

Technology-Based Risk Management: Risk Management Innovation in the Era of Fintech and Open Banking

Joni Hendra¹ Resta Sofiatul Ummah² Nurul Wulandari Saputri³ Cahaya Iklima⁴ Violla Marchella⁵

Program Studi Perbankan Syariah, Jurusan Syariah dan Ekonomi Islam, Sekolah Tinggi Agama Islam Negeri Bengkalis, Kabupaten Bengkalis, Provinsi Riau, Indonesia^{1,2,3,4,5}

Email: joniqizel77@gmail.com¹ restasopyatulumah@gmail.com²
nurulwulandarisaputri@gmail.com³ cahayaiklima59@gmail.com⁴
viollamarchella54@gmail.com⁵

Abstract

The digital transformation of the banking industry has fostered the emergence of various financial innovations, including fintech and open banking, significantly reshaping the landscape of risk management. This study aims to analyze how financial institutions adopt technology-based risk management systems to address the complexity and rapid changes in the digital era. Using a qualitative descriptive approach, this research explores the implementation of technologies such as big data analytics, artificial intelligence (AI), and blockchain in detecting, analyzing, and mitigating risks arising from the integration of banking services with third-party platforms. The findings reveal that the adoption of digital technologies not only enhances risk management efficiency but also expands the capacity for real-time and predictive risk detection. Nonetheless, challenges such as cyber risk, dependency on digital infrastructure, and the need for adaptive regulation remain critical concerns. This study is expected to contribute to the development of responsive and sustainable risk management strategies in the era of fintech and open banking.

Keywords: Risk Management, Financial Technology, Fintech, Open Banking, Banking Digitalization, Cyber Risk



This work is licensed under a [Creative Commons Attribution-NonCommercial 4.0 International License](https://creativecommons.org/licenses/by-nc/4.0/).

INTRODUCTION

The financial services industry is undergoing a profound transformation driven by the rapid evolution of technology and the growing demands for more agile, customer-centric services (Tsakila, Wirahadi, Fadilah, & Simanjuntak, 2024). At the heart of this transformation lies the emergence of financial technology (fintech) and open banking, which have introduced new paradigms in how financial institutions operate, interact with customers, and manage risks. While these innovations offer unprecedented opportunities to improve financial inclusion, efficiency, and innovation, they also bring about complex, dynamic, and often unpredictable risks that challenge traditional risk management frameworks (Tsakila et al., 2024). Fintech refers to the integration of digital technology into financial services to enhance or automate banking and financial operations. From peer-to-peer lending platforms and robo-advisors to mobile payment systems and decentralized finance (DeFi), fintech is redefining the boundaries of financial intermediation. Simultaneously, open banking—fueled by regulatory frameworks such as the Revised Payment Services Directive (PSD2) in Europe—allows third-party providers to access banking data with customer consent, fostering greater competition and collaboration within the financial ecosystem (Sriyono, Maretha, & Devi, 2023).

In this rapidly changing environment, the traditional methods of risk identification, assessment, and mitigation are increasingly inadequate. The shift from centralized to

decentralized service models, along with the reliance on third-party providers and application programming interfaces (APIs), has introduced new risk vectors, including cyber threats, data breaches, operational failures, and compliance challenges. These developments demand a more agile, technology-based approach to risk management—one that leverages the very innovations reshaping the industry(Isman, Hidayat, Narwanto, & ..., 2024). Technology-based risk management involves the use of advanced digital tools and platforms, such as big data analytics, artificial intelligence (AI), machine learning, blockchain, and cloud computing, to enhance the capacity of financial institutions to anticipate, detect, and respond to risks in real-time. These tools enable a more proactive and predictive approach to risk governance, shifting from a reactive stance to a data-driven, forward-looking strategy(Toni & Lukman, 2024). AI-powered systems, for instance, are now capable of processing vast volumes of transactional data to detect anomalies, predict fraudulent behavior, and assess creditworthiness with greater accuracy than conventional models. Big data analytics allows for comprehensive risk profiling by aggregating structured and unstructured data from various internal and external sources. Blockchain technology introduces new possibilities for enhancing transparency and traceability in financial transactions, thereby reducing the risk of fraud and operational error(Sari & Huda, 2024).

However, the adoption of these technologies also presents significant challenges. The increasing dependence on digital infrastructure creates vulnerabilities to system failures, cyberattacks, and technological obsolescence. Moreover, the complexity of algorithmic decision-making raises concerns about transparency, fairness, and accountability. Regulatory frameworks are often lagging behind technological innovation, creating gaps in oversight and legal protection. Therefore, while technology offers powerful tools for managing risks, it also necessitates a rethinking of risk governance models, as well as continuous adaptation and collaboration among stakeholders(Satrio Ronggo Buwono, Abubakar, & Handayani, 2022). This study seeks to explore the role of technology in reshaping risk management practices within the banking sector, particularly in the context of fintech integration and open banking implementation. Using a qualitative descriptive approach, the research draws on interviews with banking professionals, fintech practitioners, and risk managers to gain a deeper understanding of the challenges and strategies involved in technology-based risk governance(Indrayani, Berlian, & Lestari, 2025). The rationale for choosing a qualitative approach lies in the need to capture the complex, context-specific, and evolving nature of technological innovation in financial risk management. Unlike quantitative methods that rely heavily on numerical data, qualitative research provides rich, in-depth insights into organizational behavior, perceptions, and strategic decision-making processes(Bakri, Hasanah, & Lasmiatun, n.d.).

