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INTEGRATED RISK MANAGEMENT MODEL FOR DIGITAL BANKING PROCESSES

This paper presents a fractal-faceted model for assessing the risks associated with the digitalisation of banking activities in response to the challenges posed by digital transformation. The model categorises risks by key facets and levels of manifestation – strategic, operational and tactical – providing a multidimensional and scalable analysis. What sets this approach apart is that it considers the interrelationships and escalation of risks between levels, overcoming the limitations of traditional fragmented methods. The paper proposes the following stages for implementing the model: identification, analysis, visualisation and management. The study's findings can inform the development of adaptive economic security strategies in the banking sector.

Keywords: digitalisation risks, banking, fractal-facet model, risk assessment, systemic risks, facet analysis, fractal approach.

While the digitalisation of banking activities opens up significant opportunities, it also generates complex, interrelated risks that must be managed effectively to ensure the economic security of banks. Current literature lacks a unified typology of digitalisation risks and adaptive management models that comprehensively consider the interrelationships between risks at strategic, operational and tactical levels.

This study aims to develop and substantiate a fractal-faceted model for assessing the risks associated with the digitalisation of banking activities, with the intention of overcoming existing methodological gaps and improving the economic security of banks.

An analysis of recent studies and publications [1, 2, 3, 4] reveals a surge in scientific interest surrounding the digitalisation of banking activities and associated risks.

Despite the significant amount of research conducted on this topic, certain aspects remain insufficiently disclosed or require further elaboration.

Successful digitalisation requires banks to implement advanced technologies and fundamentally restructure their business models, as well as building robust risk management systems that cover all new aspects of their operations. This creates new vulnerabilities and generates complex challenges related to

cybersecurity, operational resilience, staff adaptation, regulatory changes and financial investments.

The ability of banks to identify, assess and manage risks effectively, and to adapt flexibly to new challenges, is becoming a determining factor in the successful completion of digital transformation and in ensuring the long-term stability and competitiveness of the institution.

Creating a fractal-facet model enables us to transition from a linear and often isolated consideration of risks to a more systematic, multi-level and interconnected understanding of them. This model can be a powerful tool for making more informed decisions and managing risks proactively during digital transformation.

Stage 1 of the fractal-facet model establishes the basis for all subsequent analysis. Its purpose is to systematically identify, describe and classify digitalisation risks within a clear structure, not just to state their existence. This structure includes two dimensions: the risk category (facet) and the level at which it could manifest (fractal level) (see Table 1).

Table 1

Structuring the risks of banking digitalization

Risk category	Tactical level	Operational level	Strategic level
Cybersecurity	Phishing, social engineering	DDoS, API attacks, data leaks	Massive attacks on critical infrastructure
Financial	Insufficient profitability of digital services	High implementation costs, cyber fraud losses	Ineffective investments in digital transformation
Operational	Automation with errors (RPA, AI)	System failures, integration issues	Dependence on business models not adapted to digitalization
Data-related	Incorrect data in analytics, incorrect storage	Privacy breaches, leaks	Reputational and legal consequences due to GDPR violations, etc.
Regulatory and compliance	Compliance solution setup challenges	Cross-border monitoring requirements	Legal uncertainty regarding AI, blockchain, open banking
Reputational	Negative customer experience through the interface	Service failures, data leaks	Loss of trust, falling market value
Technological and digital divide	Inaccessibility of services for certain categories of customers	Insufficient staff training	Alienation of the part of the population that does not have digital skills
Systemic	-	Incidents with a cascading effect	Domino effect due to the crisis in cloud platforms / payment systems

Table 1 (continued)

Strategic and business risks	-	Inefficient integration of new products	Wrong choice of technologies, competition with neobanks
Human resources/cultural	Resistance to change, fear of digital tools	Insufficient IT staff qualifications	The systemic need for cultural transformation in the bank

Source: author's own development.

The identification and structuring process:

1. Selection of the level of analysis (fractal level): The analysis begins with determining the scale at which the risks will be considered. The choice of level depends on the purpose of the assessment – whether it is a risk analysis of a specific project or technology, or an audit of the bank's overall digital resilience.

The tactical level focuses on specific tools, short-term actions and individual system components or interactions, such as risk analysis of a specific user interface or authentication process.

The operational level covers business processes, departmental functioning and the operation of major technology platforms (e.g. risk analysis of the internet banking system, payment processing and IT support).

The strategic level considers risks at the level of the bank's overall digitalisation strategy, the long-term consequences and interaction with regulators, competitors, and the entire financial ecosystem.

2. Systematic analysis by risk category (facet): After selecting a level, an analyst (or group of experts) uses each risk category sequentially to consider the selected object of analysis (e.g. process, system or strategy).

The digitalisation of socio-economic processes is characterised by intensified new challenges and transformed traditional threats. Notably, cyber risks are becoming increasingly prevalent due to the growing frequency and scale of cyberattacks, data breaches, and technological failures in critical systems.

Systemic risks are increasing due to the growing interdependence of digital platforms and financial institutions, creating the potential for chain reactions in the event of disruption or crisis. Operational risks are increasingly associated with errors in artificial intelligence algorithms and the insufficient qualifications or competence of the personnel operating the relevant systems. These dynamics necessitate a re-evaluation of current risk management strategies and the adaptation of institutional mechanisms to align with these new conditions.

Leaks of personal and financial data decrease customer confidence and negatively affect the bank's reputation. Cybercrime and technical failures can cause significant financial losses that threaten the stability of the institution. To mitigate these risks, it is crucial to implement modern cybersecurity protocols and conduct regular vulnerability assessments.

The main areas in which the risk management strategy will be implemented are as follows:

1. An integrated approach to risk management. This involves implementing a full cycle of risk management, including:

- identification of risks through scenario analysis, expert assessments, and historical data analysis;

- Risk assessment based on quantitative methods (in particular Value at Risk models) and qualitative analysis;

Management measures include asset diversification, insurance, provisioning, and the creation of internal control mechanisms.

Monitoring and control involves constant analysis and evaluation of risk.

2. Specific methods are used depending on the type of risk. Management strategies are differentiated according to the nature of a particular risk.

3. Integrating digital technologies into the risk management system. Risk management is becoming increasingly reliant on digital tools, enabling more accurate, efficient and flexible decision-making.

Big data processing technologies can be used to predict customer creditworthiness, detect fraud and identify unusual transactions.

Blockchain technologies increase transparency and trust in transactions by ensuring data integrity.

Artificial intelligence (AI) algorithms enable real-time risk monitoring.

The proposed fractal-faceted risk assessment model for the digitalisation of banking activities addresses these issues through a multilevel, multidimensional approach that considers the relationships between different risk categories and how they manifest at tactical, operational and strategic levels. The model ensures comprehensiveness, scalability and adaptability, enabling banks to identify and assess risks, and develop effective strategies to minimise them. Implementing such a model improves the economic security of banks by enabling the timely detection of threats, the forecasting of their consequences, and the proactive management of risks. To implement the model in practice, investment is recommended in cybersecurity, staff training, cooperation with regulators and the integration of digital technologies into the risk management system.

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