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Big Data and Its Impact on Research Methodology

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Abstract

The integration of information systems research and social sciences enables a new era of innovation. In this context, the social sciences are provided with new insights through the implementation of Big Data and analytics technology. It also provides innovative, adaptable solutions to critical social issues and obstacles. This article offers a thorough analysis of the wide range of literature on big data and how it affects research technique. It concluded that big data is reshaping research methodology by enabling access to vast datasets, novel analytical techniques, and dynamic data visualization tools. It fosters deeper understanding across disciplines, offering transformative potential in areas like customer behavior and sport management. However, effective application requires context-aware methods, high-quality data, and rigorous preprocessing. Conceptual frameworks assessing organizational readiness for big data adoption further enhance decision-making capabilities. As research evolves, big data's value lies in its ability to generate responsive, socially aware insights. With appropriate methodologies and a focus on data integrity, big data continues to revolutionize research and knowledge creation across domains.

Keywords: Big data, Research methodology, Social science research, Quantitative research, Qualitative research, Social implications, etc.

1 Introduction

Despite its extraordinary digital ubiquity, the study of big data is motivated by the epistemic belief that vast data sets provide higher kinds of intelligence and erudition. The reason for this is the vast array of natural occurrences and human actions that are digitally recorded. Common features of big data include

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the well-known "five Vs: volume, velocity, variety, veracity, and value" [1]. These include the enormous volume of data that is produced and preserved, the rapid growth of data, the variety of data kinds and formats, the quality of data collection, and the usefulness of data extraction, in that order. These data properties have created previously unheard-of possibilities and problems for information science data usage and analysis techniques. Sophisticated research methods are required for big data [2].

The following are the fundamental components of any empirical research study: “research objectives/aims, research methods, data, and their analysis”. They are inextricably linked. In order to accomplish the goals of a study, research methods are the strategies, tactics, and processes used to gather, process, analyse, produce, and draw conclusions. A dataset's availability, nature, and size may have a big impact on the choice of research methodologies and even study subjects [3]. Analysis and processing methodologies that are appropriate for a large dataset are necessary, as they are not self-evident. A dataset that is broad, diverse in type, and content-rich would broaden the scope of research topic selections. To the study themes, academics would also be able to use a variety of research approaches [4]. The growing big data trend has had a substantial impact on information science data-driven empirical research projects. A research study must be carried out in order to do an in-depth examination and discussion of the trend's impact on information science research methodologies [5]. The study's importance is multifaceted. It encourages the information science research community to have a productive conversation and reflect on the challenges and possibilities posed by the big data movement. Additionally, it supports academics in the area in creating effective research designs for studies focused on big data and helps information practitioners overcome the difficulties they face in the big data age [6].

A. Big data

The term "big data" refers mostly to data volumes that are either very vast or complex for traditional data processing technologies to handle. Data with a greater number of entries (rows) may provide greater statistical power, while data with a higher complexity (more attributes or columns) may result in a higher false discovery rate [7]. Traditionally used data processing tools, such as spreadsheets, are incapable of managing or analysing extremely large and intricate data sets, which are referred to as "big data". Big data includes unstructured data like social media postings or videos, structured data like inventory databases or financial transaction records, and hybrid data sets like those used to train sophisticated artificial intelligence language models. The sources of these data sets may range from Shakespeare's plays to the financial spreadsheets of a company over the past decade [8].

Big data has only grown as a result of recent technological developments that have significantly reduced the cost of processing and storage, making it easier and less expensive than ever to store more data. The growing amount of data allows businesses to utilise it to make more accurate and precise business decisions. Though this is a different benefit, there is more to making the most of big data than just evaluating it. "Astute analysts, business users, and executives" are necessary for the whole discovery process because they must be able to recognise patterns, pose pertinent queries, create knowledgeable hypotheses, and predict behaviour [9].

B. The Vs of big data

Big data is often defined by volume, velocity, and variety, however definitions may vary greatly. The term "3 Vs of big data" is often used to describe these features.

