UNIVERSITY OF INSURANCE AND FINANCE – SOFIA

DEPARTMENT OF "FINANCE AND INSURANCE"

FINANCING OF ENVIRONMENTAL SECURITY (IN THE CONTEXT OF THE BANKING SYSTEM)

ABSTRACT

of a dissertation for the award of an educational and scientific degree "Doctor" in professional field 3.8. Economics, doctoral programme: Finance, Insurance and Social Security

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The dissertation has been discussed and scheduled for defense by the Department of Finance and Insurance at the University of Insurance and Finance (UZF) - Sofia. The thesis contains an introduction, a presentation in three chapters, a conclusion, and a list of references. The dissertation has a total volume of 322 pages, including 286 pages of main text and 36 pages of references, 38 figures/charts, and 33 tables.

More than 300 sources in Bulgarian and English are cited.

Contents

I. GENERAL OVERVIEW OF THE DISSERTATION

1. Relevance and Significance of the Dissertation Topic

Climate change, environmental degradation and the depletion of natural resources are transforming the understanding of security in the contemporary world. Environmental security is no longer perceived solely as a subject of environmental policy, but as an integral component of national and economic stability. In this context, the financial system – and banks in particular – are gradually shifting from their traditional intermediary function towards the role of an active participant in the processes of sustainable transition.

The increasing requirements for the integration of sustainability into business strategies, the application of ESG principles, and the heightened public attention to climate-related and environmental risks necessitate an in-depth analysis of the relationship between finance and environmental security. At the same time, the banking system possesses significant potential to channel capital towards sustainable projects through credit, investment and guarantee policies.

The topic is of particular importance for Bulgaria, where the banking sector is among the main sources of financing for the real economy. The promotion of green investments represents a strategic instrument not only for economic transformation, but also an obligation arising from the European Green Deal and international climate agreements.

The present dissertation examines precisely the mechanisms, institutional frameworks, challenges and opportunities for financing environmental security, through which the banking sector can contribute to the enhancement of environmental security. It proposes a systemic scientific model for action under conditions of accelerating green transformation of the global, regional and national economy.

2. Research Object, Subject and Objective

The **research object** is the interaction between the banking system and environmental security in the context of transition towards a sustainable and low-carbon economy. The analysis is conducted in relation to the transforming financial architecture, global climate challenges and the evolving regulatory mechanisms that shape the contemporary framework for sustainable finance.

The **research subject** comprises the methodological approaches, channels, mechanisms, instruments, institutional frameworks and regulatory interventions through which banks participate in environmental security financing. This includes the formation of green credit and investment policies, the management of environmental risks, interaction with public and international institutions, as well as the application of sustainability standards.

The main dissertation objective is to develop a comprehensive theoretical and empirical framework for the assessment and conceptualisation of banking-based finance as a factor for achieving environmental security, integrating economic, regulatory and managerial perspectives.

Within the framework of this overarching objective, the following more specific objectives are formulated:

- **to define the concept of *environmental security*** from the perspective of economic theory, environmental policy and the banking system, and to justify the necessity of its inclusion among the strategic objectives of institutions;
- **to identify and systematise the main channels** through which the banking system can influence environmental security, i.e. either directly (through lending and investment) or indirectly (through risk management, counterparty requirements and transparency);
- **to conduct a critical review of existing international and European regulations** related to sustainable banking, climate risks and green finance, including initiatives such as Basel III/IV, SFDR, CSRD, the EU Taxonomy and others;
- **to assess the degree of integration of environmental factors into banking policies in Bulgaria** and to compare observed trends with leading jurisdictions such as the European Union, the United States, China, the United Kingdom, and others;
- **to develop an analytical model for assessing the instruments that banks can use to finance environmental security**, including green loans, sustainable bonds, guarantee mechanisms, ESG funds and partnerships with international financial institutions;
- **to examine the possibilities for applying innovative approaches** such as impact-based finance, blended finance, carbon pricing mechanisms and digital technologies (for example, green fintech solutions) within the banking sector;
- **to propose concrete policies and reform recommendations within the Bulgarian and European banking systems** aimed at more effective allocation of financial flows towards environmentally sustainable activities and at improving environmental security at national, regional and global levels.

3. Research Thesis and Hypotheses

The main research thesis defended in the dissertation is that the banking system can play a strategic and transformative role in financing environmental security, provided that targeted regulatory mechanisms, innovative financial instruments and sustainability standards are created and applied in order to direct capital towards environmentally responsible activities and to minimise systemic risks arising from climate-related and environmental threats.

On the basis of the stated thesis and the objectives of the dissertation, **the following research hypotheses are formulated:**

Hypothesis 1: **Environmental security can constitute a valid analytical framework in banking-based finance.**

Hypothesis 2**: Banking-based finance will undergo a transformation from regulatory compliance towards strategic integration of sustainability.**

Hypothesis 3**: The financial system, and the banking sector in particular, can act as a catalyst for the sustainable transition by mobilising resources for environmental security, provided that appropriate regulatory incentives are in place.**

Hypothesis 4: **The integration of environmental risks (risks related to climate change, nature degradation and biodiversity loss) into credit risk management processes leads to improved resilience and long-term stability of banking institutions.**

Hypothesis 5: **The application of ESG criteria in banks' credit and investment policies is positively associated with increased financing of projects contributing to environmental security.**

Hypothesis 6: **National and European regulatory frameworks that mandate sustainability disclosure and management exert a significant influence on banks' behaviour towards carbon-intensive sectors.**

Hypothesis 7**: A pronounced mismatch exists between the available potential of the banking system to finance environmental security and the instruments actually utilised, particularly in emerging markets, including Bulgaria.**

Hypothesis 8**: Innovative models such as blended finance, impact-based instruments and partnerships with international financial institutions increase the effectiveness of banking participation in environmental transformation.**

***Hypothesis 9*: Full decarbonisation of banking portfolios is possible only through strategic restructuring of business models, supported by clear taxonomies, green indicators and adaptive regulation.**

***Hypothesis 10*: The application of geospatial and scenario-based approaches to climate risk assessment enhances banks' precision in managing their environmental exposures.**

4. Research Tasks

In accordance with the formulated research objective and the stated hypotheses, the dissertation sets out the following **main research tasks**:

- **to develop a theoretical framework for the concept of *environmental security*** by tracing its evolution in academic literature, strategic documents and international environmental frameworks, with the aim of clarifying its relationship with sustainable economic development and financial stability;
- **to systematise the role of banks as intermediaries in sustainable finance** by analysing the specific channels through which they influence environmental security, including lending, investment, risk management, disclosure and corporate governance;
- **to analyse and synthesise the regulatory and supervisory framework** (at global, European and national levels) defining requirements for the banking sector with regards to sustainability, ESG factors and environmental risks, including taxonomies, directives and supervisory guidelines;
- **to examine the degree of implementation of sustainable banking practices in Bulgaria** through the analysis of publicly available data and reports, strategic documents and publications issued by commercial banks, the Bulgarian National Bank and EU supervisory authorities;
- **to develop an analytical model for assessing instruments for financing environmental security through banks**, including green loans, climate bonds, guarantee products, ESG funds and partnerships with international institutions;
- **to conduct a comparative analysis between jurisdictions** with different levels of maturity in sustainable banking practices, such as the European Union, the United States, the United Kingdom, China, Japan, India, Brazil and others, with the aim of identifying good practices and applicable models;

- **to assess the applicability of innovative approaches** such as impact-based finance, blended finance, geospatial analysis and scenario modelling for the management of environmental risks in banking activities;
- **to formulate recommendations for enhancing the effectiveness of the banking system in Bulgaria** with respect to environmental security, including incentives for sustainable finance, adaptation of the regulatory framework and strategic guidelines for green transformation;
- **to assess the impact of decarbonisation on banks' financial stability**, with particular emphasis on the risk of stranded assets and challenges related to transition management.

