D.A. Tsenov Academy of Economics
Faculty of Finance
Department of Finance and Credit

Doctoral Candidate Tsvetomira Georgieva Veleva
Doctoral ID: D010222267

DISSERTATION ABSTRACT

For the award of the educational and scientific degree "Doctor" (in Economics) under the doctoral program "Finance, Monetary Circulation, Credit, and Insurance" (Finance) on the topic:

"DIGITAL TRANSFORMATION IN BANKING – RISKS AND FINANCIAL EFFICIENCY"

Scientific Advisor:
Associate Professor Dr. Zhelio Vatev Vatev

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Materials related to the defense are available at the Department of Doctoral Studies and Academic Development.

CONTENTS OF THE ABSTRACT

I. General Characteristics of the Dissertation

1. Relevance of the Topic

In the contemporary world, digital transformation has become an integral part of the strategic efforts of credit institutions. With the growing influence of technological innovations, the banking sector is undergoing significant changes. Banks face new opportunities and challenges that impact the framework for risk management and financial efficiency.

In the current business environment, dominated by continuous technological advancements, the banking sector is under intense pressure. The development of modern technologies (artificial intelligence, blockchain, and digital platforms) introduces new dynamics in how banks manage their operations and serve their clients. In this context, analyzing digital transformation in banking becomes crucial for business and financial stability.

Concurrently, customers increasingly expect banks to provide seamless omnichannel experiences. They demand the ability to perform the same operations—whether through online banking, phone, call centers, physical branches, or other channels—without interruptions, regardless of the time, place, or device. Clients also expect to initiate a process in one channel and complete it in another without repeatedly providing the same information.

Meanwhile, technology giants such as Apple and Google leverage their digital advantages to offer intuitive and user-friendly financial solutions, aligning with customer expectations in the digital era. Banks recognize the need to act swiftly to transform their multichannel offerings into true omnichannel banking experiences.

2. Object and Subject of the Study

The object of the study is digital transformation in banking, analyzing the key aspects and processes related to technological changes in the banking sector.

The subject of the study encompasses the risks and financial efficiency associated with digital transformation. On one hand, the research covers the identification and assessment of risks arising from the adoption of new technologies and changes in banks' operational models. On the other hand, it focuses on measuring financial efficiency through the analysis of investments, revenues, acquisition of new clients, improvements in customer service, and optimization of operational processes.

3. Research Thesis

The thesis argued in the dissertation can be defined as follows: *in the process of digital transformation, banks in Bulgaria face challenges related to the use of relatively outdated banking systems, which limit their ability to ensure the necessary flexibility and innovative functionalities critical for competitiveness in a digital environment.* Credit institutions in Bulgaria must modernize their technological platforms to meet the growing demands for digital services. However, this modernization is accompanied by challenges stemming from outdated and complex banking systems that cannot be quickly or easily adapted to modern trends in digital banking.

4. Aim of the Dissertation

Based on the defined object, subject, and thesis, the dissertation **aims** *to analyze the possibilities for successfully implementing digital banking in the context of the Bulgarian banking market while examining the challenges that may arise during this innovative process.*

5. Objectives and Methodology of the Study

The study focuses on achieving the following **objectives**:

- Presenting the evolution of information technologies in the banking sector;
- Tracing the transition from multichannel to omnichannel and optichannel banking;
- Identifying the main prerequisites for digital transformation in banking under contemporary conditions;

- Outlining the risk profile of digital banking;
- Examining the efficiency of digital transformation in banking and proposing tools for its evaluation;
- Analyzing the state of digitalization in the Bulgarian banking sector;
- Investigating challenges in risk management and improving efficiency during digital transformation in Bulgarian banking;
- Proposing optimization solutions related to risk management and efficiency in the digitalization of Bulgarian banks.

The research employs various **methods**, including analysis and synthesis, observation, comparative analysis, inductive and deductive methods, descriptive methods, and survey methods. Graphical representations and tables are used to illustrate the research findings clearly.

6. Scope of the Study

The research, in both its theoretical and empirical components, is limited to specific aspects of digital transformation in the banking sector, with a focus on the implementation of omnichannel banking in Bulgaria from 2017 to 2024. This period covers the significant dynamics of the digital transformation process in the sector. *The study excludes* the analysis of digital transformation in non-banking financial institutions and the examination of legal and regulatory frameworks related to digitalization.

7. Structure of the Study

The dissertation, spanning 195 standard pages, is structured into three chapters as follows:

INTRODUCTION

Chapter One. **THEORETICAL AND APPLIED ASPECTS OF DIGITAL TRANSFORMATION IN THE BANKING SECTOR**

1. Literature and Practice Review

2. Transition from Multichannel to Omnichannel and Optichannel Banking

3. Prerequisites for Digital Transformation in Banking

3.1. Prerequisites Related to Advancements in Information Technologies

3.2. Financial and Economic Prerequisites

3.3. Socio-Demographic Prerequisites

Chapter Two. **RISK MANAGEMENT AND EFFICIENCY ASSESSMENT IN DIGITAL TRANSFORMATION IN BANKING**

1. Risk Profile of Digital Transformation in Banking

1.1. Identification of Risks from Banking Digitalization and Their Consequences

1.2. Factor Analysis of Risks in the Digitalization Process

1.3. Methods for Quantitatively Assessing Risks from Digitalization in Banking

1.4. Measures for Mitigating Digital Risks

2. Tools for Assessing the Efficiency of Digital Transformation in Banking

Chapter Three. **CHALLENGES OF DIGITAL TRANSFORMATION IN THE BULGARIAN BANKING SECTOR**

1. Empirical Analysis of the State of Digital Transformation in Bulgarian Banking

2. Challenges and Prospects for Risk Management and Efficiency Improvement in Digital Transformation

3. Optimization Solutions for Risk Management and Efficiency in the Digitalization of Bulgarian Banks

CONCLUSION

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8. Applicability of the Research Results

The theoretical arguments, conclusions, and empirical findings of the dissertation aim to support the notion that successful digital transformation in the Bulgarian banking sector is achievable through an integrated approach combining technological innovations, risk management, and human capital development. The proposed model for digital transformation, incorporating optimization solutions for efficiency and risk management,

serves as a valuable guide and tool for stakeholders (banking institutions, regulatory bodies, and researchers) seeking to analyze, implement, or manage digitalization processes in the banking sector.