Volume: As the name suggests, the most common attribute linked to "big data" is its volume. This phrase describes the enormous amount of data that is constantly produced and accessible for gathering from a wide range of devices and sources.

Velocity: The rate at which data is generated is referred to as "big data velocity". Since data is now often created in real-time or very real-time, it needs to be processed, retrieved, and evaluated at the same rate to make a meaningful difference.

Variety: There are many different sources of data, and it might be semi-structured, unstructured, or structured. Thus, it is heterogeneous. Currently, traditional structured data (e.g., spreadsheets or relational databases) is supplemented by "unstructured text, images, audio, video files, or semi-structured formats, such as sensor data", that are unable to be organised in a fixed data schema.

In addition to the three basic Vs, three additional variables--value, variability, and veracity--are frequently mentioned in the context of utilising potential of big data.

Veracity: It can be difficult to manage the quality and accuracy of big data because of "its chaotic, congested, and error-prone design". Larger datasets may be vexing and burdensome, while smaller datasets may offer an incomplete perspective. The data is more reliable when its veracity is higher.

Variability: The concept of data that has been collected is subject to constant evolution, which may result in inconsistency over time. In addition to data acquisition methods that are contingent upon the information that organisations intend to capture and analyse, context and interpretation are also altered.

Value: Determining the commercial value of the data you accumulate is indispensable. Big data has to be loaded with the right information and then thoroughly examined in order to provide insights that may aid in decision-making.

C. Social implications

There are numerous implications for society inherent in big data. Companies, industries, and nations employ them to enhance their "decision-making and effectiveness". Numerous industries heavily depend on data-driven decision-making, such as "banking and other financial services, insurance, telecommunications, information technology (IT), healthcare, automobile, oil, energy, and utilities, among others" [10].

Big data has also been used to predict weather and market trends, prevent catastrophes, deter fraud, increase profits, and track the environment to find the latest market trends. Furthermore, big data contributes to national security and commercial transactions [11]. Applications that use big data include customer relationship management (CRM) and enterprise resource planning (ERP), which are used for "deal monitoring, payroll, the sales pipeline, inventories, contacts, payables, authorising requests, and

more". In addition, big data applications encompass web applications that are employed for "advertising, collaboration, e-commerce, digital marketing, recommendation, weblogs, and mobile computing". Big data is also utilised in IoT applications, which include "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" [12], [13].

There is also a substantial impact of big data on management processes, including distributed process planning and supply management. In the manufacturing sector, they are also employed to enhance operational performance, manage production safety, and conduct mechanical assembly [14]. Big data are also employed to fuel design innovation that is motivated by consumer insight, as it has an impact on business-to-business processes, advertising, and marketing initiatives. Big data has facilitated the monitoring and evaluation of customer satisfaction by organisations, thereby improving customer service in the finance and banking sector [15], [16].

2 Literature Review

(Kgakatsi et al., 2024) [17] The purpose of this assessment is to examine the influence of BD on SMEs, with a particular emphasis on revenue growth, economic performance, and business enhancement. SMEs experienced substantial enhancements in operational efficiency, revenue generation, and competitiveness as a result of the adoption of BD. The research, however, demonstrates that there are ongoing obstacles, including inadequate financial resources and technical proficiency. A potential overreliance on quantitative approaches may be emphasised by this imbalance, which may restrict the profundity of insights that can be obtained. Although BD has the potential to significantly drive innovation and improve the competitiveness of SMEs, it is essential to address the current methodological biases and resource-related barriers in order to fully realise its benefits. To achieve a comprehensive comprehension of the effects of BD on SMEs, future research should emphasise the use of a variety of methodologies.

(Khan & Shao, 2024) [18] Aim to conduct a comprehensive literature review that examines the influence of big data and knowledge management on consumer interactions and consumption patterns from an applied science basis. Several theoretical and practical implications are associated with the results of this investigation. Theoretically, this review contributes to the expanding corpus of literature on the intersection of consumer behaviour, knowledge management, and big data. In order to enhance consumer interactions and consumption patterns, the findings can provide policymakers and practitioners with practical insights on how to leverage big data and knowledge management.

