EMPLOYABILITY OF BIG DATA TOOLS AND TECHNIQUES IN ENHANCING THE EFFECTIVENESS OF ITS APPLICATION IN FINANCIAL SECTOR

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ABSTRACT

Recent global development has been marked by the widespread introduction of information and communication technologies across all economic growth sectors. The adoption of digital technologies has become explosive, leading to the emergence of the term "digital economy," which reflects the integration of cutting-edge digital technologies in various global economic sectors. Today, digital transformation permeates nearly all areas of economic development, such as Industry 4.0 in manufacturing and Fintech in finance. Key breakthrough technologies driving this digital transformation include cloud computing, cyber-physical systems, artificial intelligence, and big data analytics. Financial institutions, as key market players, play a crucial role in the big data market. This paper examines the technologies and techniques employed in big data processing, explores the future development within significant data sectors, and investigates the big data market across various economic sectors, identifying leading players in the field. It also focuses on utilizing big data in financial institutions, analyzing financial indicators and market growth dynamics. Additionally, the paper addresses the main challenges hindering big data adoption in financial institutions and provides forecasts for the future development of big data usage in the financial sector.

INTRODUCTION

The pervasive use of computer technology is indispensable in today's world. Over recent years, information and communication technologies have significantly expanded across all sectors, primarily spurred by the global financial and economic crisis of 2008, which precipitated a prolonged economic downturn that persists today.

The challenging economic conditions compelled companies to seek new development strategies that could drastically reduce business expenses. A key strategy that emerged was the adoption of digital technologies, which not only helped cut costs but also introduced innovative business models capable of unlocking new development opportunities.

Recently, digital technologies have catalysed the digital transformation of entire economic sectors. This shift has given rise to the term "digital economy," referring to an economy driven by the latest digital technologies. As a result, sectors that leverage advancements in information and communication technologies, such as Fintech in the financial industry, have emerged.

Key technologies driving the digitalization of the economy include cloud computing, cyber-physical systems, quantum technology, blockchain, big data processing and analysis, and

mathematical modelling. Among these, big data processing and analysis technologies have recently taken the lead in the digital transformation of the economy. This prominence is due to the vast amounts of data generated, which cannot be managed using traditional methods and conventional databases.

Currently, around 20 petabytes of information are generated daily worldwide, and this figure is projected to exceed 163 zettabytes by 2025 (Fig. 1).
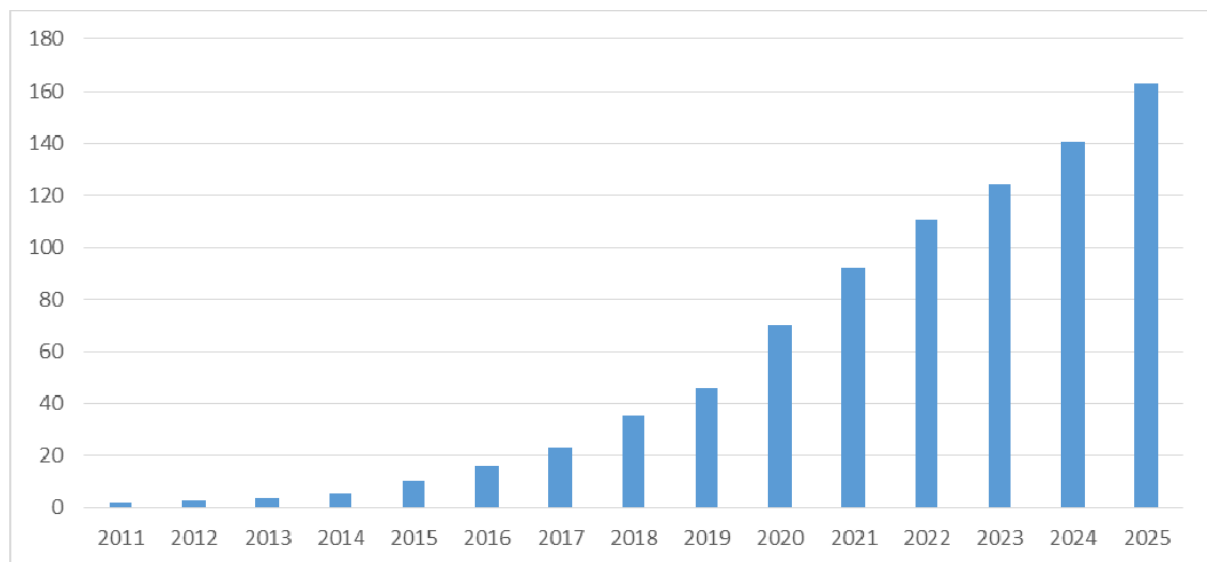

Fig. 1. Dynamics of the volume of information in the world, zettabytes

Financial institutions are at the forefront of utilizing big data. Over time, they have accumulated vast amounts of information that require further processing and analysis. The application of big data technology in this sector raises numerous questions that necessitate thorough investigation. Consequently, research is essential both for theoretical understanding and practical implementation.

