A Review on the Role of Big Data Analytics in the Financial Services Industry

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Abstract—**The financial services industry's digital revolution has facilitated the penetration and transformation of advanced analytics, machine learning, artificial intelligence, big data, and the cloud. Large organisations use these technologies to expedite digital transformation, meet consumer demand, and improve profit and loss. While most organisations hold enormous amounts of valuable data, they typically lack the knowledge essential to maximise its value because the data is unstructured or incorrectly recorded. This article discusses the applications of Big Data Analytics in the financial services industry and how they are employed. Text, audio, and predictive analytics are just a few approaches used to provide value to financial organisations. This situation can assist in resolving various critical issues in the field, including market forecasting, fraud detection, credit scoring, real-time targeted marketing, and overall customer experience enhancement.**

Keywords—Big Data Analytics, BDA Benefits, BDA Implementation Challenge, Financial Services Industry

I. INTRODUCTION

THE financial services industry is becoming more competitive due to more stringent regulations adopted following the 2008 global financial crisis and increased market participation by non-financial enterprises [1]. As a result, financial institutions' reliance on a single competitive advantage, namely the implementation of a value strategy that no other current or potential competitor is employing at a given point in time, proves insufficient as the market changes quickly and inter-organisation competition becomes much more intense as a result of globalisation [2]. Financial institution decision-makers must recognise that competitive advantages are increasingly time-sensitive, rapidly deteriorating, and must be produced regularly for their products and services to remain relevant and in demand. This continual competitive advantage production atmosphere is called "Hypercompetition" [3, 4].

The financial services industry's digital transformation has enabled advanced analytics, machine learning, artificial intelligence, big data, and the cloud to penetrate and transform how financial institutions compete. Large organisations adopt these technologies to accelerate the digital transition, fulfil customer demand, and enhance profit and loss statements [5]. However, while most organisations hold critical and valuable data, they frequently lack the knowledge necessary to maximise its potential because the data is unstructured or poorly recorded inside the company [6]. As the banking sector quickly advances toward data-driven optimisation, organisations must react smartly and widely to these transformations. Efficient technology solutions that meet the sophisticated analytical requirements of digital transformation will enable financial institutions to fully use the potential of unstructured and large volumes of data, find competitive advantages, and create new market opportunities [7].

Financial institutions are not native to the digital ecosystem and have had to undergo a lengthy conversion process that has necessitated

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behavioural and technological changes. Big Data Analytics (BDA), combined with lower data costs, can help financial institutions address this worry by gaining useful intelligence to help them roll out highly relevant products and services priced within the market's willingness to pay [8]. In recent years, big data in finance has resulted in substantial technological advances that have enabled the industry to provide convenient, personalised, and secure solutions [9]. As a result, BDA has transformed both individual corporate processes and the financial services industry.

This paper will investigate the Role of BDA in the Financial Services Industry better to understand the impact of BDA on financial services. The topic of discussion includes an overview of big data, existing BDA tools and approaches, and concerns linked to financial services in terms of digitalisation and data. This paper will discuss the possible BDA applications in the financial services sector.

II. LITERATURE REVIEW

The following section will discuss the overview of big data and the current scenario in the financial service industry towards digitalisation efforts.

A. Big Data Overview

Big Data Analytics is becoming increasingly important for organisations across all industries, including financial institutions, especially today, where data is accessible, widely available, and abundant. The term "Big Data" is a relatively recent phenomenon that refers to massive (terabytes to exabytes) and complicated (sensor to social media data) data sets that necessitate advanced and unique data storage, administration, analysis, and visualisation methods [10]. Contrary to popular belief, where data size is the most crucial feature of big data, the type of data and the frequency of generating and providing are also essential parts of the big data environment[11]. These are known as the three Vs of big data, which are (i) volume, (ii) variety, and (iii) velocity, as depicted in Fig.1