(J. Zhang et al., 2023) [2] Examine how big data is affecting information science research approaches. “The information science research community” is encouraged to engage in constructive dialogue and contemplation regarding pertinent research methodologies. In the age of big data, this may help information practitioners overcome the difficulties they face and help researchers in the area create effective study designs for big data-oriented research investigations. Any research study is essential and fundamentally dependent on research methods. The relationship between research methods and big data

analysis is quite natural. The paper investigates "an emerging and significant research field": big data, from a unique perspective on research methodologies.

(Mamo, 2023) [19] Focusses on the ethical and privacy implications of the use of modern, innovative techniques for social media data. We look at how social media data is accessed, the natural language processing methods that are utilised, the problems they solve, the advantages and disadvantages of each approach, and how social media data is accessed. Additionally, the commentary demonstrates the effectiveness and suitability of sentiment-analysis tools (such Syuzhet, Bing, and AFFIN) for the examination of social media data in the sports domain. Thus, the future of sport management research can be substantially influenced by the rigorous application of contemporary innovative techniques. Prior to employing sophisticated analytical methods, researchers must exercise caution regarding the data's origin and preprocessing.

(Omoyiola, 2022) [20] In the current era, the implications of big data are profound, and they have become increasingly relevant to society. The utilisation of big data technology has been widely adopted, with its applications being implemented "at the national, organisational, and industry levels". Big data's impact on industry transformation is changing how government, business, education, and the humanitarian sector operate. It has a positive impact on our world in "all sectors, resulting in legal, economic, political, social, and ethical implications". Additionally, it provides insights. Innovation, efficiency, improved decision-making, and a higher return on investments are other outcomes of this change. Big data's societal ramifications, risks, difficulties, and prospects are all examined in this study.

(Lytras et al., 2020) [21] The social sciences are provided with new insights through the implementation of Big Data and analytics technology. It also provides innovative, adaptable solutions to critical social issues and obstacles. Offer this edited collection on big data research's societal ramifications. It is among the first worldwide efforts to look at how this kind of study affects people and societal concerns. Three pillars form the framework of the pertinent debate: Big Data Research's Social Impact is covered in Section A. Section B. Methods and Techniques for Social Sciences and Social Impact Research Driven by Big Data. Section C. Strategies for Researching Big Data. Complementary social and technical variables are the effects of Big Social Networks on Business Intelligence and Sustainable Economic Development.

(Lytras & Visvizi, 2019) [22] "Big data and big data-based services" were examined in order to determine their precise impact on individuals and societies. This paper provides a detailed examination of the ways in which individuals perceive data, with a particular emphasis on their perceptions of the actual sharing of their data. The purpose of this paper is to establish a value space for the social impact of big data that is relevant "to three factors: the intention to share personal data, individual concerns, and the social impact of big data". The main contribution of this research is the understanding it offers of the still-emerging area of study that takes place at the nexus of social science and computer science. We anticipate that this field of research will become increasingly significant in the coming years.

3 Conclusion

In conclusion, big data has revolutionized research methodology by enabling access to vast datasets and offering advanced analytical tools to uncover complex patterns and trends. Its influence spans various disciplines, empowering researchers to visualize relationships both statically and dynamically over time. However, the successful application of big data methods depends on the research context, objectives, and design. The current study introduces a conceptual framework assessing organizational readiness for big data adoption, highlighting the importance of temporal dynamics and real-time analytics in decision-making processes. Despite significant progress, key gaps remain in understanding how big data and knowledge management influence consumer behavior, presenting opportunities for further research. By bridging these gaps, researchers and companies can optimize customer engagement strategies and enhance competitive positioning. Furthermore, big data offers powerful tools in domains such as sport management, particularly through social media analytics. Techniques like Syuzhet, Bing, and AFFIN show promise in sentiment analysis, provided that researchers prioritize data quality, representativeness, and preprocessing. Ultimately, the integration of innovative, context-appropriate research methodologies will determine the extent to which big data enhances knowledge creation. This review affirms that big data's role in shaping responsive, socially aware services and evidence-based decision-making is just beginning to unfold.

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