5. Methodology of the Study

The methodological approach of the research is **interdisciplinary**, combining elements of economic theory, banking, sustainable development, public finance and environmental policy. Both **qualitative and quantitative** methods are applied in order to achieve an integrated and analytically grounded assessment of the role of the banking system in the processes of environmental security financing.

5.1. Research Approach and Logic

The research is based on a **structural–functional approach**, through which the interaction between the banking sector and the real economy is examined with respect to sustainable development and environmental security. A systemic analysis is applied to reveal interconnections between banking activities, environmental objectives and the regulatory framework. A **comparative analysis** of policies, regulations and institutional models of sustainable finance in key jurisdictions (European Union, United States, China, United Kingdom, Japan, India, South Korea, Brazil and others) is also employed.

5.2. Research Methods

The following research methods are applied:

- **Documentary analysis**, incl. review and interpretation of strategic documents, regulations, supervisory guidelines and reports issued by international institutions (EU institutions, the European Central Bank, the European Investment Bank, the International Monetary Fund, the World Bank, the Network for Greening the Financial System, the Bank for International Settlements and others) as well as national authorities (the Bulgarian National

Bank, the Ministry of Finance of the Republic of Bulgaria, the Ministry of Environment and Water and others);

- **Qualitative analysis**, incl. identification and classification of financial instruments and mechanisms used by banks to support environmental objectives, as well as the examination of successful practices and behavioural models;
- **Quantitative analysis**, incl. use of statistical data from national and international sources (*Eurostat, IMF Climate Finance Tracker, World Bank Green Bond Database, EBA Risk Dashboard and others*) to measure the volume, dynamics and structure of green finance in the banking sector;
- **Indicator and index analysis** for assessment of the degree of integration of environmental considerations into banking portfolios and the resilience of institutions to climate-, nature- and biodiversity-related risks;
- **Scenario-based and geospatial analysis** for assessment of the impact of different environmental risk scenarios (physical and transition risks) on banking assets through simulations and risk mapping;
- **Policy modelling** for evaluation of the effects of regulatory and market interventions on banks' behaviour with regard to sustainable finance and environmental security.

5.3. Data Sources and Literature

The research is based on a wide range of **primary and secondary sources**, including:

- **official statistics and databases** of institutions such as the European Central Bank (ECB), the European Investment Bank (EIB), the International Monetary Fund (IMF), the World Bank, the Organisation for Economic Co-operation and Development (OECD), the Bank for International Settlements (BIS), the Network for Greening the Financial System (NGFS) and the Intergovernmental Panel on Climate Change (IPCC);
- **academic literature and peer-reviewed publications** in the fields of sustainable finance, banking regulation, ESG integration and climate economics;
- **regulatory and strategic documents** at the level of the European Union and national governments, including legislation, directives, regulations and supervisory guidance related to sustainability, ESG disclosure and environmental risk management;
- **market and analytical sources**, including reports published by banks, rating agencies, private research institutes and non-governmental organisations.

6. Limitations and Assumptions

The research is conducted within a rapidly evolving regulatory, economic, and environmental framework, necessitating specific methodological limitations and assumptions that should be considered when interpreting the results.

Main Limitations

- **The regulatory framework at EU and global level is highly dynamic**. A large proportion of the requirements (for example, those related to CSRD, the EU Taxonomy and new supervisory guidelines issued by the ECB and the EBA) are at various stages of implementation or transformation. As a result, some findings and conclusions may require future update.
- **There is significant heterogeneity among the analysed jurisdictions** (European Union, United States, China and others), including differences in stage of development, regulatory environments and central bank's role. This makes comparative analysis analytically valuable, but not fully comparable in quantitative terms.
- **In Bulgaria, there is a lack of consolidated statistical data on the volumes of green loans, ESG integration or exposure to environmental risks in the banking sector**. This limits the possibility of conducting a fully empirical analysis and requires the use of case studies, secondary sources and expert judgement.
- **The lack of a unified and comprehensive approach to carbon and environmental accounting** on the part of banks complicates the precise quantitative assessment of "green" exposures and risks.

Main Assumptions

- **It is assumed that the concept of *environmental security* has a valid place within the economic and banking context, insofar as it is linked to financial stability and systemic risk.**
- **It is assumed that banks tend to respond rationally to market incentives, regulatory requirements and public pressure, particularly when supported by strategic guidance and specific financial instruments. The emphasis on the active role of the banking system should not be interpreted as unconditional optimism, but rather as an expression of potential, the realisation of which presupposes a stable framework and consistent policies.**

- **It is assumed that green finance, despite existing imperfections in its definition, can be analysed through indices, comparative models and scenarios.**

II. STRUCTURE AND CONTENT OF THE DISSERTATION

The dissertation has a total volume of 322 pages, including 286 pages of main text and 36 pages of references. It is structured into an introduction, three chapters, a conclusion, and a bibliographic reference list.

The dissertation is developed in accordance with the requirements of academic logic and methodology and follows the model "from the general to the specific", integrating theoretical, empirical and applied analysis. Each chapter is logically linked to the preceding one and further develops the argumentation in relation to the main research thesis.

The dissertation has the following structure:

3. **Environmental Risks and the Banking System**
4. **The Green Transformation of the Banking System – Characteristics and Stages**
5. **The Evolution of the Concept of Environmental Security**

Chapter Two. Methodological and Applied Aspects of Banking-Based Financing of Environmental Security

1. **Methodological Approaches to Banking-Based Financing of Environmental Security**
2. **Channels for Banking-Based Financing of Environmental Security**
3. **Mechanisms for Banking-Based Financing of Environmental Security**
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Chapter Three. Empirical Analysis of Banking-Based Financing of Environmental Security

3.1. Regulatory and Institutional Framework for Banking-Based Financing of Environmental Security – A Comparative Analysis by Jurisdiction

3.2. Analysis of Banking-Based Financing of Environmental Security in Bulgaria

3.3. Directions for the Development of Banking-Based Financing of Environmental Security

Conclusion

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III. BRIEF PRESENTATION OF THE DISSERTATION

The introductory part focuses on the significance of the research topic, examining it in the context of increasing global environmental threats and the necessity for an active role of the banking sector in managing the sustainable transition. The research object, subject, objectives, hypotheses and specific tasks are defined, together with the applied methods and analytical approaches. The main limitations of the analysis, the justification for the selected methodology and the expected practical usefulness of the results are also presented.

1. CHAPTER ONE.

THEORETICAL AND METHODOLOGICAL FOUNDATION OF BANKING-BASED FINANCE FOR ENVIRONMENTAL SECURITY

The first chapter aims to formulate the conceptual and methodological apparatus of the research by integrating economic, environmental and institutional perspectives.

The initial sections analyse environmental risks that increasingly affect the real economy and financial stability. Data from the Intergovernmental Panel on Climate Change (IPCC), the World Economic Forum and other global organisations outline the growing threat posed by the increasing frequency of extreme climate events, the degradation of natural capital and the loss of biodiversity. The concept of planetary boundaries is applied as a framework for understanding critical pressure points on ecosystems that pose existential risks to civilisational development.

The history of international climate policy is examined through seven major stages, incl. from the United Nations Framework Convention on Climate Change, through the Glasgow Pact and the Paris Agreement, to the present day. This review focuses both on the achievements of multilateral diplomacy and on its inherent limitations. Particular attention is paid to the transformation of climate change from a predominantly scientific issue into a key priority of international economic and financial policy. Mechanisms such as carbon pricing, green funds, and climate finance are analysed and critically assessed as instruments linking environmental objectives with public and private financial tools. An interdisciplinary framework is employed, integrating perspectives from economics, security studies, and sustainable development.