II. Main Content of the Dissertation

Chapter One. THEORETICAL AND APPLIED ASPECTS OF DIGITAL TRANSFORMATION IN THE BANKING SECTOR

The working hypothesis tested in the first chapter is as follows: *digital transformation in banking is an inevitable and strategically necessary process, requiring the integration of innovative technologies, cultural, and organizational changes.* Its aim is to meet evolving customer expectations on one hand, and on the other to ensure competitiveness, and effectively manage risks related to cybersecurity and personal data.

In the first section of Chapter One, the evolution of the banking sector is traced, focusing on how technological advancements across various periods have influenced the delivery of financial services.

During the initial stage of the banking industry (from the 15th to the 19th century), manual operations, management, and accounting were predominant, relying entirely on paper-based processes for transaction recording and bookkeeping. Transactions were labor-intensive and time-consuming, requiring meticulous manual record-keeping by employees, which incurred significant costs and effort for processing the financial transactions.

With the introduction of the telegraph in the 19th century, banks began adopting this technological advancement to improve information exchange, accelerate transaction processing, and enable faster communication between financial institutions across geographic regions.

In the first half of the 20th century, the banking sector underwent significant technological changes with the *introduction of typewriters* and mechanization. Typewriters facilitated more efficient accounting and documentation processes, while

mechanical calculators reduced the burden of manual calculations, accelerating accounting and transactional processes. This stage marked a transition from fully manual to partially mechanized processes in the banking industry.

The next phase of technological development in banking was driven by *the advent of computers* in the second half of the 20th century. Computer systems enabled banks to process transactions, manage accounting, and handle customer data more efficiently. The adoption of computers in the financial industry allowed for the automation of routine operations, improving accuracy and facilitating faster information exchange. Specialized software applications supported various banking activities, from check processing to risk management and financial analysis.

In the 1960s and 1970s, the introduction of *ATMs and credit/debit cards* marked a revolutionary moment. ATMs enabled customers to perform quick and convenient transactions outside regular banking hours, reducing dependence on branch operating schedules. Combined with the introduction of credit and debit cards, customers gained access to tools for fast and secure payments.

A significant milestone in the advancement of banking technology was the *development of electronic banking services*. With the rise of the internet and digital technologies in the late 20th and early 21st centuries, the financial industry adapted to new possibilities by offering online banking, electronic transfers, mobile applications, and other innovative electronic services. Online banking allowed customers to manage their finances through web browsers, simplifying access to banking services. Electronic transfers enabled fast and secure fund exchanges, reducing the need for physical branch visits. Mobile applications became particularly popular, enabling customers to perform transactions anytime, anywhere, transforming banking into a flexible and personalized process.

The early 21st century saw the *adoption of technologies such as blockchain and artificial intelligence.* Blockchain, known for its decentralized and tamper-proof structure, provides a safer and more transparent method for recording and verifying transactions, eliminating the need for intermediaries and enhancing transaction security. Artificial

intelligence plays a critical role in risk management and delivering personalized financial services.

In recent decades, the fintech sector and cloud technologies have seen rapid growth. Fintech companies leverage innovative technologies to offer groundbreaking financial products and services, utilizing mobile payments, robo-advisors, and cloud services to revolutionize how individuals interact with their financial resources. Cloud services enable secure storage, processing, and sharing of financial information.

In literature and practice, terms are increasingly used interchangeably, although they have different nuances and emphases.

Terms such as *Digitalization of banking operations* refers to the process of converting traditional services and operations into digital formats, using technology to enhance efficiency, accuracy, and convenience. Examples include electronic banking, mobile applications, electronic signatures, and digital payment systems.

Terms such as *Digital banking* encompasses a broader range of online and mobile services, from balance inquiries and fund transfers to complex operations like investment management and online loan applications, aiming to provide easy and fast access to financial services without requiring physical branch visits.

Meanwhile, Terms such as *Digital transformation in banking* involves a deeper, more comprehensive change in how banks operate and deliver services, including not only technology adoption but also changes in organizational structure, culture, and business models.

And about the terms such as *Digital revolution in banking* describes the fundamental shift in the sector driven by the widespread adoption of new technologies and innovations, such as blockchain, artificial intelligence, machine learning, and the Internet of Things (IoT), which transform traditional processes.

Section 2 of Chapter One focuses on the transition from multichannel to omnichannel and optichannel banking, highlighting differences in how banks interact with customers through various channels. A channel is defined as a “point of contact” between the customer and the bank.

Multichannel banking allows customers to access banking services through various channels, but these channels are often not interconnected. *Omnichannel banking* integrates all channels, enabling customers to switch seamlessly between channels without loss of information or service quality. *Optichannel banking* focuses on delivering the most optimal channel for a specific customer in real-time, tailored to their needs, behavior, and preferences (see Table 1).

Table 1. Comparative Characteristics of Multichannel, Omnichannel, and Optichannel Banking

	Multichannel	**Omnichannel**	**Optichannel**
Brand Objective	Maximize audience coverage across channels	Ensure seamless transitions between channels	Enhance customer experience by understanding preferences and optimizing interactions per channel
Corporate Strategy	Brand-oriented	Customer-oriented	Experience-oriented
Channel Integration	No	Yes	Yes, with the ability to identify the optimal channel
Channel Mix Optimization	No	No	Yes
Context Transfer Across Channels	No	Yes, seamless	Yes, based on the customer's preferred channel
Personalization Capability	Channel-focused	Customer-focused	Context/moment-focused for specific customers
Use of Artificial Intelligence	No	No	Yes

Source: Author's summary

Section 3 of Chapter One analyzes the prerequisites for digital transformation in banking.

Arguing that digitalization is an objective process driven by diverse *factors*—technological, economic, socio-demographic, and others.

Key prerequisites for the emergence of omnichannel banking include the proliferation of advanced mobile devices, the exponential growth of their users, and the increasing engagement of customers with social media, online stores, and mobile

applications. Smart branches utilizing technologies such as video conferencing and interactive ATMs provide personalized services and enhance interaction efficiency with the customers.

Analyses indicate that digital transformation in banking is catalyzed by financial and economic factors, including cost reduction, revenue growth opportunities, competitive pressures, changing consumer attitudes, and product diversification.

Additionally, evolving generational preferences act as a catalyst, with Millennials (born in the 1980s to mid-1990s) and Generation Z (born approximately between 1995 and 2015) showing strong preferences for mobile and digital banking services, demanding convenience, speed, and transparency. Millennials and members of Generation Z prefer mobile apps and intuitive platforms to manage their finances, while also seeking personalized and transparent solutions. Generation Z, having grown up in the digital age, is the main driver of this transformation, demanding a fully digital experience integrated with new technologies.