KEY RESEARCH FINDINGS

A. Main Directions of Big Data Development

Big data refers to the vast amounts of structured and unstructured data in various formats processed using horizontally scalable software. Broadly, "big data" represents a socio-economic phenomenon driven by technological advancements that enable the analysis of massive datasets, resulting in transformative effects in various problem areas. The defining characteristics of big data, often summarized as the "three Vs," are:

Volume: The sheer amount of data.

Velocity: The speed at which data is generated and processed.

Variety: The diverse data types, including structured and semi-structured formats.

Critical technologies in the field of big data include:

NoSQL Technologies: Approaches for database storage that differ significantly from traditional relational databases using SQL.

MapReduce: A distributed computing model for parallel processing large datasets, up to several petabytes, in computer clusters.

Hadoop: A framework comprising utilities, libraries, and tools for developing and running distributed applications on clusters of numerous nodes.

R: A programming language and free software environment for statistical data analysis and graphics.

Business Intelligence (BI): Computer methods and tools that convert transactional business information into a human-readable form suitable for business analysis and facilitate handling large amounts of processed data.

B. Financial Analysis of the Global Big Data Market

The global big data market is not just dynamic, but also highly lucrative. With an average annual growth rate of 16.6%, it significantly outpaces the global information technology market's annual growth rate of about 5%. This rapid growth is not without reason. The big data market has been delivering substantial investment returns over recent years, making it an attractive prospect for financial analysts and decision-makers.
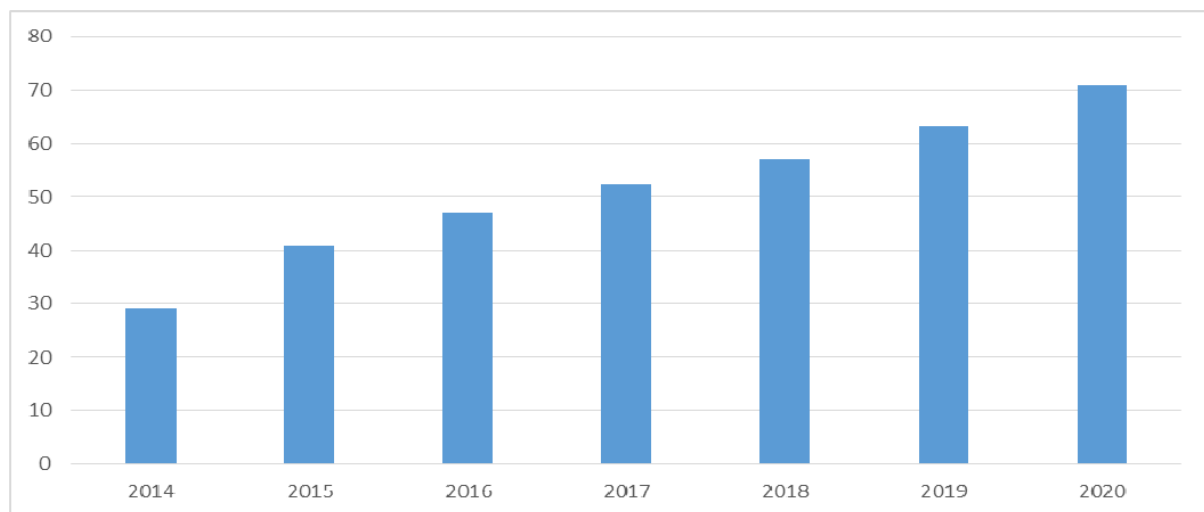