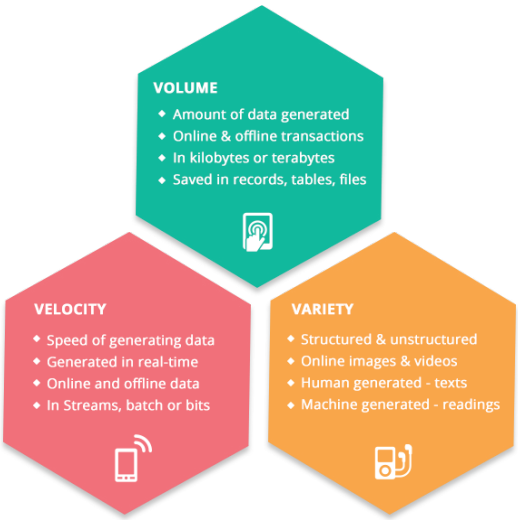

Fig. 1. Three Vs of Big Data

Volume refers to the volume of data produced. The total amount of data created, captured, copied, and consumed globally is forecast to increase rapidly, reaching 64.2 zettabytes in 2020. Over the next five years up to 2025, global data creation is projected to grow to more than 180 zettabytes [12]. This increases the demand for data storage frameworks with such high degrees of scalability. Variety refers to the various forms of data that are currently available. Data is classified into three types: structured, semi-structured, and unstructured The increase of unstructured data has pushed the demand for even more advanced data analysis methodologies (e.g., books, images, videos, etc.). Unstructured data is predicted to account for 90 per cent of all data created during the next decade. In comparison, only 5% of all existing data is organised (e.g., customer information such as age, address, gender, and so on) [13].

Data velocity examines the rate at which data is generated. This term is not limited to the rate of receiving data; it may also describe the rate at which data travels from one device to another. People can rapidly create and share data content such as photographs and videos thanks to social media and mobile devices, contributing to the rapid development of BDA today[14]. Though

the three Vs described above have been established as the foundations of Big Data, some academics have discovered additional traits in characterising Big Data, such as "Value" and "Veracity" [15]. The added value that data might provide in determining a proposition or an intended process is value, whereas veracity refers to data consistency and dependability.

With suitable tools and methods, big data might be precious to an organisation. Otherwise, these massive amounts of data are worthless, like a heap of trash in a landfill. Data management mainly refers to data acquisition, storing, and retention processes, whereas analytics is the process of extracting valuable information from the data. The Big Data Extraction Process Insight is depicted in Fig. 2.

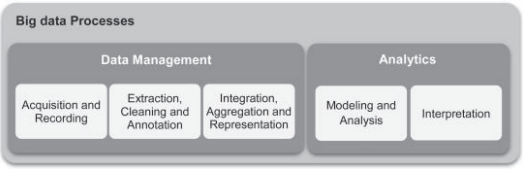

Fig. 2. Big Data Extraction Process Insight

Fundamentally, the overall framework of insight extraction from big data can be divided into five components, creating two key sub-processes: data management and analytics [16].

B. Current Scenario in Financial Industry Data and Digitalisation

Financial services generate a great deal of data. Within a business, structured data is preserved to give critical decision-making insights. Unstructured data is becoming more prevalent from various sources and offers significant analytical potential [17]. Each day, trillions of dollars pass through global markets, and analysts are tasked with monitoring this data with precision, security, and speed to generate projections, identify trends, and build predictive tactics [9]. The value of this data is highly contingent on how it is acquired, processed, stored, and comprehended. Analysts increasingly turn to cloud data solutions since older systems cannot store unstructured and segregated data without requiring considerable IT involvement.

Financial services is a highly data-driven industry that deals with enormous volumes of sensitive data. To help consumers and financial service providers, the financial services business requires substantial data analytics [8]. It helps financial services firms to leverage massive data sets accumulated over time and develop compelling use cases. The potential influence of big data on the financial services industry is exciting. Financial institutions' most precious asset is data, which they have mastered. Seventy-one per cent of banking and financial market organisations that use BDA have a competitive edge over their counterparts, according to research [6]. It affects how consumers access to cash, investments, payments, and the services of other financial service providers.

Banks, credit unions, credit card companies, insurance companies, and Fintech organisations are vital financial services that use big data [18]. Big data influences how these suppliers determine the most appropriate items for their consumers based on their usage and history and how they produce new products to satisfy changing demands [19]. Customers receive the most relevant products, while financial service providers save time, money, and effort in reaching the necessary conclusions. As many unstructured and structured sources rapidly generate big data, older data systems become incapable of dealing with the data's volume, velocity, and variety [7]. Management becomes dependent on building proper processes, enabling sophisticated technology, and extracting insights from data. In the next section, we will look at many significant use cases of BDA in the financial services industry, utilising the tools and methodologies described above, and analyse the benefits and anticipated challenges in implementation.