Chapter Two. RISK MANAGEMENT AND EFFICIENCY ASSESSMENT IN DIGITAL TRANSFORMATION IN BANKING

In the second chapter of the study, the following ***working hypothesis*** is tested: *digital transformation, when managed with a comprehensive approach, reduces risks, improves financial efficiency, and optimizes processes.*

Section 1 of Chapter Two examines the risk profile of digital transformation in banking.

By "***risk of digitalization in banking***," we understand the potential threats and the possibility of incurring damage that may arise as a result of the growing dependence of the financial industry on digital technologies. Risk management in the context of digitalization includes: identifying these risks; analyzing the sources of the respective risks and the consequences of their occurrence; outlining ways to mitigate risks during

digital transformation; and quantitatively assessing the risks in the process of digitalization.

The risk of digitalization in the financial sector manifests in specific forms or variations. Therefore, **identifying the risks** associated with the digitalization of banking activities is of key importance. The typical types of risks encountered in banks' operations during their digital transformation are outlined.

Risks related to breaches of information security and cybersecurity include potential incidents such as unauthorized access, theft or manipulation of sensitive financial and/or personal information, hacking attacks, etc., which can lead to serious consequences (financial losses, breaches of customer confidentiality, and a decline in trust in the banking system).

Operational risk in the field of digital banking refers to potential disruptions in the day-to-day operation of digital banking systems that may lead to losses or interruptions in the services provided. This type of risk encompasses various scenarios, including technological failures, software errors, or deficiencies in the infrastructure.

Risks related to personal behavior in the context of digital banking include potential irregularities that may arise from both employees and clients (such as unethical behavior by banking staff, use of confidential information for personal gain, or engagement in improper financial practices by clients).

Technological risks in the field of digital banking refer to potential failures, errors, or the use of inadequate technological systems. These risks can negatively impact the stability and reliability of digital platforms. This category includes scenarios involving technical issues such as software crashes, cybersecurity vulnerabilities, or physical infrastructure failures.

Regulatory risk in the sphere of digital banking involves the challenges arising from changes in regulations and compliance requirements. These risks may emerge due to the dynamic nature of digital transformation. With constantly evolving rules and guidelines, credit institutions are faced with the need to adapt their processes and technologies to remain compliant with new regulatory frameworks.

Third-party risks refer to the dependence on external entities, such as technology providers, whose actions or vulnerabilities can affect the security and functionality of digital banking systems. These risks include scenarios in which technology vendors or other third parties that banks rely on for access to technologies and services are exposed to cyberattacks, security breaches, and similar threats.

Money laundering risks in digital banking involve new opportunities for concealing identities and financial transactions. This makes digital platforms vulnerable to abuse for money laundering purposes.

Risks from external shocks, such as economic downturns or financial crises, pose a significant challenge in the field of digital banking. During periods of economic instability, customer transactions and loans may behave unpredictably, exposing digital banks to increased uncertainty. At the same time, financial crises lead to a loss of trust in the banking system, a rise in insolvency, and difficulties in risk management.

Risks related to the instability of funding sources. Digital banks are vulnerable to changes in market conditions, especially regarding their sources of funding. In times of instability or financial hardship, customers may alter their behavior by withdrawing part of their deposits, which can lead to a lack of liquidity for digital banks.

Risks from transactional and procyclical lending in the context of digital banking are a cause for concern, as loans provided by digital banks may exhibit procyclical characteristics—expanding during periods of economic growth but becoming more exposed to risk during downturns. If not managed properly, such loans can impose a significant financial burden on businesses during times of economic hardship, potentially hindering their operations or even driving them out of business.

Risks from digital monopolies in the field of digital banking are based on the potential for monopolistic control over data. Situations in which a single organization or platform holds a significant share of customer or market data can lead to price discrimination—where users pay different prices for similar services based on their profiles and characteristics. Moreover, digital monopolies may use their control over data to hinder competition, ultimately resulting in negative consequences for consumers.

The risks of discrimination and privacy issues in digital banking include potential problems that lead to discrimination, privacy breaches and misuse of sensitive data. When the algorithms used to process data in banking systems contain interference or bias, they give rise to unfair treatment of certain groups of customers (e.g. by gender, race or financial status). The misuse of sensitive data has serious consequences, including financial fraud or identity theft.

The analysis of **the drivers (sources) of risk** in banks' digital transformation covers a range of different aspects. The following groups of risk factors are included in the model proposed in the study:

1. ***Technological factors:***
    - *Infrastructure:* challenges relating to the readiness of existing banking infrastructure to adopt and manage new technologies.
    - *Cybersecurity:* issues related to data protection and cybersecurity during the digital transformation.
2. ***Regulatory factors:***
    - *Compliance:* circumstances regarding regulatory requirements and compliance during the digital transformation.
    - *Legalisation:* difficulties arising from changes in legislation that may affect digital innovation in the banking sector.
3. ***Organizational factors:***
    - *Entrepreneurial culture:* risks associated with the willingness of bank staff to adopt and use new technologies.
    - *Change management:* risks related to change management and the implementation of new business processes.
4. ***Financial factors:***
    - *Investments:* financial issues related to investment in new technologies and systems.

- *Operational costs:* difficulties caused by cost increases during the transition to digital solutions.

5. Consumer factors:

- *User acceptance:* adverse consequences of customers' failure to accept new digital services.
- *User experience:* dangers related to user satisfaction and the quality of digital products and services.

According to our view, **the quantitative assessment of risks** associated with the digitalization of the banking sector requires the use of a combination of various methods and quantitative indicators. Suitable for this purpose are the Value at Risk (VaR) and Expected Shortfall (ES) models, although they are typically employed for assessing financial and market risks.

The Value at Risk (VaR) method is a traditional model for quantitatively measuring potential financial losses. However, it can be adapted and applied to certain aspects of digitalization in the banking sector. Some of the risks that can be measured using VaR include cybersecurity, technological failures, operational risks, regulatory impacts, issues related to personal data protection, and commercial risks.

Expected Shortfall (ES), also known as Conditional Value at Risk (CVaR), is an extension of the Value at Risk (VaR) concept. It focuses on moderate and extreme cases of financial losses. This model is used to assess the average value of financial losses that exceed a specified critical threshold, providing insight into the distribution of extreme values within the loss distribution.

VaR calculates a specific percentile of the loss distribution (e.g., 95% or 99%). ES goes further by evaluating the average value of losses that occur beyond this threshold.

