TRANSFORMATIVE IMPACT AND CHALLENGES OF DISRUPTIVE TECHNOLOGIES IN THE FINANCIAL SERVICES SECTOR

ТРАНСФОРМАЦІЙНИЙ ВПЛИВ ТА ВИКЛИКИ ПРОРИВНИХ ТЕХНОЛОГІЙ У СЕКТОРІ ФІНАНСОВИХ ПОСЛУГ

The rapid evolution of disruptive technologies has resulted in significant upheaval across various industries, including financial services. This research aims to characterize the most widespread disruptive technologies in the financial services sector that are gaining popularity and becoming familiar to us in our everyday life, and describe the challenges and concerns of their usage. The particular focus is made on such disruptive technologies as blockchain, artificial intelligence (AI) and machine learning (ML) applications, big data analytics, and some of emerging technologies: quantum computing, the Internet of Things (IoT), and biometric authentication. By examining each technology's possible usage options and implementation specifics, as well as its overall advantages and drawbacks, this study aims to identify their potential disruptive effects on the financial services. The research offers valuable insights into the transformative power of these technologies and their implications for different financial operations such as financial reports, data and market analysis, banking transactions, trading, insurance, risk assessment and others. It also analyzes the impact of them on security and privacy, customer experience and overall operational efficiency within the financial services industry. Furthermore, it addresses the opportunities and challenges associated with the adoption and integration of these disruptive technologies. Understanding of all the findings of this paper's research is expected to provide important and useful insights on the complexities introduced by disruptive technologies advancements in the finance industries sector, as these complexities must be measured and strategically operated to ensure that each disruptive technology used harness the benefits while mitigating potential risks. Thus, we hope that this comprehensive analysis can equip people interested in the usage of disruptive technologies in the financial sector with the necessary needed basic knowledge to navigate the rapidly changing landscape of this technological innovation.

Key words: financial services, disruptive technologies, blockchain, artificial intelligence, machine learning, big data analytics, quantum computing, internet of things, biometric authentication.

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Стрімкий розвиток проривних технологій призвів до значних потрясінь у різних галузях, включаючи фінансові послуги. Це дослідження має на меті охарактеризувати найпоширеніші проривні технології у секторі фінансових послуг, які набувають популярності та стають звичними для нас у повсякденному житті, а також описати виклики та проблеми, пов'язані з їх використанням. Особливу увагу приділено таким проривним технологіям, як блокчейн, додатки штучного інтелекту (ШІ) та машинного навчання (ML), аналітика великих даних, а також деяким новим технологіям: квантовим обчисленням, Інтернету речей та біометричній автентифікації. Вивчаючи можливі варіанти використання кожної технології та особливості її впровадження, а також її загальні переваги та недоліки, це дослідження має на меті визначити їх трансформаційну силу та потенційний вплив на фінансові операції, такі як фінансові звіти, аналіз даних і ринків, банківські операції, торгівля, страхування, оцінка ризиків тощо. Проаналізовано вплив проривних технологій на безпеку і конфіденційність, клієнтський досвід і загальну операційну ефективність у сфері фінансових послуг. Розуміння результатів даного дослідження може забезпечити людей, зацікавлених у використанні проривних технологій у фінансовому секторі, необхідними базовими знаннями щодо ймовірних перспектив та складнощів.

Ключові слова: фінансові послуги, проривні технології, блокчейн, штучний інтелект, машинне навчання, аналіз даних, квантові обчислення, інтернет речей, біометрична автентифікація.

Introduction. There are few key issues regarding the implementation of disruptive technologies into the financial sector. First and the most important, as many people consider, is the security and privacy concern. For example, though big data analytics offer valuable insights from massive datasets, such extensive use of customers personal data raises crucial data privacy and security concerns [6]. Similar vulnerabilities have a place in other technologies as well. The introduction of new technologies can also have not the best impact on day-to-day operations, as it is not that easy to implement new technologies into the already existing systems, – financial institutions must develop strategies to minimize downtime and ensure business continuity during the integration process [5]. It is also important to note that new automation can generate unwanted regulatory concerns or issues, as it must comply with existing regulatory frameworks [12]. The list of all the possible problems arising from the disruptive technologies' integration can be expanded.