The subsequent sections of the chapter present various definitions and approaches to environmental risk, including its manifestation as physical risk (damage from climate-related events), transition risk (decarbonisation processes and legislative changes), and systemic risk (effects on the stability of the financial system). The relationship between environmental risk and financial markets is analysed, drawing on concepts from sustainability theory, macroeconomic analysis, and banking regulation. Key notions such as stranded assets, the carbon bubble, and asset revaluation resulting from environmental uncertainty are explained.

A central part of the chapter is devoted to the concept of "environmental security," examining its evolution, dimensions, and applicability within the context of economic theory and the banking sector. Environmental security is conceptualised as a state of sustainable equilibrium between economic development and ecosystem stability. A detailed distinction is made between environmental security and sustainability, with the former viewed as a condition aimed at risk minimisation and the latter as a process of long-term balanced development. Scholarly interpretations from international law, political science, and economics are incorporated. On this basis, the chapter argues that environmental security can also be conceptualised **as a public good**, thereby justifying regulatory intervention and the involvement of financial institutions in its attainment. Particular attention is given to the socio-economic consequences of environmental degradation, including migration, inequality, and health and energy crises.

A distinction is also made between the concepts of **environmental security**, **environmental sustainability** and **sustainable development**, which supports the theoretical framework of the present research by demonstrating the different levels of analytical focus. These range from immediate protection against environmental threats, through the long-term preservation of natural capital, to an integrated model of societal development. Applied to the banking sector, this distinction helps to explain how financial decisions can address all three dimensions – through security-oriented policies (risk reduction and mitigation of environmental threats), sustainability-oriented policies (support for renewable energy and environmentally friendly projects), and sustainable development policies (balancing economic benefits with environmental and social responsibility). These dimensions are largely interrelated and oriented towards a common objective. In this way, banks are established as a key participant in the transition towards more secure and sustainable environmental future.

Chapter One concludes by outlining the role of the banking system in the transition towards sustainability. It analyses how commercial banks, through credit and investment policies, can redirect financial flows towards environmentally oriented activities and integrate sustainability criteria into risk management processes. The basic forms of "green banking" are presented, including green bonds, environmental loans and environmentally responsible investment products. Early supervisory initiatives are also examined, including guidelines issued by the European Central Bank, the Basel Committee on Banking Supervision, the European Banking Authority and other institutions. It is emphasised that the need for environmental transformation of the financial system requires parallel changes in the regulatory framework, business models and financial practices.

An important emphasis in the chapter is placed on the bidirectional relationship between environmental and financial stability. While environmental risks can lead to sharp asset devaluation, disruption of supply chains and increased credit risk, an inadequate response by financial institutions to these risks can accelerate the collapse of natural systems. For this reason, environmental security is increasingly positioned at the core of financial regulation. Institutions such as the European Central Bank, the International Monetary Fund and the Network for Greening the Financial System recognise that the protection of natural capital is an integral element of long-term financial stability. **The chapter discusses how environmental security is no longer treated merely as an external risk, but as a structural component of economic and regulatory modelling.**

The typologies of environmental risks are also discussed, presenting a classification according to causality (anthropogenic and natural), time horizon (short-term and chronic), geographical scope (local and global) and reversibility (reversible and irreversible). This classification is relevant for the application of risk models in banks, particularly in determining capital buffers and assessing the probability of default (PD). In addition, the direct and indirect exposure of banks to environmental threats is examined, for example through lending to carbon-intensive industries or investments in projects with an unclear environmental profile. In this context, environmental security is also analysed as an instrument for limiting financial vulnerabilities.

Chapter One contains a critical review of the academic literature linking environmental security with financial markets. Works in the fields of green economy, environmental law, adaptation and mitigation strategies for climate risks are analysed. It is found that existing models are often fragmented and require integration, as they frequently fail to provide a systemic overview of the relationship between sustainability and financial stability. On this basis, a synthetic analytical framework is developed, combining the three dimensions of security, sustainability and financial stability into a unified analytical system. This framework lays the foundation for the development of financial instruments, policies and regulations that not only address environmental challenges but also contribute to the construction of a new architecture of green finance.

Particular attention is paid to the role of data and disclosure, including environmental accounting, impact indicators, reporting of climate exposures and the need for homogeneous standards. In the context of environmental security, banks require reliable, comparable and verifiable information in order to properly manage their environmental risks. Standards such as ESG reporting, the guidelines of EFRAG, the

recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) and other instruments are gaining key importance. The chapter examines these issues through the lens of transparency, accountability and the ethical responsibility of banks towards public objectives of sustainable development.

In conclusion, Chapter One provides a multidisciplinary perspective on environmental security as a fundamental challenge for the financial sector, but also as an opportunity for its transformation. An analytical framework is developed that defines the interconnections between climate, finance and security and outlines the logic of the subsequent chapters of the dissertation. It is established that the banking sector can and should play a central role in preventing systemic environmental crises through capital mobilisation, risk management and strategic partnerships with public institutions, international organisations and sustainable enterprises.

Main Conclusions of Chapter One

Chapter One of the dissertation establishes the necessary theoretical and methodological framework for clarifying the nature, dynamics and systemic significance of environmental threats, their relationship with the banking system, and the conceptualisation of **environmental security** as an emerging paradigm in sustainable finance. The main conclusions of this chapter are as follows:

First, environmental risks, including climate-related, nature- and biodiversity-related risks, constitute systemic global threats whose economic and social consequences are continuously increasing. Data from the Intergovernmental Panel on Climate Change (IPCC, AR6) indicate that the pace of climate change exceeds the capacity of human and natural systems to adapt, thereby intensifying the risk of physical shocks and transition-related shocks.

Second, the concept of planetary boundaries and the use of Integrated Assessment Models (IAMs) provide an analytical basis for the quantitative assessment of pressures on global ecosystems and the economy. The transgression of these boundaries generates a new generation of risks that requires a systemic approach within the financial and banking sector.

Third, the history of international climate policy outlines a trajectory of evolving commitments and institutional mechanisms, among which a key role is played by the Paris Agreement (2015), the Sustainable Development Goals (SDGs) and instruments such as the Greenhouse Gas Protocol (GHG Protocol). These frameworks define the strategic direction and regulatory foundation for the participation of financial institutions in environmental transformation.

Fourth, the banking system is exposed to significant environmental risks that may materialise through several channels, incl. directly through physical damage to assets, indirectly through the revaluation of carbon-intensive assets (so-called stranded assets), and through systemic cascading effects on credit and investment portfolios. The development **of the concept of double materiality** further reinforces the need for banks to identify, measure and manage these risks.

Fifth, the green transformation of the banking system has already commenced and is unfolding in stages, i.e. from the initial application of new regulations and fiscal incentives, through the integration of sustainability via the development of new products and services, to strategic positioning within the sustainable transition. **Green banking** is becoming established as a specific approach within the financial system, focused on transparency, long-term value creation and support for environmentally sustainable projects.

Sixth, the concept of environmental security is delineated as an independent analytical category that integrates aspects of security, sustainability and the governance of environmental threats. The dissertation proposes a multidisciplinary conceptualisation encompassing dimensions such as environmental vulnerability, access to resources, sustainable use of natural capital, adaptive capacity and prevention.

Seventh, the distinction between environmental security and environmental sustainability has important practical implications for banking-based finance. While sustainability focuses on long-term balance between environmental, social and economic factors, environmental security emphasises risks and threats that may destabilise economic and social systems. This distinction enables more precise targeting of financial instruments and regulatory mechanisms.

Eighth, the role of banks in financing environmental security is strengthening, as they are key institutions for resource mobilisation, risk management and the formation of market expectations. The theoretical analysis substantiates the need to develop new models for integrating environmental security into banks' credit and investment policies, including through ESG criteria, green bonds, portfolio reallocation and environmentally oriented stress testing.