The use of Value at Risk (VaR) and Expected Shortfall (ES) in assessing risks associated with the digitalization of the banking sector can be combined with other methods, such as cybersecurity models, resilience analysis, and incident detection systems.

Cybersecurity models play a pivotal role in the modern banking environment, where digitalization heightens vulnerabilities to new types of threats. These models encompass risk analysis, internal and external cybersecurity, identity management, and access control. By integrating these models with VaR and ES, financial institutions can more effectively assess potential financial losses resulting from cybersecurity incidents.

Another method offering broader possibilities for the quantitative measurement of risk is **resilience analysis**. This approach involves assessing the likelihood of a banking infrastructure recovering from adverse events or incidents. Resilience can be viewed as a quality that reduces the vulnerability of an element, absorbs the effects of disruptive events, enhances the element's capacity for response and recovery, and facilitates its adaptation to similar disruptive events previously experienced. For this purpose, the application of the CIERA (Critical Infrastructure Elements Resilience Assessment) methodology is suitable. This methodology is designed to evaluate the resilience of elements within critical infrastructure systems. Its principle involves a statistical analysis of the resilience level of these elements, encompassing a comprehensive assessment of their robustness, recovery capabilities following disruptive events, and adaptability to prior disruptive incidents. The resilience of critical infrastructure elements is determined by various domains, components, and variables. Technical resilience includes components of robustness, recovery, and adaptation. Organizational resilience encompasses the ability to detect, respond to, and manage various challenges. Thus, infrastructure elements must be prepared to handle crises, possess the necessary material and financial resources, foster innovation and educational processes, and demonstrate rapid recovery and adaptation to changing circumstances.

Security Information and Event Management (SIEM) systems provide automated monitoring and real-time analysis of events. These systems are designed to detect potential cybersecurity breaches, identify anomalies, and respond to incidents.

Integrating SIEM with VaR and ES enables rapid response and optimal management of risks associated with cybersecurity threats.

Banks employ various **methods to mitigate digital risks**. Table 2 specifies the necessary actions on their part, presented *from the perspective of the diverse factors (sources) of the respective risks*.

Table 2. Measures for Mitigating Digital Transformation Risks in Banking by Risk Factors

Factors (sources) of digital risks		**Required Actions by Banks**
Mitigation of Risks Related to Technological Factors	*Infrastructure*	Banks should actively invest in modernizing their systems and infrastructure to ensure scalable and flexible platforms. Conducting a detailed analysis of the current infrastructure and developing a phased transformation plan help prevent potential operational disruptions during digital transformation.
	Cybersecurity	Banks should develop and implement cybersecurity strategies, including regular audits, staff training, and the adoption of advanced technologies to prevent cyberattacks. Establishing reactive and preventive measures ensures the protection of sensitive information and maintains customer trust.
Mitigation of Risks Related to Regulatory Factors	*Compliance*	Banks should establish detailed procedures for monitoring regulatory changes and integrating updates into their internal systems. Active participation in industry and regulatory forums facilitates the anticipation and swift implementation of relevant changes.
	Legislation	Banks should maintain legal teams to track legislative changes and assess their potential impact on digital transformation. Ongoing communication with regulators and government institutions helps anticipate and manage legal risks.
Mitigation of Risks Related to Organizational Factors	*Entrepreneurial Culture*	Banks should foster an entrepreneurial culture through training, encouraging innovation, and creating structures for expressing innovative ideas. Establishing training programs and incentivizing creativity accelerates the adoption of new technologies.
	Change Management	Banks should have clear and communicated change management strategies that involve all levels of staff. Implementing feedback systems and regular communication with employees facilitates the transition and management of potential resistance to change.
Mitigation of Risks Related to Financial Factors	*Investment Risks*	Banks should conduct detailed cost-benefit analyses of new technologies before making investments. Developing innovative financial models and investment risk management plans helps banks adapt to new technologies while minimizing financial risks.
	Operational Costs	Banks should anticipate and manage operational costs associated with implementing new technologies. Effective planning and cost management ensure financial sustainability and the successful application of digital solutions.

Mitigation of Risks Related to Consumer Factors	*Consumer Adoption*	Banks should actively engage their customers throughout the digital transformation process. Developing educational campaigns and providing intuitive, user-friendly interfaces enhance customer acceptance of new technologies.
	Consumer Experience	Banks should build and maintain a high-quality consumer experience by testing products and monitoring customer feedback. Analyzing feedback and continuously improving interfaces ensure that customers receive a satisfactory and secure user experience.

Source: Author's summary

The necessary actions for banks to mitigate risks associated with digital transformation*, differentiated by risk types*, are outlined in Table 3

Table 3. Measures for Mitigating Risks in Digital Transformation by Risk Type

Risk Types in Digital Transformation	**Required Actions by Banks**
Risk of Information Security and Cybersecurity Breaches	implement high cybersecurity standards, including effective protection and prevention measures to mitigate potential incidents.
Operational Risks	maintain strict protocols for testing, monitoring, and rapid recovery, as well as invest in advanced technologies and staff training.
Behavioral Risks	introduce strict ethical standards and oversight, provide staff training on proper conduct, and ensure an effective mechanism for reporting and resolving potential irregularities within the system.
Technological Risks	invest in modern and secure technologies, ensure systems for monitoring and rapid recovery, maintain high cybersecurity standards, and continuously update and test technological systems.
Regulatory Risks	actively monitor and interpret legislative changes, invest in regulatory compliance, and maintain flexibility in their systems to adapt to new requirements.
Third-Party Risks	conduct thorough assessments of service and technology providers, ensure clear contractual obligations for security and data protection, and maintain active monitoring and risk management related to these partners.
Money Laundering Risks	actively implement and maintain strict systems for client identification, transaction monitoring, and reporting of unusual activities. They should collaborate with regulators and align their policies with the latest anti-money laundering standards to uphold the integrity and security of the banking industry and prevent the illegal use of digital banking platforms.
Risks from External Shocks, such as Economic Downturns or Financial Crises	ensure the resilience and adaptability of their systems and processes. Prudent portfolio management, robust risk management strategies, and continuous monitoring of economic conditions are essential to mitigate the potential negative impacts of external shocks and maintain the sustainability of digital banking operations.
Risks from Funding Source Instability	monitor market conditions and develop strategies to diversify funding sources to ensure financial stability.