Analysis of recent research and problem definition. The impact of the disruptive technologies into the financial sector is more and more discussed among the financial specialists. There are a lot of researches conducted on this topic, such as "Disruptive Technology in Banking and Finance. An International Perspective on FinTech" edited by Timothy King, Francesco Saverio Stentella Lopes, Abhishek Srivastav and Jonathan Williams [10].

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Article of Rudy Shoushany [13] and the research of Chang, Baudier, Zhang, Xu, and Arami [4] show how the blockchain disruptive technology can affect finance industry. Paul Tierno described the specifics of Artificial Intelligence and Machine Learning in Financial Services in his work [15]. Other authors also analyzed impacts of different disruptive technologies on the finance sector in their research. Though, the summarized, easily explained and understandable overall analysis of all the most widespread disruptive technologies was not presented in any of the works we've examined. Thus, we've decided to provide a collective analysis of the most popular nowadays disruptive technologies in this paper, to make it easier to understand, compare and weight their impact on the financial sector.

The purpose of the article. This study aims to identify and analyze the potential disruptive effects of emerging technologies by examining the transformative effects of these technologies on traditional banking operations, the enhancement of customer experiences, and the emergence of new security and regulatory challenges. Overall, the research seeks to provide a comprehensive understanding of the opportunities and risks associated with the adoption of disruptive technologies in the financial sector.

The results of research. Despite the slower rate of adoption of new technologies in banking and financial services when compared to other industries, financial institutions are attempting to accelerate their incorporation of artificial intelligence, blockchain, and related technologies to benefit customers, maintain competitiveness, and improve business outcomes. Though, the implementation of the disruptive technologies has many challenges for the financial sector. To understand all the nuances, it is better to analyze each of the recent biggest technology trends.

Blockchain: In essence, blockchain may be defined as a distributed ledger or list of data records of transactions, which may involve any kind of value, including money, goods, property, or votes. Speaking a bit simpler, blockchain is a list of transactions that can involve any kind of value. The blockchain is shared in a decentralized network of computers, based on advanced cryptography and can be either public or private [3, p. 5390].

1. Blockchain technology has the potential to significantly transform the way financial services are delivered. The main effects of it include improved personalized customer services based on the specific needs of everyone; saving of time and money for the companies: faster transactions and lower operational costs; such viable advantages as better transparency and the number of transactions which can be handled efficiently [13]. The use of blockchain technology enables the acceleration of payments and transfers of value. It also facilitates the transfer of asset ownership, such as investments. It exemplifies the potential to integrate financial systems, infrastructure and forms of value while ensuring global interoperability. Blockchain also offers more decentralized and distributed networks as alternatives to the current financial services landscape. Thus, it is totally understandable why this technology became one of the biggest interests for many financial institutions.

At the same time, the significant challenges associated with blockchain, including scalability, security, privacy, latency, and energy consumption, have yet to be fully addressed. As the volume of transactions increases, blockchain systems encounter difficulties in terms of scalability. This is due to the limited capacity of blocks and the prioritization of transactions with higher fees, which results in delays for smaller transactions. It has been demonstrated that blockchain-based systems are susceptible to a range of security threats. Notable incidents include the theft of bitcoins from platforms such as Mt. Gox and Bitfinex, which resulted in significant financial losses. Despite the ability of blockchain to generate multiple addresses to protect user identities, it is unable to prevent the leakage of transaction information since all transaction details are public. Cybercrime in this technology is really a great threat, unfortunately. Legal landscape in this field still needs loads of improvements as well. In addition, it is evident that the reliance of blockchain on substantial computing power, particularly in systems utilizing proof-of-work consensus mechanisms, results in a significant energy consumption [4].

As we can see, despite the advantages of such technology, it is important to consider all the possible risks and difficulties in its implementation.

2. Artificial Intelligence (AI) and Machine Learning (ML) Applications are becoming increasingly prevalent in the field of finance. These technologies enable the analysis of a vast amount of data, the detection of patterns, and the generation of intelligent predictions.

AI is the term for a range of technologies that help computers learn and reason. Earlier versions of AI were programmed by humans using rules and content, needed specific commands and responses. Nowadays, most current applications of AI are ML, and that is why the terms are therefore synonymous. Unlike earlier AI, ML is meant to be adaptable: it attempts to provide computers with the ability to learn and change without the need for reprogramming, which could be beneficial in many contexts [15, p. 2].