Fig. 2. Growth of the big data market, billions of dollars

The big data market is rapidly evolving, with the segment focused on improving customer service projected to comprise over 34.6% of the total market by 2020. This underscores the practical applications and benefits of big data in the financial sector, with the segment of big data analytics expected to be the second-largest, and the segment focused on building computer infrastructure for big data following closely behind.
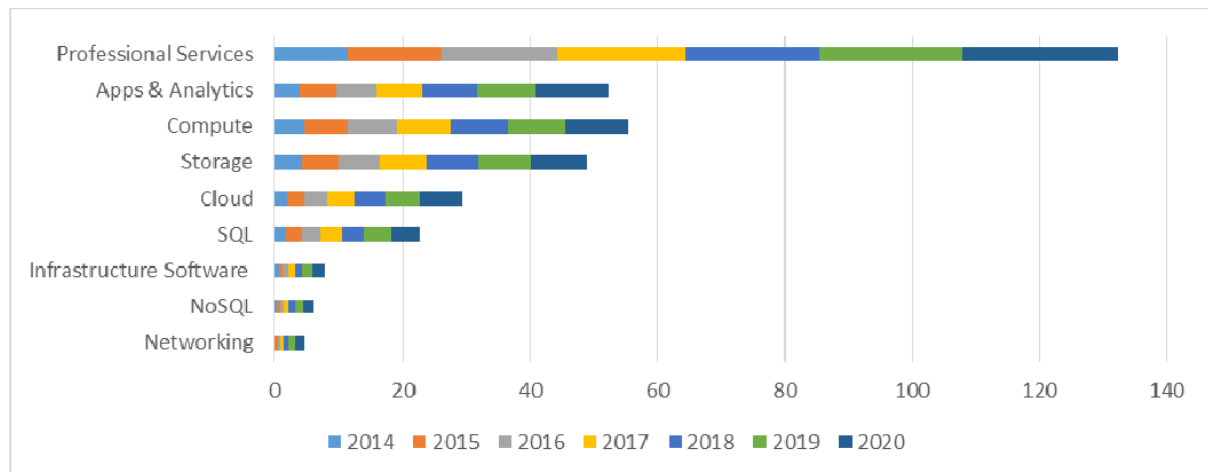
Fig. 3. Dynamics of the global big data market by segments, billions of dollars

C. Evaluation of Big Data Use in the Financial Sector

Telecommunications enterprises were the primary consumers of big data technology, with a 61% adoption rate in 2017. By 2020, the financial sector is expected to rank third in big data technology implementation, with a 45% adoption rate, following logistics companies in terms of return on investment.
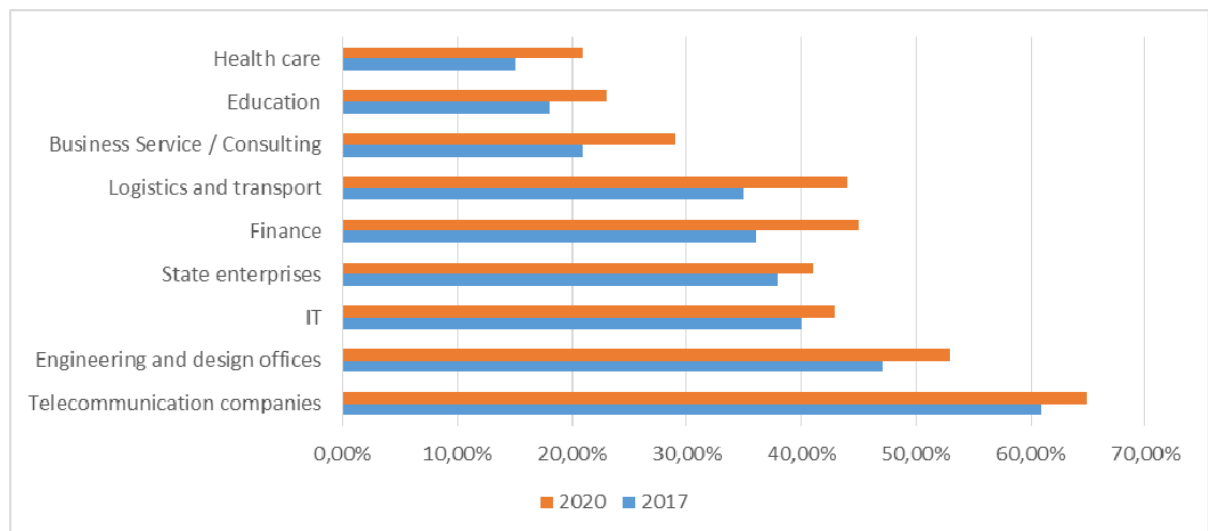

Fig. 4. Dynamics of the implementation of big data technology by industry

In 2017, the global big data market in the financial sector was valued at approximately $9.5 billion, with an average annual growth rate exceeding 21.3%. Big data technologies enable financial institutions to manage various tasks efficiently

Improving Customer Interaction: Big data helps banks tailor their services to meet the needs of specific client groups, optimizing resource allocation and enhancing customer satisfaction.