Transactional and Procyclical Loan Risks	apply rigorous risk assessments and implement appropriate protective measures to support SMEs, offering sustainable and adaptable financial products that reflect the real needs of businesses under varying economic conditions.
Digital Monopoly Risks	work on establishing and implementing appropriate rules and standards to ensure fairness and consumer protection in digital banking.
Risks from Algorithmic Discrimination and Privacy Issues	invest in technologies that ensure transparency and accountability in algorithmic systems, as well as implement measures to check and correct biases, guaranteeing the ethical and impartial use of data.

Source: Author's summary

In paragraph 2 of Chapter Two, the focus is on the tools for assessing the efficiency of digital transformation in banking.

The analysis of the return on investment (*ROI*) and key performance indicators (*KPIs*) holds significant informational value in evaluating the efficiency of digital transformation in the banking sector.

The Return on Investment (ROI) analysis for digital transformation in banking aims to determine the relationship between the benefits derived by the bank from digital transformation and the costs incurred to achieve it. The specified components can be detailed as follows:

- ***Measurement of Investments***: This involves identifying and analyzing investments in new technologies, software, staff training, and other related costs. Measuring investments in the context of digital transformation in banking requires examining and evaluating various expenses associated with implementing technologies such as blockchain, artificial intelligence, digital customer channels, and more. Beyond the technologies themselves, a significant portion of investments relates to software solutions that ensure integration and compatibility between different systems. Providing the necessary knowledge and skills to staff through training is also a critical component that must be considered when calculating investments. However, this analysis is not limited to technological aspects alone; it also includes other related costs, such as changes in business processes, regulatory compliance, and modifications to the work environment.
- ***Revenue Calculation:*** This involves analyzing realized revenues, taking into account both the increase in revenues from the introduction of new products and the

enhancement of operational efficiency. This includes revenues resulting from innovations such as digital banking products, improved customer services, expanded digital channels, and other advancements. The evaluation also encompasses measuring improvements in operational processes that lead to greater efficiency and contribute to revenue growth.

A suitable tool for assessing the efficiency of digital transformation in banking is *the analysis of Key Performance Indicators (KPIs).* These include:

- ***Number of New Clients.*** This parameter not only provides insight into the success of digital initiatives in serving new users but also serves as an indicator of the expansion of the customer base. Attracting new clients through digital channels and innovative technologies can be quantitatively measured through metrics such as: Increase in the number of registered users; Number of active users (those actively using digital banking services); Number of newly opened bank accounts; Comparison of the number of new users before and after the implementation of digital services, among others.

- The following can be used as key indicators for ***assessing the increase in customer satisfaction and loyalty***: the level of customer satisfaction (measured, for example, through the Net Promoter Score or other surveys among customers); the proportion of customers who trust digital banking and prefer to use it compared to the total number of customers; the share of customers receiving personalized banking services compared to the total number of clients; the average size of transactions conducted through digital channels; the frequency of use of digital services by customers; the reduction in the number of lawsuits filed by clients against the bank related to operations conducted through digital channels, among others.

- ***Improvement in Customer Service***: This parameter embodies the primary goal of digital innovations—to enhance customer interaction and provide a greater number of higher-quality, personalized services. To measure the impact on customer service, banks can use various performance indicators: the average response time to a request, which provides insight into the speed of customer service; the average time required to process and execute transactions through respective digital channels; the proportion of customer operations or inquiries conducted through digital channels without the direct involvement

of bank staff or a visit to a physical branch; the convenience, speed, accessibility, and ease of use of mobile applications; the number and percentage of successfully completed transactions through digital channels; the number and percentage of unsuccessful transactions conducted through digital channels, among others.

- ***Measurement of Internal Process Optimization***. This involves monitoring indicators such as: the number of implemented new technologies (e.g., automation, artificial intelligence, and robotic data processing); the average time required to complete respective operations; the reduction in human errors; the number of cybersecurity-related incidents; the increase in the number of offered digital products; the number of concluded collaboration agreements with fintech companies; the degree of compatibility of new digital technologies with traditional banking systems; the costs of maintaining IT infrastructure as a percentage of total expenses, among others.
- ***Staff Competency in Working with New Digital Technologies***. This encompasses quantitative indicators such as: the level of employee satisfaction and readiness to adopt and use digital technologies (determined based on surveys conducted among staff); the number of training courses on digital skills conducted over a specific period; the number and proportion of employees who have undergone training to acquire knowledge and skills for working in a digital environment; the proportion of employees with the necessary knowledge and experience to work with new digital technologies; the average training costs per employee; staff productivity (measured by the revenue generated from digitalization per employee); the number of innovative ideas and proposals from staff; staff turnover rates, and so forth.

As evident from Figure 1, achieving certain indicators serves as a prerequisite for the realization of others.

Chapter Three. CHALLENGES OF DIGITAL TRANSFORMATION IN THE BANKING SECTOR IN BULGARIA

In the third chapter, the following ***working hypothesis*** is tested: *the successful digital transformation of the banking sector in Bulgaria requires the application of a balanced approach that combines the utilization of strengths and opportunities on one*

hand, and the minimization of weaknesses and rational management of risks in the digitalization process on the other.

In **paragraph 1 of the third chapter**, an empirical analysis of the state of digital transformation in banking in Bulgaria is conducted.

