Big Data and Analytics:
Prospects, Challenges, and the Way Forward

Md. Toriqul Islam

https://orcid.org/0000-0003-3004-770X

Transparency International Bangladesh (TIB), Bangladesh

Borhan Uddin Khan

University of Dhaka, Bangladesh

1. INTRODUCTION

Appearing as a buzzword, big data received increasing popularity in the past few decades. The world community has become enthusiastic about big data and advanced big data analytics not solely due to the sheer magnitude of data involved but because of the substantial potential for impacts (McKinsey & Company, 2016). With the discovery of the Internet, the Internet of Things (IoT), other associated emerging technologies, and social networking sites, digital data has exponentially grown in the last few decades. This large volume of data sets requires real-time analysis and processing capacity for getting better insights into diverse businesses in the current information economy. Eventually, this data-driven ecosystem begets the notion of big data.

Big data refers to large-scale, complex, unstructured, semi-structured, or structured datasets that require unique computational techniques for processing in place of traditional ones. Gartner defines big data as 'high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing, which enable enhanced insight, decision making, and process automation' (Gartner, 2023). Big data brings both huge opportunities and challenges for numerous industries in the current data-driven economy. According to recent research, the total market value of big data is projected to exceed US $655 billion by 2029, compared to approximately $241 billion in 2021 (Taylor, 2022). Big data research has gained significant importance in the Fourth Industrial Revolution (4IR/Industry 4.0) owing to its substantial role and impact in driving transformative social change.

This chapter provides a succinct overview of big data and analytics, including their usage, advantages, disadvantages, applications, prospects, challenges, general recommendations, future research directions, and concluding remarks. Section two presents the background, focus, and research method. Section three offers a brief conceptualization of big data and analytics. Section four discusses how big data works, while section five outlines the advantages and disadvantages. Section six highlights the applications of big data, and section seven unveils its prospects. Section eight discusses the challenges associated with big data. Section nine proposes the way forward, and section ten outlines future research directions. Finally, section eleven concludes the chapter with a brief summary.

2. BACKGROUND, FOCUS AND RESEARCH METHOD

The development trajectory of human civilization has witnessed radical transformation through several industrial revolutions. Throughout history, beginning with the discovery of steam engines, followed by the emergence of fossil fuel-based engines, and the evolution of integrated business models, human society has now entered the information age. In the evolving information age, a significant portion of world affairs relies on computing power and wider applications of Information and Communications Technology (ICT). Presently, approximately 40% of the global population is connected online, over 1.5 billion websites are operational, Google handles an average of more than 40,000 search queries per second, and nearly 650 million Tweets are posted on Twitter (Internet Live Stats, 2023; Bulao, 2023). These statistics undeniably highlight that we are living in a data-driven world that is constantly evolving, offering abundant opportunities but also posing substantial challenges.

Big data has immense potential for various industries by producing precise insights about diverse products and services. The utilization of data-driven technologies holds promising prospects for enhancing productivity, improving trade intelligence, addressing societal challenges, fostering research and innovation, reducing costs, and expediting performance across various fields. Big data opens up a new horizon for innovation, competition, and productivity (Manyika et al., 2011).

In essence, big data appears with a plethora of promises while entailing numerous challenges. Specifically, big data may entail huge ethical, legal, social, practical, and technical challenges. This chapter would focus on the technical, practical, and legal challenges of big data and big data analytics from a regulatory perspective. For data collection and analysis, this chapter adopted doctrinal and qualitative legal research methodologies. The doctrinal legal research method has been adopted due to the nature and context of the current work and the suitability of the doctrinal approach over other research methodologies.

3. BIG DATA AND BIG DATA ANALYTICS

The central focus of this chapter shall be on the usages and applications of big data and analytics, including their prospects, challenge, and way forward. To begin with, it is essential to provide an overview of some conceptual features. Thus, this section aims to conceptualize two fundamental notions: big data and big data analytics.

3.1. Big Data

Although the term 'data' is deeply rooted in the long past, there are differences in opinions regarding the first use of the phrase 'big data'. Some authors argue that the phrase 'big data' has been coined by John R. Mashey in the mid-1990s (Diebold, 2019). Others contended that the concept of 'big data' was introduced in 1997 by NASA scientists to highlight the challenges and limitations of mainframe computers in analyzing and storing large amounts of data (Austin & Kusumoto, 2016; Gangadharan, 2013). Another group of scholars argues that the term first appeared in the field of econometrics and statistics in the early 2000s, referring to the vast amount of potentially relevant public data and the latest advancements in data collection and storage methods (Favaretto et al., 2020).

Doug Laney explained big data in 2001 using three characteristic features, e.g., volume, variety, and velocity. To him, big data refers to a dataset that is huge in size, variable in nature (as comprises various types of data, unstructured, semi-structured, or structured, and data of numerous forms or formats,

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