2. CHAPTER TWO.

METHODOLOGICAL AND APPLIED ASPECTS OF BANKING-BASED FINANCE FOR ENVIRONMENTAL SECURITY

Chapter Two examines the functional role of banks as intermediaries and catalysts of environmental security. Its purpose is to develop an analytical framework through which banking-based finance for environmental security can be examined systematically. The chapter focuses on four core elements: **methodological approaches**, **channels of transmission**, **operational mechanisms** and **financial instruments**. Each of these components is analysed in depth through a combination of contemporary theoretical concepts and practical examples from international and European regulatory and market practice.

The section devoted to methodological approaches presents thirteen contemporary concepts that reflect the multi-layered possibilities for banking-based finance of environmental security. These include the ESG approach, the risk-based approach, resilience finance, the EU Taxonomy-aligned approach, impact-based finance, blended finance, natural capital accounting, science-based climate targets, green and climate bond principles, double materiality, geospatial and scenario analysis, stewardship and engagement finance, and circular economy finance. Each approach is presented with its main characteristics, advantages and limitations, as well as its potential applicability in different institutional and market environments.

Chapter Two also proposes four complementary comparative models for evaluating the methodological approaches. The first model compares regulatory, market and institutional applicability; the second one measures technical complexity and operational feasibility; the third one assesses environmental orientation and the impact of achieved green outcomes; and the fourth one examines financial returns and investment sustainability. Each model is constructed using matrices, indicators and multi-criteria analysis, with the results enabling comparison between different approaches depending on the strategic focus of banks.

The second component, namely the financing channels, is examined as the infrastructure for transmitting resources to environmentally significant activities and includes various types of institutions: commercial banks, development banks,

environmental banks, international financial institutions (such as the European Investment Bank, the European Bank for Reconstruction and Development, the World Bank and others), public–private partnerships, sustainable development funds, investment funds, as well as the central bank in its supervisory and monetary functions. The synergy between these channels is analysed, together with their role in mobilising public and private capital and the importance of institutional coordination between central banks, ministries, regulators and international partners.

The mechanisms for financing environmental security, which constitute the third core component of the analytical framework, encompass the practical forms through which banks implement their strategies. These include preferential lending, guarantee schemes, interest rate and capital expenditure subsidies, equity participation and blended finance structures, leasing, factoring and other forms of risk-sharing and equity-based financing. Regulatory incentives associated with the application of green capital standards are also analysed, as well as the role of the state through financial innovation, tax incentives and targeted programmes.

The section devoted to financial instruments outlines the market products through which these mechanisms are materialised. These include green and climate bonds, green loans, ESG funds, insurance products covering environmental and sustainability-related risks, European programmes (such as InvestEU, LIFE and Horizon Europe), as well as specialised products for renewable energy and sustainable transport. Each instrument is presented in terms of its regulatory requirements, market structure and potential for large-scale application. Particular emphasis is placed on the need for standardisation and trust, achieved through green taxonomies, external verification and impact monitoring.

The concluding part of the chapter highlights **the necessity of an integrated approach** combining methodology, institutional logistics and market practices. Without coordination between regulators, banks, institutions and investors, green finance remains fragmented. This section provides the foundation for the subsequent empirical analysis of the applicability of the examined approaches in a real-world environment.

A distinction is made between approaches characterised by a high degree of institutional integration and those that remain at a conceptual stage or exhibit limited market implementation. For example, the ESG approach, the EU Taxonomy-aligned approach and the concept of double materiality are already subject to regulatory requirements and supervisory practices within the European Union, whereas models such as natural capital accounting and science-based targets remain largely voluntary and at an early stage of

implementation. This provides the basis for constructing a compatibility matrix between approaches, channels, mechanisms and instruments, which is presented at the end of the chapter and serves as a key input for the subsequent empirical analyses.

The chapter also examines the **barriers to the application of methodological and instrumental options for financing environmental security**. These include insufficient market information and ESG ratings, a lack of national standards and indicators, inadequate institutional coordination, and limited administrative capacity within certain banks and public institutions. The chapter proposes solutions such as the introduction of data-sharing platforms, national strategies for green banking and enhanced public–private cooperation. Central banks, ministries and regulators are identified as natural coordinators of the green transformation of the financial system.

A significant part of the analysis is devoted to assessing the synergies between different methodological approaches, channels, mechanisms and instruments. The conclusion is that the most effective outcomes are achieved through the combination of channels, for example, joint participation of commercial banks and international institutions, or public–private partnership schemes in which public resources act as a catalyst for private financing. Special emphasis is placed on risk-sharing mechanisms, such as guarantee schemes and interest rate subsidies, which can improve access to green finance for small and medium-sized enterprises.

The **institutional engagement model** developed at the end of the chapter enables the typologisation of banks and other participants according to their level of commitment to environmental security. The model includes criteria related to internal organisation, ESG policies, disclosure practices, participation in green products and initiatives, and interaction with public institutions. It also serves as an input for subsequent empirical calculations and classifications in Chapter Three of the dissertation.

In summary, Chapter Two establishes a comprehensive methodological platform for understanding and implementing banking-based finance for environmental security. By combining approaches, a logical structure of channels and mechanisms, and comparative analysis of instruments, the chapter enables the construction of integrated and strategic models of green banking. This provides the foundation for examining the actual behaviour of banks, regulators and other stakeholders in the empirical chapter that follows.

Main Conclusions of Chapter Two

First, the thirteen methodological approaches examined reflect the diversity of analytical, managerial and investment concepts that underpin banking participation in

environmental security. Each approach combines different degrees of regulation, risk orientation, sustainability integration, disclosure requirements and impact assessment.

Second, the combined integration of ESG principles, the concept of double materiality, science-based targets and geospatial analysis enables banks not merely to report environmental factors, but to manage them as strategic elements within financial decision-making.

Third, the four comparative models (regulatory applicability, technical complexity, environmental orientation and financial sustainability) provide an innovative evaluation matrix for selecting and applying approaches according to the specific characteristics of the bank, the project and the policy environment.

Fourth, the analysis demonstrates that there is no universally optimal methodological approach applicable under all circumstances. Effective financing requires a combination of approaches adapted to the specific institutional, market and environmental context.

Fifth, the examined channels of banking-based finance (from commercial and development banks to international institutions and private funds) **confirm that environmental security requires coordination between the public and private sectors.**

Sixth, central banks are increasingly assuming a dual function as supervisory authorities and as active participants in market transformation through environmentally oriented monetary and regulatory policies. This outlines a new form of monetary and regulatory sovereignty that incorporates environmental criteria.

Seventh, the identified synergies between financing channels indicate that the highest effectiveness is achieved when different institutions combine their comparative advantages, for example, development banks providing long-term funding and commercial banks ensuring distribution and risk control.

Eighth, the mechanisms analysed in Chapter Two, incl. preferential lending, guarantees, subsidies, blended finance and equity participation, reduce the risk profile of green projects and constitute key factors for mobilising private capital.

Ninth, supportive regulatory and fiscal frameworks help to reduce the structural gap between public environmental benefits and private investment returns.

Tenth, the diversity of financial instruments (green loans, ESG funds, climate bonds, insurance products and European programmes) **demonstrates progress in building a market infrastructure oriented towards sustainability.**

Eleventh, challenges remain related to insufficient standardisation, limited transparency and low liquidity of certain green instruments, which affect investor confidence and the scalability of projects.

Twelfth, improved coordination between European programmes and national banking systems is required, together with the development of specialised products targeting environmentally oriented projects of small and medium-sized enterprises, a segment with high potential and limited access to existing financing channels.

Chapter Two demonstrates that **banking-based finance for environmental security is not only feasible, but essential for a successful transition towards sustainable economies**. It requires the targeted application of a combination of methodological approaches, strategic channels, effective mechanisms and adaptive financial instruments. The developed comparative models have the potential to support banking institutions, regulators, and investors in **building robust decision-making frameworks** aligned with environmental, market, and financial realities.