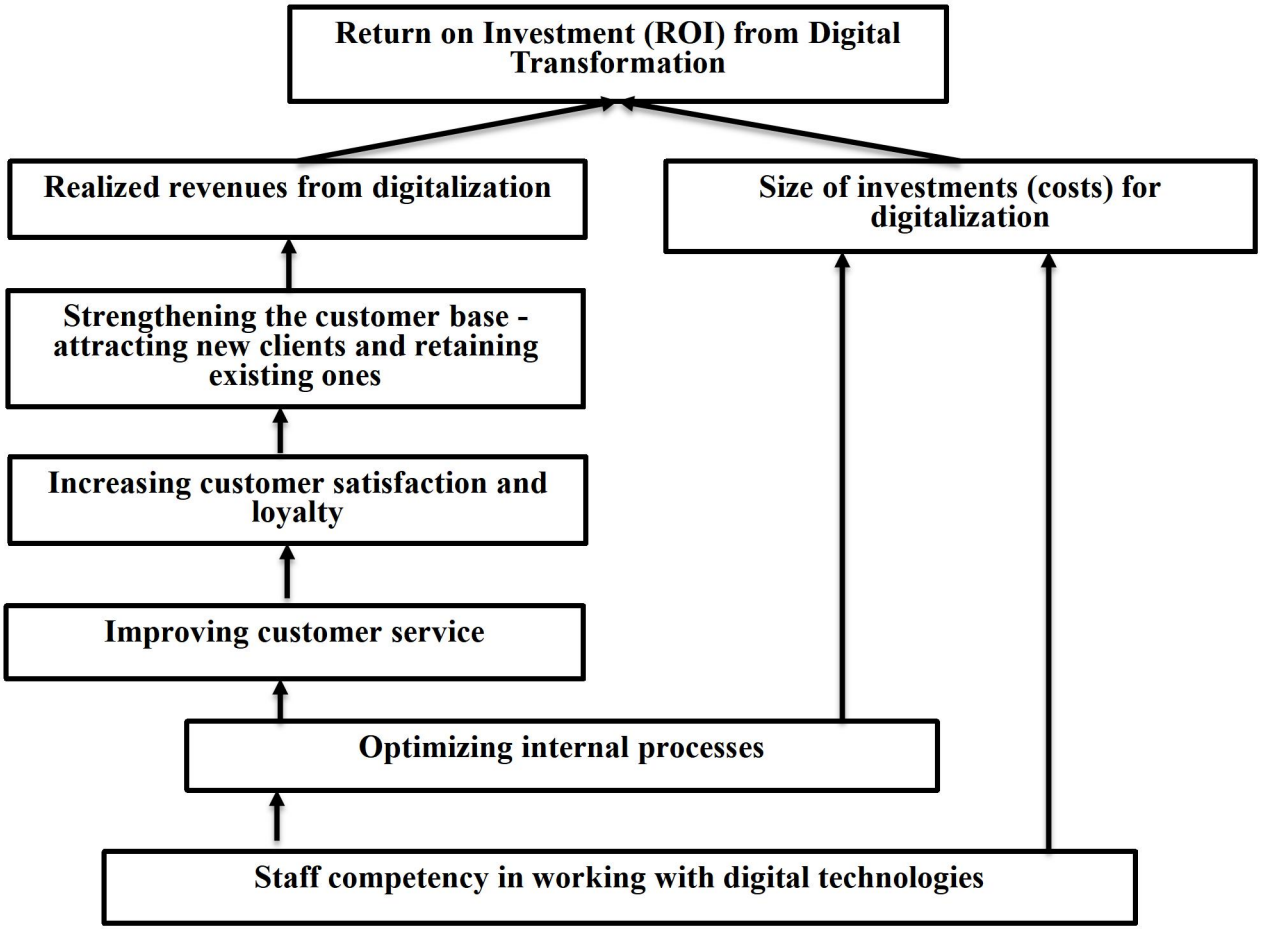

Figure 1. Parameters for Assessing the Efficiency of Digital Transformation in Banking – Causal Relationships

Source: Author's summary

Banks in Bulgaria are actively striving to adapt to digital requirements. They offer hybrid products that combine digital and traditional elements. This hybrid service model allows them to meet diverse customer preferences, providing both digital capabilities and opportunities for personal interaction.

The experience of Bulgarian banks in omnichannel offerings can be divided into the following categories:

Category 1: Banks that enable customers to open accounts online but also maintain branches where clients can visit to speak with a representative in person and open an account on-site.

Category 2: Banks that offer mobile banking applications, allowing clients to check account balances, make payments, and transfer money on the go, as well as call centers where customers can speak with a representative over the phone.

Category 3: Banks that integrate their online and mobile banking platforms with their branch network, enabling clients to schedule appointments, check account balances, and conduct transactions online or via the mobile application, and then visit a branch to complete the process in person if necessary.

Category 4: Banks that use data analytics to personalize the customer experience and provide targeted marketing and recommendations based on the client's banking history and preferences.

The omnichannel offerings of banks in Bulgaria across the four categories are summarized in Table 4.

Table 4. Omnichannel Offerings of Banks in Bulgaria

Bank	***Category 1***	***Category 2***	***Category 3***	***Category 4***
DSK Bank	DSK Direct Electronic Banking	DSK Smart Mobile Banking	Omnichannel mortgage and consumer loans	Digital Factory for Clients
Postbank (Eurobank)	e-Postbank Novo Online Accounts	m-Postbank Mobile App	Digital offices and self-service zones	Premium Banking
Central Cooperative Bank AD	CCB Online	CCB Mobile Smart Banking	Omnichannel account openings and transactions	
First Investment Bank AD	My Fibank Electronic	My Fibank Mobile App	Omnichannel loans and account/card openings	Fibank Digital Zone

	Banking			
UniCredit Bulbank AD	Bulbank Online	Bulbank Mobile	Omnichannel platform integrated with branches and call centers	Call Center
United Bulgarian Bank AD	UBB Online Banking	UBB Mobile		AI Virtual Assistant – KATE
Investbank AD	Ibank Internet Banking	Ibank Mobile	Omnichannel loans and account/card openings	Live Chat
Allianz Bank Bulgaria AD	Allianz Bank Online	Allianz Bank Mobile	Omnichannel mortgage offerings	
Bulgarian-American Credit Bank AD	BACB Online	BACB Plus Mobile	BACB Plus Virtual Bank	
TBI Bank EAD	TBI Bank Online	TBI Bank App	Omnichannel account openings and transactions	Storyly Personalization Platform
ProCredit Bank (Bulgaria) EAD	Probenking Online	Procredit Mobile	Digital offices and self-service zones	
International Asset Bank AD	Asset Online	Asset Mobile/Digital	Omnichannel account openings and transactions	
Commercial Bank D AD	D Bank Online	D Mobile App	Omnichannel account openings and transactions	
Bulgarian Development Bank EAD	Internet Banking		Omnichannel account openings and transactions	Business Booster Platform, Virtual Assistant Vicky
Tokuda Bank AD	Online Banking	Mobi-B Mobile App	Omnichannel account openings and transactions	
Texim Bank AD	Online Banking	Texim Bank Mobile	Omnichannel account openings and transactions	
Municipal Bank AD	DiGiBank Online	MB-mobile App	Omnichannel account openings and transactions	

Source: Author's summary

From the data in Table 4, it can be concluded that all banks in Bulgaria from the first and second groups offer online and mobile banking to their clients. However, only a few have integrated their mobile and online platforms with in-person services and/or use data analytics for personalized offerings and customer experiences.

In **paragraph 2 of the third chapter**, some challenges and prospects for risk management and efficiency improvement in the digital transformation of banking in Bulgaria are outlined. For the purposes of the study, an author-conducted survey was carried out among 100 individuals working in various banks in Bulgaria.