In the financial sector, the application of artificial intelligence (AI) and machine learning (ML) can facilitate the automation and enhancement of decision-making processes. Using these technologies, institutions can perform comprehensively accurate

and fast risk assessments, underwriting and credit scoring. AI algorithms can be advantaged in trading strategies, assets management and so on. If we talk about other significant roles of AI in the finance sector, it is crucial to mention that regulatory technology can also be aided by AI/ML, as it makes easier for the financial institutions to control the unauthorized and illicit financial activities. Considering AI-powered chatbots and virtual assistants, these technologies are useful in providing 24/7 services and personalized recommendations [15, p. 5–12].

However, as this disruptive technology is constantly changing, a number of legislative and regulatory framework and policy issues must be addressed. Policymakers are paying more attention to AI/ML in finance, but few changes have been made yet. As in most of the disruptive technologies, Data-related Policy and Risk issues are one of the biggest in this technology. The other important concern about the AI/ML is the possibility of bias – providing the same service to different people differently. While AI/ML may remove bias by eliminating discrimination, some believe it may introduce or exacerbate it [15, p. 13–23].

3. Big Data Analytics: The modern financial services industry relies on big data and analytics. New data-driven services can boost revenues, cut costs, and improve efficiency, making the industry more competitive. Security can also be improved, leading to better, safer services for customers.

Big Data is a large set of data that is rather structured into the database, or unstructured data like a number of documents/emails/etc. There can also be such type of Big Data set as the semi-structured one, which is usually structured simply by tags and markers [14].

Big Data technologies have many benefits for the businesses in the financial industry. First, it helps in noticing trends and predicting outcomes, thus improving the decision-making processes. Credit scores and risks, transactions, market trends and many other tasks are improved by using the Big Data Analytics. And, of course, it reduces costs by such an automation of number of tasks, and levels up the efficiency. No doubt, competitive advantages of such technologies are in the understanding of the market, customers, and risks. Such insights help to make better investments and lending decisions in business. If looking from the customer service perspective, Big Data technologies help to provide personalized banking services by adapting services to the persons' recent activities and behavior, as well as perform customer segmentation for better analysis and care [6].

As in the previous technologies characterized, the Big Data challenges facing the finance industry also include data security and privacy ones, and the regulatory requirements. The unique issue for this disruptive technology is definitely the Data silos, as lots of data stored in different systems can be difficult to analyze and can lead to incomplete and inconsistent data analytics results.

4. Emerging Technologies: There are many new disruptive technologies arising and becoming more and more used in the financial sector in the recent years. Among them we can focus on the next ones:

4.1. Quantum Computing is the new powerful computing technology which is prognosed to be a lot more efficient than the nowadays computing systems and become a game-changer in the operation of many industries. Though the market of such machines is still quite small and available only in the research laboratories now, it is just a question of time when will a "race" for their massive development begin.

That is more than obvious that financial institutions are believed to be able to achieve great results by using such complex mechanisms to increase optimization and prediction and reduce risks. According to the studies performed in this field, the benefits of quantum computers from which the financial industry can benefit are trade optimization, fraud detection, anti-money laundering, security improvements, risks assessment, complex probabilistic algorithms creation and other related tasks. Talking about this technology, the accuracy level is also needed to be noted: financial trends predicted by quantum computers are a lot clearer but still not 100% accurate.

The risks of this disruptive technology are as impressive as its advantages, unfortunately. Quantum computers can break the banking protection systems' encryption algorithms, so they are not safe for usage until this encryption problems are secured. And, considering the speed of the technological progress, all the financial institutions should already start planning and doing transition to the quantum-safe encryption [8; 11].

4.2. The Internet of Things (IoT) is one of the most powerful disruptive technologies which uses physical world information to create new services, improving companies' operational efficiency and overall productivity [2]. This technology suggests numerous advantages and opportunities for every industrial sector, and the finance one is not an exception.

Talking about the specific areas where the Internet of Things technologies can offer value, we can mention next ones [9]:

– Customer services can be enhanced. For example, one of the most "famous" improvements due to the advent of IoT technologies were Radio Frequency Identification (RFID) and Near Field Communications (NFC), which led to a transformation in the realm of electronic payments.

– Location-aware services can facilitate enhancements to the safety, security, and efficiency

of existing services. As a great example, in the context of mobile banking transactions, the user's location can be leveraged as a means of detecting potential fraud.