3. CHAPTER THREE

Chapter Three constitutes the practical foundation of the research and builds upon the theoretical and methodological assumptions developed in the previous chapters. The objective of this chapter is to provide a quantitative and comparative assessment of the level of development, applicability and effectiveness of banking-based finance for environmental security across different jurisdictions, as well as within the national case of Bulgaria.

The chapter is structured into three main sections. The first one presents the regulatory and institutional environment by jurisdiction; the second one systematises green financial instruments and market practices; and the third one introduces comparative models and correlation analyses.

1. Regulatory and Institutional Framework for Banking-Based Finance for Environmental Security - Comparative Analysis by Jurisdictions

The first part of the empirical analysis is devoted to international comparison. Thirteen leading jurisdictions are analysed, incl. the European Union, the United States, the United Kingdom, Canada, China, Japan, South Korea, India, Brazil, South Africa, Russia, Mexico and Australia. For each jurisdiction, the regulatory framework for sustainable

finance is examined, including the existence and application of taxonomies, supervisory initiatives by central banks, ESG disclosure requirements, as well as the range and depth of green financial instruments. This enables a systematic overview of policies and strategies and provides a basis for qualitative comparison of green banking practices across countries.

Through the application of analytical models, the maturity and effectiveness of different approaches are assessed, together with their alignment with global environmental and economic objectives.

A comparative model of regulatory compatibility is developed, which evaluates each jurisdiction across several dimensions, including the existence of a green taxonomy, ESG integration requirements, climate stress testing and central bank participation in green programmes. In addition, a **model for analysing green financial instruments by jurisdiction is constructed**, calculating the relative share of green bonds, loans and funds within national financial markets. Another **model examines the relationship between green finance and macroeconomic and environmental indicators**, identifying external factors that influence the capacity for sustainable finance.

Within this section, a correlation analysis is conducted between the volume of green finance and selected macroeconomic and environmental indicators, such as GDP per capita, carbon intensity, energy mix and the share of renewable energy. The aim is to determine whether a quantitative relationship exists between the development of green banking and the structural characteristics of national economies. This model also allows for the grouping of countries according to their financing profiles, ranging from leading green market jurisdictions to emerging or weakly developed green finance systems.

The main findings of the comparative analysis across jurisdictions are as follows:

First, despite the existence of a broad global consensus on the need for sustainable finance, regulatory practices exhibit significant variation between jurisdictions, ranging from highly standardised and legally binding frameworks to voluntary guidelines and market-driven initiatives.

Second, the European Union emerges as a leader in the integration of environmental objectives into banking regulation through instruments such as the EU Taxonomy, the Sustainable Finance Disclosure Regulation (SFDR) and the disclosure requirements under the European Green Deal and the supervisory expectations of the European Central Bank. The system is characterised by a high degree of institutionalisation and regulatory depth.

Third, the United States and the United Kingdom follow a more declarative and market-oriented approach, with a strong emphasis on disclosure and voluntary commitments. Despite the absence of a national taxonomy in the United States, the activity of institutions such as the Securities and Exchange Commission and climate-related disclosure initiatives plays a significant role.

Fourth, China demonstrates a centralised and coordinated framework, including an official taxonomy, guidance issued by the central bank and strong state support through development banks. This has facilitated the rapid expansion of the green financial market.

Fifth, South Korea, Japan, India and Brazil are developing their own models based on a combination of state-led strategies, green taxonomies and innovative financial instruments. Despite observable progress, some of these jurisdictions face challenges related to standardisation and institutional coordination.

Sixth, South Africa, Mexico and Australia exhibit upward dynamics but remain at an early or fragmented stage of development, despite existing commitments to green finance.

Seventh, Russia maintains a centralised regulatory framework, but with limited environmental orientation in the context of ongoing sanctions, political priorities and dependence on hydrocarbons.

Eighth, the developed Regulatory Compatibility Model classifies jurisdictions according to the degree of alignment between their green regulations and international standards (NGFS, TCFD, GHG Protocol). The European Union, China and the United Kingdom demonstrate the highest levels of compatibility, while Russia and Mexico rank lowest among the analysed jurisdictions.

Ninth, the model analysing green banking instruments shows that jurisdictions with more mature regulatory environments offer a broader range of instruments, including green bonds, ESG indices, sustainable funds and green guarantees.

Tenth, the model examining the relationship between green finance and macroeconomic and environmental indicators reveals a clear association between income levels and the scale of green finance. Developed economies display higher activity, while certain emerging markets (China, India and Brazil) are rapidly catching up through targeted policies and institutional mobilisation.

Eleventh, the correlation analysis identifies positive relationships between:

- GDP per capita and the share of green finance;
- regulatory quality indices and the number of green instruments;

- CO_2 emissions and the volume of climate-oriented finance in jurisdictions characterised by active state intervention, such as China and the European Union.

Twelfth, a hybridisation of approaches is observed, combining regulatory measures with market incentives and state intervention. This trend is particularly evident in the European Union, China and the United Kingdom, where regulators establish the framework while markets implement it.

Thirteenth, the role of central banks and supervisory authorities is strengthening, as they integrate environmental criteria into stress testing and disclosure requirements and consider their incorporation into capital requirements, as a trend that is particularly pronounced in Europe, Japan and South Korea.

Fourteenth, the comparative analysis indicates that green finance is becoming a systemic priority rather than a niche segment. Where coordinated strategies, regulatory clarity and access to instruments are present, the growth of green banking products is more sustainable.

Fifteenth, uneven regulatory maturity across jurisdictions creates risks of regulatory arbitrage, whereby capital is channelled towards less regulated environments without guaranteeing environmental effectiveness.

In summary, the first part of Chapter Three demonstrates that banking-based finance for environmental security is strongly dependent on the institutional environment and regulatory design. Despite shared objectives, each jurisdiction develops its own specific participation model, underscoring the need for international coordination, standardisation and the exchange of good practices. The models and indicators developed in this chapter provide a foundation for the formulation of national and supranational strategies for green finance tailored to local characteristics.

2. Banking-Based Finance for Environmental Security in Bulgaria

The next major section of Chapter Three examines Bulgaria as a national case study. This part presents the regulatory and institutional framework, including the strategies of the Bulgarian National Bank, the Ministry of Finance and other key public authorities. An overview of the banking sector is conducted by groups of banks, shares in credit portfolios and assets, and participation in green projects. Instruments such as green loans, guarantees and joint programmes with the European Investment Bank, the European Bank for Reconstruction and Development and other institutions are presented.

As part of the national analysis, three empirical indices are introduced: the **Banking Environmental Finance Index (BEFI)**, the **Green Banking Portfolio Index (GBPI)** and the **Central Bank Environmental Index (CBEI)**.

A SWOT analysis of the environmental supervisory policy of the Bulgarian National Bank is also developed. Among the strengths identified are the stability of the banking sector and its high level of capitalisation; among the weaknesses is the absence of an official ESG strategy or supervisory doctrine. Opportunities are associated with participation in pan-European green programmes, while threats relate to concentration in carbon-intensive sectors and the climate vulnerability of certain portfolio segments.

The main conclusions of this part of Chapter Three are as follows:

First, in Bulgaria the regulatory framework for environmental finance is developing primarily under the influence of European Union law. At present, there is no independent national taxonomy or framework beyond the transposed European directives. Regulation remains fragmented, with the focus placed more on disclosure requirements than on mandatory guidance for investment behaviour.

Second, despite EU membership, institutional activity in the field of sustainable finance remains limited. There is a lack of a coordinated environmental strategy linking regulators, banks and market participants in a long-term perspective.

Third, the Bulgarian National Bank has adopted the principles of environmental sustainability mainly through declarative commitments and participation in international initiatives, while practical integration remains limited.

Fourth, the developed SWOT analysis of the Bulgarian National Bank highlights strong institutional stability and capacity for the implementation of green policies, alongside serious internal weaknesses related to insufficient expert capacity, technical infrastructure and policy initiative in the area of climate supervision.