III. DISCUSSIONS AND SUGGESTION

A. Potential Use of Big Data Analytics in the Financial Services Industry

As the sector faces increased competitive pressures as interest rates fall, financial institutions are beginning to use BDA to uncover new revenue sources in noninterest income and improve methods of controlling systemic risks relevant to the industry [7, 19]. We will discuss a few significant data analytics use cases for financial institutions, namely; (i) personalised marketing, (ii) enhancement of customer experience, (iii) market prediction, (iv) credit risk assessment, and (v) fraud detection.

Personalised Marketing refers to marketing activities for items and services specifically relevant to a high prospective client at a given point after the customer has been identified through intensive data analytical procedures. Banks increasingly automate real-time customised offers to consumers based on transactional and demographic data and utilise data from customers' social media feeds to generate effective connections[6]. A bank, for example, may offer someone a line of credit for specialised in-home appliance purchases after learning that the customer has made multiple recent purchases of housing items using their credit or debit card, as well as knowing that the customer has recently expressed interest in home renovation initiatives on their social network platforms. As a result of the gathered information, the bank can provide the correct product to the right consumer. The consumer would be more likely to continue doing business with the bank, lowering the likelihood of customer attrition.

Customer Experience Enhancement includes personal encounters with a company's front-liners, phone conversations, online chats, and human and artificial intelligence. Implementing BDA in this area is expected in banks' call centres, where financial institutions are increasingly monitoring the service quality of call centre executives handling consumer queries and complaints. The recorded calls are then analysed, and standardised direction call scripts are developed to help customer care executives resolve issues swiftly and efficiently. Service quality can also be measured to determine cost-effectiveness. Aside from that, banks can identify common trends in customer complaints using audio analytics on phone calls or text mining on online chats and then use artificial intelligence to formulate automated responses, reducing the need for costly human capital and improving perceived customer experience due to reduced service time [8].

Market prediction in the financial services industry is essential for dealers of financial products such as foreign currency, equities, and bonds. Stock price movement is influenced mainly by market sentiment as analysing current news via text mining to identify sentiment. Machine learning is critical, as demonstrated in investigating implementing a version of the Support Vector Predicting stock price movement using a machine algorithm. Rather than focusing just on stock prices, machine learning transforms commerce and investing by using big data for accounting for political and societal factors that may affect the stock market [20]. Machine learning continuously monitors patterns, enabling analysts to compile and analyse pertinent data and make informed judgements.

Big data is also employed for Credit Risk Assessment in the financial services industry. Big data enables the analysis of customer behaviour and the provision of actionable information. It rapidly assesses the danger of identity theft, card fraud, and insurance fraud and responds [21]. Numerous financial decisions, such as investments and loans, are now made entirely based on unbiased machine learning. Predictive analytics-based judgments use a variety of factors, including the economy, customer segmentation, and business capital, to identify possible risks such as poor investments or payments. Machine learning might be used to automate credit underwriting procedures, as predictive models do not need to be developed manually each time new data is received, saving organisations money [22]. As a result, BDA may enhance the detection of impediments to potential customers' repayment.

With the rising accessibility of customer access to financial services, aided by internet banking, fraudulent banking activities such as credit or debit card purchases are becoming more sophisticated. Thus, financial organisations have used statistical and machine learning techniques such as Neural Networks, Decision Trees, and Logistic Regression to develop systems to detect abnormalities in credit card fraud and money laundering [23]. For example, credit card security issues can be addressed through analytics that analyses purchasing trends. Banks can immediately freeze the card and transaction when credit card information is stolen and notify the consumer of security dangers. As a result, the likelihood of paying regulatory fines and customer reimbursements due to unauthorised spending is reduced.

B. Benefits of Big Data to Financial Services

Financial institutions could now leverage big data to produce new income streams through data-driven offers, make personalised suggestions to clients, boost efficiency to gain a competitive edge, and provide greater security and support to consumers[5]. For instance, a BDA solution can increase revenue and customer satisfaction. This action is done by developing analytics platforms capable of forecasting clients' payment behaviour. By gathering knowledge about customers' activities, an organisation may reduce payment delays and increase revenue while increasing customer satisfaction [24].