The sample includes not only senior managers but also employees from functional departments such as marketing, IT, operations, and customer service. This ensures a more comprehensive view of employees' perceptions at different levels of the organizational

hierarchy. The survey was conducted online between January and February 2024. It consists of 20 questions grouped into four sections focusing on: (1) the readiness of banks in Bulgaria for digital transformation; (2) the challenges and problems faced by banks and their clients in the digitalization process; (3) the benefits of digitalization for banks and clients; (4) the prospects and expectations related to the digital transformation of the banking sector in the country.

The results of the conducted survey can be summarized as follows:

First, responses to questions regarding ***the readiness of banks in Bulgaria for digitalization*** provide an overview of employees' perceptions and experiences concerning their readiness for digital transformation. Half of the participants express optimism about their bank's ability to adapt to digital requirements. However, a significant percentage have certain doubts or a negative stance. Employees in the marketing department assess their department's success in handling new technologies and innovations with increased optimism. Regarding cybersecurity, while a large portion of employees express confidence, there are still those who believe that preparedness is insufficient. The effectiveness of training is a point of contention—some consider it successful, while others question its effectiveness. Perceptions of the flexibility and speed of changes in work processes are mixed, with half being positive, but another portion expressing doubts or dissatisfaction.

Second, regarding responses to questions about ***challenges and problems in digital transformation***, bank staff primarily point to financial constraints and technological infrastructure as the main difficulties hindering successful digital transformation. There are concerns that the modernization of technological platforms is accompanied by challenges stemming from relatively outdated banking systems that are not easily adaptable to modern trends in digital banking. At the same time, expectations regarding client reactions are not uniform. Even when assuming positive client acceptance of digitalization, this is done with an awareness of the need to manage negative and neutral reactions. It is also emphasized that clients face challenges, such as concerns about the security of their personal data and the need for new technical skills.

Based on the provided suggestions for measures and initiatives, the importance of training, support for staff and clients, and investments in secure technologies and improvements to digital platforms are highlighted to overcome these challenges.

Third, responses to questions about ***the benefits of digitalization for banks and clients*** highlight a variety of expectations and priorities. For banks, greater efficiency, operational optimization, improved customer service, and enhanced competitiveness are key focuses, along with a desire to reduce operational costs and attract new clients. Customers expect greater convenience, easy access, lower fees, and more investment opportunities, accompanied by increased transparency and security. Bank employees see advantages in better personalization, faster processes, a variety of online products, and opportunities for building long-term relationships. The conclusion is that digital transformation has the potential to improve bank efficiency, meet customer needs, and create longer-term relationships with them, but it is important to consider the diverse expectations and challenges of both banks and clients.

Fourth, the provided responses highlight the complex nature of ***the prospects and expectations related to digital transformation in the banking sector***. Despite the diversity of views, optimism about the future prevails. A significant number of survey participants see the implementation of new technologies as an opportunity for expanding services and the client base, as well as for greater innovation and personalization. This optimism is accompanied by acknowledgment of challenges, including concerns about sector stability and maintaining competitiveness. Uncertainty about the future remains, as reflected in the responses of those who cannot predict the specific outcome of digital transformation. Overall, the variety of responses underscores the need for flexibility and adaptability in the sector, as well as careful management of the changes that are inevitable in an era of rapidly evolving technologies.

Overall, the results of the conducted survey indicate that banks in Bulgaria recognize the need to enhance their technological platforms to meet clients' demands for digital services. However, this modernization process is accompanied by obstacles stemming from relatively outdated and complex banking systems that adapt more slowly

and with difficulty to modern trends in digital banking. Nevertheless, it cannot be denied that many banks in Bulgaria are actively striving to adapt to digital requirements by offering hybrid products that combine digital and traditional elements.

In the final **paragraph 3 of the third chapter**, optimization solutions related to risk management and efficiency in the digitalization of banks in Bulgaria are sought. For the purposes of this study, a SWOT analysis was conducted.

Table 5. SWOT Analysis of Digital Banking in Bulgaria

	STRENGTHS ***of banks in Bulgaria in digital transformation***
INTERNAL ANALYSIS	• Developed IT infrastructure • High penetration rate of internet and mobile banking • Accumulated experience and knowledge in managing digital projects • Customer trust in traditional banks • Regulatory support for digitalization • Good integration with international payment systems • Reduction of risks from errors and fraud, as well as greater data security and protection • Cost optimization, leading to increased profitability and efficiency • Interaction with clients through multiple channels • Improved banking management quality, including the application of more precise risk and efficiency assessment models • Increased speed and accuracy of operations • Enhanced customer service
	WEAKNESSES ***of banks in Bulgaria in digital transformation***
	• Use of complex and outdated banking systems that are difficult to adapt to modern trends in digital banking • Weak innovation culture • Insufficient capacity for staff training and development • Slow changes in organizational structure and modernization of internal processes • Difficult transition from a product-oriented to a customer-oriented banking model • High costs of digital transformation • Insufficient funding for digital projects • Complex procedures for implementing new technologies • Lack of a comprehensive digital transformation strategy

	• Limited personalization of digital services
EXTERNAL ANALYSIS	***OPPORTUNITIES for banks in Bulgaria in digital transformation***
	• Modernization through cloud technologies and API solutions • Development of open banking and fintech partnerships • Implementation of automation and AI solutions • Stimulation of banking competition • Digitalization of credit and payment services • Opportunities for expanding personalized financial services • Access to European digitalization programs • Opportunities for more effective data analysis and risk management • Opportunities for expanding access to new markets, clients, and regions, as well as the range of provided products and services
	THREATS for banks in Bulgaria related to digital transformation
	• Cybersecurity breaches and data protection issues • Increased competition from fintech and BigTech companies • Shortage of financial resources • Strict regulatory requirements and complex regulatory frameworks • Technological dependence on external providers • Changes in consumer behavior • Resistance to change from bank employees or clients • Insufficient technical skills or internet access among some clients • Difficulties in migrating to new technological platforms • Economic uncertainty and inflation

Source: Author's summary

The SWOT analysis of digital banking in Bulgaria allows for the identification of four main strategies for digital transformation.

The first strategy can be formulated as the ***Strengths-Opportunities (SO) Strategy*** . In this context, banks in Bulgaria should leverage their developed IT infrastructure and high penetration rate of internet and mobile banking to expand their market share through digital channels. The accumulated experience and knowledge in managing digital projects can be applied to introduce innovations and personalize services, contributing to attracting new clients and retaining existing ones.