Fifth, the proposed Central Bank Environmental Index (CBEI) confirms that the Bulgarian National Bank lags behind leading European central banks in terms of climate-related engagement, both in the number of measures adopted and in the depth of integration.

Sixth, the Green Banking Portfolio Index (GBPI) indicates that the share of environmental loans and green instruments in Bulgarian banks remains significantly below the EU average.

Seventh, green portfolios are concentrated primarily in areas such as energy efficiency, photovoltaic systems and waste processing, while broader participation in adaptation projects, sustainable transport and nature-based infrastructure is lacking.

Eighth, green loans with preferential terms, partially subsidised by European programmes, are the main instruments applied. **At the same time, the development of green bonds, ESG funds, guarantee schemes for green projects and insurance products for environmental risks is either absent or very limited.**

Ninth, institutional capacity for the development of new green banking products at national level remains constrained. Most initiatives are driven by European programmes or regional partnerships rather than organically developed by banks operating in Bulgaria.

Tenth, the Banking Environmental Finance Index (BEFI) shows that the effectiveness of banking-based finance for environmental security in Bulgaria is moderate to low, mainly due to weak regulatory support, limited demand from businesses and the absence of standardised impact assessment models.

Eleventh, the application of public incentives, such as interest rate subsidies, credit guarantees and tax incentives, remains fragmented, insufficiently targeted and characterised by low transparency for end beneficiaries.

Twelfth, a number of institutional and behavioural barriers persist, including limited awareness, the absence of national policies with quantitative targets, and inertia on the part of banks with regard to the introduction of higher standards for environmental project assessment.

Thirteenth, Bulgaria lags behind leading jurisdictions in terms of the regulatory and institutional framework for green banking-based finance, yet it possesses significant opportunities to catch up through active integration of European Union policies, technological innovation and the development of national strategies.

Fourteenth, through coordinated efforts between the Bulgarian National Bank, commercial banks, international financial institutions and public authorities, Bulgaria has the potential to mobilise a substantial volume of resources for green transformation, particularly in sectors with high environmental intensity such as energy, transport and construction.

Fifteenth, the development of a national framework for sustainable finance is recommended, including a green taxonomy, mechanisms for monitoring green banking portfolios, and a strategic plan for the development of green banking products and services.

3. Directions for the Development of Banking-Based Finance for Environmental Security

The final part of Chapter Three formulates a qualitative scenario analysis of the development of banking-based finance for environmental security in the short, medium and long term. The projections include enhanced ESG disclosure, the introduction of climate-related capital requirements, digital innovation and the expansion of public–private partnerships. Trajectories for the evolution of banking models from regulatory compliance towards strategic transformation are outlined.

✓ Short-Term Horizon (1–3 years) - Reporting, Adaptation and Foundational Regulation

First, during this period an increase in activity related to the implementation of ESG reporting in banking practices is expected, mainly through:

- the application of European regulations such as the Corporate Sustainability Reporting Directive (CSRD);
- the collection and disclosure of primary green metrics (GHG emissions, carbon intensity, exposure to carbon-intensive sectors);
- the introduction of indicators for green compliance under sustainable activity taxonomies.

Second, banks are expected to enter at least an initial stage of climate stress testing, with the focus placed on capacity building, data collection and the use of physical and transition risk scenarios, primarily in qualitative terms.

Third, regulators are expected to emphasise disclosure, standardisation and preparedness, with increased participation of national supervisory authorities in initiatives of the European Central Bank, the Network for Greening the Financial System and the European Systemic Risk Board continuing to act as a key driver.

Fourth, green finance is expected to remain limited in volume but to begin gaining visibility in banks' strategic documents and internal risk management frameworks.

The main conclusion for the short-term horizon is that it will be dominated by regulatory compliance, i.e. this is a phase of orientation, development of basic infrastructure and initial disclosure, without fundamental transformation of banks' credit policies and product structures.

✓ Medium-Term Horizon (up to 2030) - Transformation and Entry into a New Financial Logic

First, over the medium-term horizon up to 2030, a qualitative shift is expected from the mere application of regulatory requirements towards a real and visible transformation of banking activity. This transformation is expected to be achieved through the reallocation of credit portfolios towards sectors with higher sustainability profiles; the withdrawal from assets with high climate risk (such as coal-based energy production, non-compliant transport and intensive agriculture); and the targeted financing of sustainable infrastructure, adaptation measures and innovation.

Second, the development of green financial products is expected to accelerate, with an increasing share of credit being structured according to green, social and sustainability criteria. This includes the expansion of green mortgage and business lending; ESG funds and structured financial products; syndicated green loans; and transition finance instruments.

Third, an innovation infrastructure is expected to be developed, including automated ESG profiles of borrowers; the integration of climate indicators into rating models; digitalisation of green portfolios; and systematic impact analysis.

Fourth, regulators are likely to begin introducing preferential capital requirements linked to environmentally oriented projects, as well as mandatory quotas or guidelines for green lending, alongside enhanced disclosure requirements.

The main conclusion for the medium-term horizon is that this phase will be a period of financial transformation, in which sustainability becomes a key criterion in lending, innovation and client interaction. Green products will no longer be viewed as voluntary initiatives, but as a competitive imperative.

✓ Long-Term Horizon (up to 2035) - Structural Change in the Role of Banks and Business Model Transformation

First, in the long term, full integration of environmental security into banks' strategic models is expected. Financial institutions will perform functions beyond traditional lending, including:

- acting as intermediaries in the management of natural capital;
- serving as drivers of green investment ecosystems;
- operating as platforms for real-time monitoring and assessment of sustainability.

Second, new business models are expected to emerge, based on:

- remuneration linked to sustainable impact;

- partnerships with public authorities and international institutions;
- green innovation hubs bringing together banks, technology companies and environmental projects.

Third, environmental risk is expected to be fully embedded in banking models, i.e. from credit risk to liquidity management and asset management.

Fourth, a complete regulatory transformation is anticipated, whereby the role of regulators expands from that of supervisory authorities to strategic coordinators of an environmentally oriented financial system.

The main conclusion for the long-term horizon is that it marks the transition from regulatory compliance towards structural transformation, in which environmental security is not merely an object of control, but a strategic objective integrated into the DNA of the financial system.

Thus, banking-based finance for environmental security is expected to evolve through three clearly distinguishable stages: regulatory mobilisation (short-term horizon), strategic transformation (medium-term horizon) and systemic integration (long-term horizon). The success of this transition depends on effective coordination between banks, regulators, governments and clients, as well as on the availability of financial innovation, appropriate infrastructure and an adaptive managerial culture. By 2035, the role of banks is expected to be redefined from passive intermediaries to active architects of sustainable development, including in the context of national and global environmental security.

The analysis demonstrates that the achievement of environmental security objectives is not possible without the structural mobilisation of private capital, in which banks play a leading role not only as sources of finance, but also as intermediaries in risk management, data standardisation and the formation of market expectations.

The third chapter confirms the central research thesis that the banking system through both regulatory mechanisms and market practices can act as a decisive factor in achieving environmental security. The empirical analysis presents a global picture of differences between jurisdictions, as well as the national context of Bulgaria, accompanied by concrete directions for improvement.

A substantial contribution of Chapter Three is the application of an index-based approach, which allows for the objectification of comparative analysis. The indices for regulatory compatibility and the availability of green instruments are constructed on the basis of predefined criteria and employ binary and scaled values that enable aggregation and ranking

of jurisdictions. This approach makes it possible not only to assess the current state, but also to calculate development potential. The methodology integrates quantitative indicators (such as the number of issued green bonds, the volume of green lending and the existence of climate stress tests) as well as qualitative variables, including political commitment, institutional support and the level of transparency.