– The concept of usage-based insurance products is now considered as an IoT technology that can transform the insurance industry. In this context, some car insurers already have begun to collect data about driving behavior of their clients in order to adjust their insurance rates and conditions with the risk level associated with each individual driver's driving patterns.

– The merge of healthcare services and financial sector ones is also being actively discussed in the concept of IoT technologies usage to optimize their services, considering the health status and needs of the consumer.

Of course, it is necessary to address several challenges of Internet of Things (IoT)-based financial technology (FinTech). As the technology uses great amount of customers' data, privacy and data protection is one of the primary concerns here. Connected with the previous one, the issue of cybersecurity is also a significant challenge for the IoT. The technical difficulties of IoT implementations also still have place, as to integrate IoT and financial services, it is needed to collect and combine different datasets from different systems. It is also reported that network teams often forget to update the operating system (OS) and software on IoT devices, especially when there are many in use. At the business level, financial institutions and IoT service providers still do not have proven business models. Not to forget, there

are not so many specialists who can deal with IoT technologies and help in developing, implementing, operating, and marketing IoT-based financial services for the sector [2; 9; 16].

4.3.Studies have shown that Biometric Authentication is the best way to protect and secure data. These measures use unique characteristics of people that cannot be repeated between two people to identify them accurately and effectively [1].

This technology has gained huge popularity in the financial sector services. For instance, we all know that facial recognition and fingerprints are now used in every bank to gain access to the clients' accounts in the mobile banking apps, authorize payments, or withdraw money at ATMs – it is all now fast and easy to do. Voice recognition, iris scanning, and many other technological inventions are also gaining popularity in the Biometric Authentication field. Such technologies improve customer services significantly and save costs for the businesses as there is no need to perform many of the processes manually.

However, while there seem to be many advantages, Biometric Authentication has its drawbacks that must be addressed as well.

First, such technologies are not always 100% correct and can't fully replace real people. If a fingerprint scanner doesn't read a person's fingerprint right due to even simple dust/dirt/etc. or any other obstacle, customer might not be able to access the needed service. Facial recognition also does not work ideally: facial expressions, makeup, glasses, lightning conditions, and other changing circumstances can

Table 1

Challenges and Concerns of Disruptive Technologies in Finance

Technology	Values / Benefits	Associated Risks and Concerns
Blockchain	Transparency, security, and decentralization; traceability; faster transactions; lower operational costs; automatization and enforcement of contracts.	Data Security Privacy Concerns Regulatory Compliance Ethical Considerations Systemic Risks
Artificial Intelligence and Machine Learning Applications	- Accurate and fast risk assessments, underwriting and credit scoring. - Trading strategies and execution speed, optimizing returns. - Personalized services and improved customer experience.	
Big Data Analytics	- Insights, trends, and predicted outcomes generation. - Risk management. - Market analysis. - Personalized services.	
Quantum Computing	- Financial modeling and optimization. - Fraud detection, anti-money laundering. - Risk assessment.	
The Internet of Things (IoT)	- Real-time data collection. - Operational efficiency - Customer services enhancement. - Location-aware services. - Usage-based products.	
Biometric Authentication technologies	- Accessibility of financial services. - Stronger security. - Theft and fraud prevention.	

Source: compiled by authors

affect the biometric technology accuracy and fail its process.

We should again note that many people are concerned about the safety of their personal sensitive information and organizations must implement many technologies to protect such biometric data from breaches, keep this valuable information safe, use encryption, secure storage, and strict access controls. Spoofing and impersonation attacks are a great danger for financial systems, as attackers may try to fool the system by using fake fingerprints, photos, or voice recordings to impersonate legitimate users. This also leads to some regulatory requirements, laws, and regulations [7].

Considering the analysis that was made, we've distinguished the main characteristics of every disruptive technology discussed in this paper and summarized them in the Table 1.

Conclusion. The various disruptive technologies discussed in this paper possess their own values and advantages, providing the financial industry sector with new, efficient tools and making it easier for the common people to use different finance services. However, the drawbacks and risks to be concerned about are not smaller than the positive impact. Nevertheless, it is essential to note that specialists in this field are all the time working on improving the mechanisms to provide safety and prevent different issues that may arise. Based on this analysis, it can be concluded that such innovations are worth the risks and have a lot of great opportunities.

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