, storage, sharing, visualization, and analysis (Ahrens *et al.,* 2011). It is recommended that appropriate solutions should be developed for all the risks and challenges of big data.

Opportunities

There are significant opportunities for the use of big data today and, in the future, there will be even more opportunities. Aside from the aforementioned merits of big data in the social implication section, there are many more benefits and opportunities for big data. By 2025, big data in the healthcare industry could be worth $67 billion. Big data also have a significant effect on the finance sector (Begenau *et al.,* 2018). Predictive applications that could predict hidden behavioural patterns and intentions of humans have been developed. Predictive analysis and data visualization is a plus for the finance sector as it helps finance firms to make better decisions. Big data in the finance sector have also led to audit analysis and connection with ERP. This has improved audit and business greatly (Sun *et al.,* 2020). In addition, big data have a huge effect on internet finance, and it is a 21st-century enhancement to financial access (Yang *et al.,* 2018).

Developments in data storage and mining technologies have emerged. In addition, multimedia applications that utilize big data have been developed. The unification of big data and the IoT is another good opportunity because it enhances people's lives by making business easy (Richins *et al.,* 2017). An integrated IoT and big data will benefit the finance sector by aiding the measurement of their performance and forecasting their future purchases (Sun *et al.,* 2020).

In the health industry, patients' information could aid the production of cures, X-rays, computerized tomography (CT) and magnetic resonance imaging (MRI), and e-health networks. In such cases, big data could help doctors in the healthcare system to offer therapies based on diagnoses by providing precise insights, hence helping them achieve value-based care and precision medicine (Garoufallou & Gaitanou, 2021). Big data could be utilized for security and enforcement of law in the security industry. They could also be utilized for criminal and surveillance investigations (Michael & Miller, 2013). big data also serve as a large unbounded resource for society. In addition, more employment opportunities can be open when big firms adopt big data (Omoyiola, 2015). Lastly, in the future, big data could become another point of reference for economic growth (Mishra & Sharma, 2015).

Conclusion

Big data have come to stay. They have continued to be important resources over the years, and are getting more important with time as they keep on evolving and emerging. Thus, one can conclude that they will become even more important in future. The big data business is highly lucrative and is worth hundreds of billions of dollars, and with time it will become more valuable because more billions of dollars are being made each year in revenue. Some companies, industries, and nations have invested in big data, and many more are buying into it. Big data have been found to have versatile applications, and their impact is being felt in banking, healthcare, finance, energy, and other industries. But in spite of their benefits, big data have some risks and challenges, such as unreliable data. Making sure data are reliable could be challenging (Whyte *et al.,* 2022). The other risks and challenges of big data include error handling, lack of standardization, policy and legal issues, heterogeneity, inconsistency, timeliness, incompleteness, and scalability of data. It is recommended that solutions should be proffered to the risks and challenges. However, regardless of their risks and challenges, big data have several current and future opportunities for organizations, industries, and nations. From the opportunities derived from integrating with IoT to their predictive analysis opportunities and their potential to contribute to the economic growth of nations, big data are abound with good opportunities.

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Open Peer Review

Current Peer Review Status: ? ?

Version 1

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Mirela Danubianu
Associate Professor of Computer Science, Stefan cel Mare University of Suceava, Suceava, Romania

The paper briefly presents social implications, risks, challenges and opportunities of Big Data. In my opinion, the paper lacks a proper format and content for its sections.

Firstly, in the Introduction section the context and the Big Data concept are presented, but the aim of the paper, its novelty, and its contribution to advancement of the domain is not specified.

Second, the next three sections are insufficiently detailed. It should be indicated to explain in more detail how the social implications manifest, or what are the challenges and their potential solutions, what risks are involved in the use of Big Data and the appropriate mitigation actions, and so on.

Conclusions should reflect the authors' opinions of what is presented. In the paper it appears that other works are cited in the conclusions.

The existing literature provides a huge amount of information related to Big Data. The paper cites a very limited number of sources.

The factual statements are generic. The paper lacks depth in addressing the proposed topics. I suggest a proper detailing of the presented ideas.

The language is accessible to non-specialists. For informed readers the language does not denote a good knowledge of the field. In addition, English and spelling should be carefully revised.

The paper is not convincing in terms of supporting with evidence what it wishes to transmit.

Is the topic of the review discussed comprehensively in the context of the current literature?
Partly

Are all factual statements correct and adequately supported by citations?
Partly

Is the review written in accessible language?
Partly

Are the conclusions drawn appropriate in the context of the current research literature?
Partly

Is the argument information presented in such a way that it can be understood by a non-academic audience?
Yes

Does the piece present solutions to actual real world challenges?
Not applicable

Is real-world evidence provided to support any conclusions made?
No

Could any solutions being offered be effectively implemented in practice?
Not applicable

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Data Science - Data mining, Big Data, Data Lakes, Data analysis, Information technology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 16 September 2022

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Akintunde Samson Alayande
Department of Electrical and Electronics Engineering, University of Lagos, Lagos, Nigeria

The paper presents the reviews of the social implications, risks, challenges, and present and future opportunities of big data. The arrangement and planning of the manuscript are good and it is well-organized. However, I have the following comments for the author:

1. The main contributions of the manuscript offered to the active stream of research should be

summarized in the introduction.

2. The manuscript needs to be proof-read in order to reduce the grammatical errors to barest minimum.

Is the topic of the review discussed comprehensively in the context of the current literature?
Yes

Are all factual statements correct and adequately supported by citations?
Yes

Is the review written in accessible language?
Partly

Are the conclusions drawn appropriate in the context of the current research literature?
Yes

Is the argument information presented in such a way that it can be understood by a non-academic audience?
Yes

Does the piece present solutions to actual real world challenges?
Yes

Is real-world evidence provided to support any conclusions made?
Yes

Could any solutions being offered be effectively implemented in practice?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Power systems, complex network theory, data analytics, renewable energy and smart networks

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.