Second, BDA can expedite manual processes, and data integration solutions may expand rapidly as an organisation's demands evolve [25]. Financial institutions can automate laborious tasks, save IT staff time, and give insights into their clients' daily transactions when they have a full view of their daily activities. Thirdly, cloud-based data management solutions may aid financial organisations in migrating data from various online services to data warehouses for consumption by multiple departments such as finance, marketing, business intelligence, market intelligence, and reporting [21]. Cloud technologies streamline the purchasing process for clients, enabling daily performance metrics and forecasting and enabling ad hoc data analysis.

Fourth, including BDA in your workflow will increase workflow efficiency and system dependability. The growing volume of data in financial services is pushing the upgrading of core financial services data and application systems through standardised integration platforms. By combining a simplified workflow and a dependable processing technique, any extensive financial transactional data can be integrated and processed daily at a rate of more than 2TB, implemented over 1,000 interfaces, and managed through a single process for all information logistics and interfacing [21]. Finally, BDA can assist in analysing financial performance and expansion control. With thousands of activities each year and hundreds of company divisions, analysing financial performance and restricting the development of firm personnel might be challenging [25]. Consequently, data integration procedures will streamline daily reporting, boost IT team efficiency, and enable business users to access and analyse critical information quickly.

C. BDA Implementation Challenges in Finance Services

Implementing big data technology is fraught with difficulties. The time and financial costs associated with extensive data are significant. The vast amounts of unstructured data generated by big data technologies are challenging to analyse and process. The technology available today is insufficient for processing large amounts of high-velocity data. Maintaining the security of big data and adhering to stringent regulatory regulations adds numerous hurdles to financial service firms' use of big data [17]. Technology exists to address these issues. However, businesses must grasp how to manage extensive data, integrate new technological efforts into their operations, and overcome general organisational reluctance. For various reasons, the particular issues of big data in finance are more complicated than in other businesses. As summarised in earlier research, numerous

predicted obstacles include the following: 1) Regulatory restrictions, 2) Data Security, 3) Data Quality, and 4) Data Silos.

The financial services business is subject to tight regulatory restrictions that restrict access to crucial data and necessitate expedited reporting [9]. Innovative big data technology enables financial institutions to expand risk management at a low cost, while enhanced metrics and reporting aid in transforming data for analytic processing to give essential insights. Additionally, with the emergence of hackers and complex, persistent threats, data governance controls are critical for mitigating financial services business risks. Big data management technologies provide data security and protection, as well as the rapid detection of suspicious activities [26]. Regarding data quality problems, it is clear that financial institutions want to do more than retain data; they want to use it. Because data is derived from various diverse sources, it is not necessarily consistent, posing a challenge to data governance [6]. Data management systems assure the accuracy, usability, and security of data.

Simultaneously, real-time analytics solutions give organisations to access, accuracy, and speed to massive data warehouses, enabling them to draw actionable insights and launch new products, service offers, and capabilities [7]. Additionally, financial data is derived from various sources, including employee papers, emails, and corporate apps. Combining and reconciling large amounts of data requires data integration technologies that ease storage and access. Despite the problems identified, big data solutions and the cloud operate in tandem to address and overcome the industry's most urgent issues. As more financial institutions utilise cloud solutions, they will send a stronger signal to the financial market that big data solutions are helpful for business applications and IT use cases.

IV. CONCLUSION

This paper summarised BDA's position in the financial services industry, examining potential applications, advantages, and implementation issues. To be more precise, incorporating big data technologies into the financial services industry provides several benefits for both users and providers of financial services. BDA would enable financial service providers to concentrate on individualised marketing, enhanced customer service, and client nurturing. Additionally, they can manage risks more effectively due to increased risk identification and evaluation speed. Consequently, the user benefits from a more personalised and efficient experience, as well as new products like connected home and vehicle insurance, individualised wealth management, personal financial management, and algorithmic trading. In brief, big data assists financial service providers in increasing business efficiency and lowering operational expenses. BDA is an area that should be investigated further by all businesses, regardless of their industry. The use cases presented above assist financial institutions in maintaining compliance with increasingly strict rules and consistently reinventing new competitive edges to remain relevant in this era in which technology simplifies every aspect of our lives, including financial services. Future industry uses, such as biometric verification for in-store purchases, may assist in focusing more on addressing consumer security concerns.

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