Big data plays a crucial role in the financial sector by assisting banks in adhering to regulations such as PSD2, Basel III, and FACTA, as well as national regulations concerning information

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security and business continuity. This demonstrates the role of big data in ensuring regulatory adherence and maintaining industry standards.

Modernizing Core Banking Systems: Incremental, modular upgrades to outdated systems help banks modernize without complete system overhauls.

-Implementing Mobile Solutions: Mobile banking, payments, and NFC technology are increasingly popular, although data access, security, and integrity remain challenges.

-Big data technologies are used in many areas of the financial sector, from targeted mobile marketing to fraud detection, cash management, and customer acquisition. Experts note that investments in big data solutions for personnel management, customer attraction, process optimization, and risk identification often exceed expectations. Critical areas for database technologies include:

- Improving operational efficiency

- Enhancing customer service

- Managing risks and complying with legal requirements

Big data technologies are not just a buzzword, but a practical solution for the financial sector. They enable higher automation levels, reduce costs, boost productivity, enhance customer relationships, predict risks, and ensure legal compliance. This reassurance of their practical applications should instill confidence in financial analysts and decision-makers about the value of investing in big data technologies.

Additionally, big data contributes to developing personal financial management tools, typically available through Internet banking. These tools provide visual aids for tracking finances, budgeting, and planning expenses, helping clients manage their money more effectively. Banks can strengthen customer relationships and improve client financial health by offering insights into spending patterns and potential savings.

As big data technology evolves, banks will discover more efficient ways to leverage it for business growth. This will open up new opportunities for collaboration with other industries and generate additional revenue streams through data sharing and sales.

ANALYSIS OF THE CHALLENGES IN IMPLEMENTING BIG DATA IN THE FINANCIAL SECTOR

Despite the rapid adoption of big data technologies in the financial sector, several challenges hinder their widespread implementation.

Key Limiters in the Big Data Market:

-High Implementation Costs: The financial burden associated with setting up big data infrastructure is significant.

-Data Protection and Confidentiality: Ensuring the security and privacy of data is critical and challenging.

- Lack of Qualified Personnel: There is a shortage of skilled professionals to manage and analyze big data.

- Distrust of Technology: Skepticism about the reliability and benefits of big data technologies persists.

-Insufficient Data Volume: The amount of available data may not always be adequate for comprehensive analysis.

-Ongoing Funding for Database Support: Maintaining databases requires continuous investment, adding to the costs.

-Complex Integration with Existing Systems: Integrating new big data technologies with current systems is often complicated.

- Limited Data Providers: The number of available data sources can be restrictive.

Major Barriers to Big Data Adoption:

-Data Security Issues: Representing 47% of the cases, data security is the most significant barrier.

-Budget Constraints: Limited financial resources are the second biggest barrier, with an indicator of 43%.

-Shortage of Qualified Personnel: The lack of skilled professionals is the third most significant barrier, with an index of 41%.

Despite these challenges, the barriers to big data implementation in the financial sector have been decreasing in recent years, suggesting a trend towards broader adoption in the future.

CONCLUSIONS

Digital Transformation: Recent years have seen a digital transformation across various economic sectors, with big data technologies playing a leading role due to the massive amounts of data generated daily.

Market Growth: The global big data market is rapidly expanding, projected to reach around $71 billion by 2020 with an average annual growth rate of 16.6%, significantly outpacing the overall digital technologies market.

Industry Leaders: Telecommunications companies are at the forefront of big data implementation, followed by the engineering, IT, state sectors, and finally, the financial sector. However, by 2020, the financial sector's use of big data is expected to grow significantly.

Investment Growth: Investment in big data within financial institutions is anticipated to increase to $16.3 billion by 2020, with an average annual growth rate of 21.3%. This growth is driven by the high return on investment in big data technologies.

Primary Use Cases: In the financial sector, the main applications of big data technologies are increasing operational efficiency (45%), attracting new customers (42%), and optimizing business processes (37%).

Future Prospects: As barriers decrease, the financial sector is likely to see more widespread implementation of big data technologies. Enhanced collaboration with other industries will enable the development of targeted client offerings. However, overcoming issues like data security, budget limitations, and a shortage of skilled personnel remains crucial.

In conclusion, while the financial sector faces significant challenges in implementing big data, ongoing reductions in these barriers suggest a promising future for the technology's integration.

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