The second strategy is ***the Weaknesses-Opportunities (WO) Strategy*** . In this case, banks focus on overcoming the lack of an innovation culture and insufficient capacity for staff training and development. They can utilize opportunities for collaboration with fintech companies, which can provide the necessary knowledge and technologies for rapid adaptation and implementation of new digital solutions. This way, banks will modernize their systems while overcoming resistance to change.

The third strategy is ***the Strengths-Threats (ST) Strategy*** in the digital transformation process. Banking institutions in Bulgaria can use their developed IT infrastructure and expertise in managing digital projects to address threats related to cybersecurity and data protection. They have the opportunity to implement advanced security systems and establish procedures for rapid response to breaches. Additionally, banks must monitor regulatory requirements and adopt technologies that ensure compliance and transparency.

The fourth strategy is ***the Weaknesses-Threats (WT) Strategy*** in the digital transformation process. This strategy requires banks to focus on modernizing complex and outdated systems and overcoming resistance to change. They should invest in staff training and development to foster an innovation culture and prepare employees for working with new technologies. Furthermore, adequate funding for digital projects must be secured to ensure successful adaptation and sustainability of digital solutions

Conclusion

The conclusion presents the final results of the theoretical and applied research on current issues related to the digital transformation of banks in Bulgaria. It reflects the achievement of the set objective, working hypotheses, and the research thesis of the dissertation.

III. Directions for Future Research on the Dissertation Topic

The issues related to digital transformation in the banking sector are not exhausted by the main research directions covered in the dissertation. The topic remains relevant and can be further developed in the following directions for future research:

1. Investigating the impact of digital transformation on the long-term sustainability and competitiveness of the banking sector, analyzing how digitalization affects financial performance and customer satisfaction.
2. Expanding the scope of studied institutions to include smaller banks, fintech companies, and non-banking financial institutions to assess the interaction between traditional banking structures and new market players.
3. Including more groups and types of models in comparative analysis to explore the issue of cybersecurity and data management in the digital environment in greater depth, with a focus on innovative technologies such as blockchain and artificial intelligence.

IV. Overview of Scientific and Applied Contributions in the Dissertation

1. The concept of "digitalization risk in banking" is defined, and the risk profile of digital transformation in banks is examined. The elements of digitalization risk management are analyzed in detail. For this purpose, types of risks are identified, their sources and consequences are specified, possible mitigation measures are analyzed, and specific indicators for their quantitative assessment are proposed.
2. A system of specific quantitative indicators for assessing the efficiency of digitalization in the banking sector is substantiated, with causal relationships between them outlined.
3. A comparative analysis of banks in Bulgaria regarding digital transformation is conducted empirically, and a critical assessment of the state of this process in recent years is provided.
4. Based on an author-conducted survey among specialists in Bulgarian banking practice, the difficulties and challenges of digital transformation in the sector are summarized. The key issue in this regard is identified as the discrepancy between the relatively outdated infrastructure of banks in Bulgaria and the rapid pace of technological development, necessitating strategic investments and organizational changes.
5. Based on a detailed SWOT analysis summarizing the strengths, weaknesses, opportunities, and threats in digitalization, specific opportunities for optimizing the processes of managing efficiency and risk in the digital transformation of banks in Bulgaria are outlined.

V. List of Doctoral Candidate's Publications

Studies:

1. Veleva, Tsv. Risk Management and Efficiency Assessment in Digital Transformation in Banking // Dialogue Journal, 2025, Issue 1, pp. 97-117 (ISSN: 1311-9206; DOI: https://doi.org/10.58861/tae.di.2025.1.05).
   Link: https://dialogue.uni-svishtov.bg/title.asp?title=3102
2. Veleva, Tsv. Challenges of Digital Transformation in the Bulgarian Banking Sector // Annual Almanac "Doctoral Research" of D.A. Tsenov Academy of Economics, Svishtov, AI Tsenov, 2024, Issue XVII, Book 20 (ISSN: 1313-6542) – in press.

Articles:

3. Veleva, Tsv. Challenges of Omnichannel Banking // Annual Almanac "Doctoral Research" of D.A. Tsenov Academy of Economics, Svishtov, AI Tsenov, 2023, Issue XVI, Book 19, pp. 522-537 (ISSN: 1313-6542).
   Link: https://almanahnid.uni-svishtov.bg/title.asp?title=3068
4. Veleva, Tsv. Macroprudential Policies – A Tool for Preventing Ad-Hoc Situations and Risks in Banking // Annual Almanac "Doctoral Research" of D.A. Tsenov Academy of Economics, Svishtov, AI Tsenov, 2022, Issue XV, Book 18, pp. 515-528 (ISSN: 1313-6542).
   Link: https://almanahnid.uni-svishtov.bg/title.asp?title=2961

VI. Compliance with the Minimum National Requirements under the Regulations for the Implementation of the Law on Academic Staff Development in the Republic of Bulgaria

Minimum national requirement: **30 points**

Author's Publications	Points
1. Veleva, Tsv. Risk Management and Efficiency Assessment in Digital Transformation in Banking // Dialogue Journal, 2025, Issue 1, pp. 97-117	15
2. Veleva, Tsv. Challenges of Digital Transformation in the Bulgarian Banking Sector // Annual Almanac, 2024, Issue XVII, Book 20 – in press	15
3. Veleva, Tsv. Challenges of Omnichannel Banking // Annual Almanac, 2023, Issue XVI, Book 19, pp. 522-537	10
4. Veleva, Tsv. Macroprudential Policies – A Tool for Preventing Ad-Hoc Situations and Risks in Banking // Annual Almanac, 2022, Issue XV, Book 18, pp. 515-528	10
Total	**50**

Total points: 50 > 30

VII. Declaration of Originality

The dissertation, spanning 195 pages, titled: "Digital Transformation in Banking – Risks and Financial Efficiency," is authentic and represents the author's original scientific work. It incorporates original ideas, texts, and visualizations through graphs, diagrams, tables, and formulas, adhering to all requirements of the Copyright and Related Rights Act through proper citation and referencing of external sources, including:

1. The results and contributions are original and not derived from studies or publications in which the author has no involvement.
2. The information provided, including copies of documents, publications, and personal reports, corresponds to objective truth.
3. Scientific results obtained, described, and/or published by other authors are duly and thoroughly cited in the bibliography.

Doctoral Candidate: 

/Tsvetomira Veleva/