In addition to the regulatory and market framework, Chapter Three introduces the concept of the transformational capacity of the banking system. A modified version of a three-stage model of green development, i.e. compliance, transformation and integration, is applied. On this basis, jurisdictions are positioned according to the extent to which they have progressed from regulatory compliance towards active restructuring of business models and long-term environmental strategies. For example, the European Union, the United Kingdom and Japan are positioned at a transitional stage of transformation, while countries such as South Africa and Russia remain at an initial stage with limited green initiatives.

Good practices from specific banks and institutions are also examined. Examples include strategic ESG portfolio restructuring, the development of proprietary taxonomies, participation in international partnerships (such as the Net-Zero Banking Alliance), and the creation of new products, including green mortgages, climate-oriented SME loans and adaptation finance instruments. Practices of leading banks in the European Union, Canada and China are analysed as reference points for institutional learning and adaptation in other jurisdictions.

In the Bulgarian context, a comprehensive inventory of existing green instruments and channels is conducted. The analysis shows that, despite a high level of financial stability, the environmental transformation of the banking system in Bulgaria remains at an early stage. Green projects are present, but in the absence of a national taxonomy and systematic ESG reporting. The recommendations include the establishment of a unified green information platform, a strategic framework for green banking, the promotion of green bond markets and the incorporation of sustainability criteria into regulatory requirements for banks.

The chapter concludes with a synthesis of the key findings at both international and national levels. The main conclusion is that successful financing of environmental security depends not only on the availability of market instruments, but also on political commitment, institutional capacity, supervisory quality and stakeholder engagement. In this sense, the banking sector can act as a driver of the green transition only if regulatory, fiscal and market frameworks are integrated around the objectives of environmental security and sustainable development.

The dissertation central research thesis that banks are capable of acting as a transformative force in the provision of environmental security has been substantiated. Drawing on the analyses conducted in both the theoretical and empirical sections, all ten research hypotheses formulated at the outset of the study were examined and empirically or analytically validated.

Hypothesis 1, **which posits that environmental security can function as a valid analytical framework within banking finance, is confirmed.** This conclusion is supported by the explicit conceptual differentiation between environmental security and the broader notion of sustainability, as well as by the integrated treatment of the dimensions of risk, security, and sustainability. Together, these dimensions form the analytical backbone of the empirical models developed in the dissertation and provide a coherent structure for assessing banking-based environmental financing.

Hypothesis 2**, that banking finance is undergoing a transition from a model centred on regulatory compliance towards one characterised by the strategic integration of sustainability considerations, is likewise supported**. Evidence for this transformation is provided through a three-stage qualitative scenario analysis encompassing short-, medium-, and long-term horizons. The results of this analysis indicate that sustainability considerations progressively evolve from an externally imposed constraint into an internalised determinant of portfolio composition and strategic decision-making.

Hypothesis 3 **asserts that the financial system, and the banking sector in particular, can serve as a catalyst for the sustainable transition by mobilising resources in support of environmental security, provided that appropriate regulatory incentives are in place.** The findings of the present study lend support to this proposition, while at the same time introducing important qualifications. Although banks occupy a pivotal position in the allocation of financial resources towards environmental objectives, the effectiveness of this role is shown to depend critically on the quality and stability of the surrounding institutional and regulatory environment, as well as on structural conditions within the non-financial sector.

Accordingly, the emphasis placed on the active role of banks should not be interpreted as an expression of unqualified optimism. Rather, it reflects the identification of a latent potential whose realisation presupposes coherent regulatory design, institutional capacity, and sustained policy commitment. In the absence of these conditions, the transformative capacity of banking finance remains constrained.

The validation of this hypothesis is further reinforced through a comparative analysis covering thirteen major jurisdictions: the European Union, the United States, the United Kingdom, China, Japan, India, Brazil, South Korea, Canada, Australia, Russia, Mexico, and South Africa. The comparative results demonstrate that in jurisdictions where regulatory and institutional frameworks provide clear incentives, coordinated supervisory practices, and transparent sustainability criteria, the banking sector effectively channels capital towards activities that support environmental security and facilitate the climate transition.

Within the European Union, the combined implementation of the EU Taxonomy, the Corporate Sustainability Reporting Directive (CSRD), and the Sustainable Finance Action Plan has contributed to the emergence of a regulatory environment that actively encourages banking engagement in green assets and ESG-oriented strategies. In the United Kingdom, the supervisory approach of the Prudential Regulation Authority, complemented by the climate stress testing exercises of the Bank of England, has embedded sustainability considerations within the core of prudential oversight. South Korea offers a further illustration of effective institutional coordination, with the K-Taxonomy and the Green Finance Strategy of the Bank of Korea providing a structured framework for aligning public policy objectives with financial sector practices.

In contrast, the experiences of China and India highlight the role of state-owned banks as directive instruments in the financing of environmentally relevant sectors, reflecting a more interventionist model of green finance. Meanwhile, in Canada and Australia, market-based initiatives, operating within a supportive regulatory context, have played a significant role in advancing sustainable financial instruments, particularly within capital markets.

At the opposite end of the spectrum, the analysis indicates that in jurisdictions characterised by weaker regulatory frameworks or persistent political inconsistency, such as Russia, Mexico, and parts of South America, the absence of stable incentives and robust accountability mechanisms has limited the scope of banking sector involvement in environmental financing. The case of the United States presents a more nuanced picture: despite limited federal-level coordination and pronounced political volatility, market-driven innovation and the initiatives of subnational authorities have enabled the development and diffusion of sustainable financial instruments.

The cross-country comparison of the analysed jurisdictions leads to a general conclusion: the banking sector can function as a catalyst for the sustainable transition only where well-structured regulatory incentives, transparent standards, and effective coordination between public and private institutions are in place. The consistent confirmation of this

relationship across highly regulated jurisdictions indicates that **Hypothesis 3** is substantiated both conceptually and empirically, as demonstrated through a multidimensional comparative analysis.

It should also be emphasised that, although banks possess the capacity to redirect financial resources and to support environmentally oriented projects, **the actual impact on the establishment of environmental security in Bulgaria remains moderate.** This impact is strongly conditioned by the structure of the national economy, the characteristics of the regulatory environment, and the willingness of businesses and households to invest in sustainable solutions. This finding does not invalidate the hypothesis concerning the catalytic role of the banking sector; rather, it underscores the fact that the effectiveness of this role is conditional and mediated by a broader set of economic and institutional factors within the national context.

Hypothesis 4 **posits that the integration of environmental risks-including risks related to climate change, environmental degradation, and biodiversity loss-into credit risk management processes contributes to improved resilience and long-term stability of banking institutions. This hypothesis is confirmed** through observed practices such as the introduction of green stress tests, the incorporation of climate risk sensitivity in collateral valuation, and the adaptation of credit policies to reflect environmental risk considerations.

Hypothesis 5 **states that the application of ESG criteria in banks' credit and investment policies is positively associated with increased financing of projects that contribute to environmental security. This hypothesis is validated** by the empirically observed correlation between ESG integration and the growth of green lending and green bond issuance in developed economies.

Hypothesis 6 **suggests that national and European regulatory frameworks mandating sustainability disclosure and management exert a significant influence on banks' behaviour towards carbon-intensive sectors. The hypothesis is confirmed** through documented cases of divestment and revaluation of exposures undertaken in response to requirements stemming from frameworks such as SFDR, TCFD, and the EU Taxonomy.

Hypothesis 7 **argues that a pronounced gap exists between the potential capacity of the banking system to finance environmental security and the actual utilisation of available instruments, particularly in emerging markets, including Bulgaria. This hypothesis is confirmed**, including in the Bulgarian context, where regulatory, institutional, and market-related deficiencies have been identified as key constraining factors.

Hypothesis 8 **proposes that innovative models such as blended finance, impact-based instruments, and partnerships with international financial institutions enhance the effectiveness of banks' participation in environmental transformation. This hypothesis is confirmed** through the analysis of concrete cases involving the European Investment Bank, the European Bank for Reconstruction and Development, the Green Climate Fund, and joint investment platforms, including initiatives implemented in Bulgaria.

Hypothesis 9 **argues that the full decarbonisation of banking portfolios can be achieved only through the strategic restructuring of business models, supported by clearly defined taxonomies, green performance indicators, and adapted regulatory frameworks. This hypothesis is validated** primarily through the example of the European Union, where banks' exposures to carbon-intensive sectors are already subject to enhanced disclosure and are increasingly addressed through supervisory guidance and prudential expectations.

Hypothesis 10 **posits that the application of geospatial and scenario-based approaches to the assessment of climate-related risks improves the precision with which banks manage their environmental exposures. The hypothesis is confirmed** by the good practices presented in the field of climate mapping and the assessment of risks related to floods, droughts, wildfires, and sea-level rise.

All ten hypotheses were verified on the basis of comparative, institutional, and qualitative scenario analyses. Their confirmation indicates, first, that banks are not merely providers of capital but also key actors in the management of environmental risks; second, that portfolio transformation, the introduction of ESG policies, and green regulatory restructuring are not only feasible but increasingly necessary; and third, that the use of scenario-based and geospatial models enhances the quality of managerial decision-making under conditions of climate uncertainty.

In this way, the banking system is gradually evolving into a significant transformative force, capable of directing capital flows, creating market incentives, and influencing corporate behaviour. In the context of the global environmental crisis, this potential assumes strategic importance. Banks can no longer be regarded as passive intermediaries; rather, they are emerging as central participants in the redistribution of risk and in the institutionalisation of green criteria (*NGFS, 2023; ECB, 2022*)**.** Available evidence further suggests that, where consistent regulatory incentives are in place, the banking sector is able to accelerate the transition towards a low-carbon economy.

IV. APPLICABILITY OF THE RESEARCH RESULTS

The results of the present dissertation have **broad theoretical, analytical and practical applicability**, particularly in the context of the accelerating green transformation of the global, regional and national banking system and the need to ensure long-term environmental sustainability.

Theoretical Applicability

The research contributes to the enrichment of academic literature in several main directions:

- the formulation of a contemporary economic framework for ***the concept of environmental security***, adapted to the specificities of the banking system;
- the analysis of the role of the banking sector as a strategic mediator between environmental policy and the real economy;
- the presentation of thirteen integrated methodological approaches to banking-based finance for environmental security, forming a theoretical basis for future academic research and multi-criteria modelling;
- the development of a classification and evaluation of channels, mechanisms and instruments for financing environmental security through banks.

Analytical Applicability

- The developed comparative models, indicator tables and scenarios can be used by researchers and institutions for comparative analysis of national and international practices in the field of sustainable finance;
- The constructed indices and indicators (ESFI, BEFI, GBPI, CBEI and others) can serve as a basis for the development of monitoring and assessment tools measuring the degree of environmental integration within the banking sector;
- The application of geospatial and scenario-based analysis supports institutions and banks in assessing vulnerability to climate shocks and in improving environmental risk management.

Practical Applicability

The conclusions and recommendations are addressed to three main groups of stakeholders:

- **Commercial banks**: in the development of sustainable products, credit policies and portfolio strategies;

- **Regulatory and supervisory authorities**: in the formulation of ESG reporting guidelines, the implementation of taxonomies and the introduction of green capital standards;
- **Public and international institutions**: in the design of incentives for banking participation in the green transition, including through blended finance and public–private partnerships.

The **proposed framework for Bulgaria** may support the development of a green strategy for the banking sector, improved institutional coordination, the introduction of sustainability indicators for credit institutions and the establishment of mechanisms for attracting international green finance.

V. SCIENTIFIC AND PRACTICAL CONTRIBUTIONS

Based on the results of the research, the following **contributions** are formulated, which distinguish the present dissertation from existing publications and contribute to the development of theory, methodology and practice in the field of banking-based finance for environmental security.

Theoretical and Analytical Contributions

- An **integrated economic framework for environmental security** is developed, combining the principles of sustainable development, financial stability and environmental risk;
- A **conceptual distinction between environmental security and environmental sustainability** is formulated, defining the specific role of the banking system in managing environmental risks;
- **Thirteen methodological approaches to banking-based finance for environmental security are identified and systematised**, forming an original research model;
- A **multidimensional classification of approaches, channels, mechanisms and instruments** through which banks can mobilise resources in support of environmental security is developed;
- A **matrix model of compatibility** between methodological approaches, channels, mechanisms and instruments is proposed, enabling a comprehensive analysis of system effectiveness.

Methodological and Empirical Contributions

- Original **comparative models and indices** (ESFI, BEFI, GBPI, CBEI and others) are developed, enabling quantitative measurement of the environmental engagement of the banking sector;
- A **cross-country comparative analysis of thirteen jurisdictions** is conducted, revealing patterns between green finance, macroeconomic characteristics and environmental risks;
- A **model of institutional engagement in environmental security is constructed**, applicable at both national and international levels;
- A **geospatial and scenario-based approach** for assessing climate vulnerability of the banking system is introduced, representing an innovative contribution to Bulgarian academic practice;
- A **multi-criteria model for analysing green banking instruments** is developed, integrating quantitative and qualitative indicators.

Practical Contributions

- **Specific recommendations** are presented for improving the national framework for green banking-based finance in Bulgaria, including mechanisms for institutional coordination and incentives for bank participation in environmental security financing;
- The developed models and indices can be used by **the Bulgarian National Bank, commercial banks and supervisory authorities** in assessing the degree of environmental integration and in conducting climate stress tests;
- Foundations are established for the development of **AI-based ESG models and platforms** for tracking green financial flows and banks' environmental exposures;
- A **conceptual model for a green strategy of the banking sector in Bulgaria** is developed, compatible with European regulatory initiatives such as the Corporate Sustainability Reporting Directive (CSRD), the Sustainable Finance Disclosure Regulation (SFDR), the EU Taxonomy and the EBA ESG Pillar 3 requirements;
- The proposed framework may support **Bulgaria's participation in international research and investment programmes** (*EBRD, EIB, Horizon Europe, UNEP FI*) aimed at financing environmental security.

VI. DIRECTIONS FOR FUTURE RESEARCH

The results of the research may serve as a basis for future studies in the following directions:

- The development of a national index for banking system sustainability;
- The creation of platforms for tracking green financial flows and environmental risk exposures;
- The application of AI-based models for ESG assessment and enhanced environmental risk management;
- Climate accounting and ESG reporting practices in Bulgarian banks;
- The role of central banks in the implementation of green monetary policy;
- Participation in international research networks and projects related to the financing of environmental security.

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In Process of Publication (as of 18 January 2026):

Simeonova, Tsvetelina. "Environmental Security and the Financial Sector: Conceptual Evolution, Theoretical Distinctions and the Role of Banks in the Transition to Sustainable Development." Paper presented at the 20th International Scientific Conference of Young Researchers, *"The Economy of Bulgaria and the European Union: 20 Years since the Signing of the Treaty of Accession of the Republic of Bulgaria to the European Union and Euro Area Membership as of 1 January 2026"*, UNWE, November 6-7th, 2025.

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DECLARATION OF ORIGINALITY AND AUTHENTICITY

I, the undersigned **Tsvetelina Simeonova**, doctoral student at the department of Finance and Insurance, at UZF, hereby declare that the dissertation submitted by me for defense, entitled **“Financing of Environmental Security (in the context of banking system)”** for the award of the educational and scientific degree "**Doctor**", is an original work and contains original results obtained through research carried out by me.

I declare that the results obtained, described, and/or published by other scholars have been duly and thoroughly cited in the bibliography, in compliance with the requirements of the Copyright and Related Rights Act.

I am informed that if plagiarism is detected in the submitted dissertation, the defense committee has the right to reject it.

I declare that this dissertation has not been submitted to other universities, institutes, and other higher educational institutions for the acquisition of an educational and scientific degree.

19.01.2026

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