By examining real-world experiences and practices, this study aims to contribute to the growing body of literature on digital transformation in finance, particularly in the domain of risk governance. It also offers practical implications for financial institutions, regulators, and technology providers who are navigating the challenges of safeguarding financial systems in an increasingly interconnected digital landscape(Ferozi Ramdana Irsyad, Filja Azkiah Siregar, Jonatan Marbun, & Hasyim Hasyim, 2024). In conclusion, as fintech and open banking continue to disrupt traditional financial models, the imperative for robust, adaptive, and technology-driven risk management frameworks becomes more pressing. Understanding how financial institutions respond to these challenges is essential not only for maintaining financial stability but also for building trust in the evolving digital economy. This study endeavors to shed light

on the innovations, tensions, and pathways forward in the field of technology-based risk management.

RESEARCH METHOD

This study employs a qualitative descriptive approach to explore how financial institutions implement technology-based risk management strategies in response to the challenges posed by fintech innovation and open banking. A qualitative design is particularly well-suited for this research, as it enables a comprehensive understanding of complex, context-dependent phenomena that cannot be easily captured through quantitative metrics. By focusing on the lived experiences, practices, and perspectives of key actors in the financial sector, this approach facilitates a deeper exploration of risk governance in the digital age.

RESEARCH RESULTS AND DISCUSSION

This section presents the findings from semi-structured interviews with professionals across banking and fintech sectors in Indonesia. Thematic analysis identified four major themes reflecting the current state, challenges, and innovations in technology-based risk management: (1) Digital Risk Typologies and Institutional Exposure, (2) Technological Tools and Their Strategic Deployment, (3) Organizational Adaptation and Capacity Building, and (4) Regulatory Ambiguity and Institutional Response. Each theme is discussed in detail with excerpts and interpretations that illustrate the dynamic interplay between digital transformation and risk governance.

Digital Risk Typologies and Institutional Exposure

One of the most prominent findings is the evolving typology of risks associated with fintech integration and open banking. Participants consistently noted that cybersecurity threats have surpassed traditional operational risks in terms of frequency and perceived severity. "The moment we opened our system to third-party APIs, we had to rethink our entire cybersecurity architecture. It's no longer just about firewalls—it's about end-to-end data control, encryption, and authentication across unknown endpoints." (Risk Manager, Bank BUKU IV) Another emerging category is algorithmic risk, particularly in the context of AI-based credit scoring and fraud detection systems. Misclassifications due to biased data, overfitting models, or lack of explainability were mentioned as key concerns: "There's a belief that AI is smarter than humans, but in risk management, that's dangerous. A model that learns from biased loan histories could systemically exclude worthy borrowers." (Fintech Compliance Lead). This finding highlights the paradigm shift from deterministic to probabilistic risks, which require different governance logic—more iterative, predictive, and constantly updated.

Technological Tools and Strategic Deployment

The adoption of big data analytics, machine learning, and real-time monitoring systems was widely cited as transformative. Institutions have begun moving from static risk assessment to dynamic, event-driven systems capable of flagging anomalies as they occur. "We've integrated streaming analytics into our fraud detection. If a transaction deviates even slightly from a customer's behavioral norm, it's flagged in milliseconds." (Chief Technology Officer, Digital Bank) However, there is considerable variation in maturity and integration levels. Larger, well-capitalized banks are able to internalize risk-tech, while smaller institutions and fintechs rely heavily on third-party solutions, which introduces another layer of vendor risk. The deployment of blockchain technology, while still in early stages, is being explored

particularly for auditability and transaction integrity. “We’re testing blockchain not for payments, but for interbank settlement records. It gives us a tamper-proof trail, which is a huge plus from a risk perspective.” (IT Head, Regional Bank) This suggests that technological innovation is not limited to the front-end experience, but is reshaping core risk infrastructures at the institutional level.

Organizational Adaptation and Capacity Building

Effective technological risk management is not solely a function of tools, but of organizational readiness and adaptability. Several participants emphasized the need for cross-functional integration between IT, compliance, and risk departments. “You can’t leave risk to the risk team anymore. Everyone needs to understand the tech. Risk managers are learning code, and developers are attending compliance training. It’s a culture shift.” (Operational Risk Officer, Fintech Lender) There is a marked shift toward agile governance models, in which risk decisions are embedded in real-time workflows rather than retrospective assessments. This mirrors broader DevSecOps practices in technology sectors. Despite these shifts, many institutions reported gaps in human capital, especially in terms of risk analysts with tech fluency or data scientists with regulatory knowledge. Upskilling initiatives are underway, but limited by time, resources, and cultural inertia.

Regulatory Ambiguity and Institutional Response

The regulatory environment is perceived as both enabling and constraining. On one hand, the Otoritas Jasa Keuangan (OJK) and Bank Indonesia have encouraged digital innovation through regulatory sandboxes and tiered licensing. On the other hand, participants described regulations as lagging behind the speed of fintech development. “We’re not against regulation—we need it. But when the rules are unclear, we either overcomply or delay implementation, both of which create risk.” (Legal Counsel, Open Banking Platform) Particularly in data sharing, cross-border data storage, and API standardization, regulatory grey areas were cited as critical risks. Some institutions are proactively engaging with regulators to co-develop frameworks, while others maintain legal buffers through conservative policies. These findings illustrate the emergence of regulatory co-creation as a strategy, where institutions actively shape compliance structures rather than passively awaiting enforcement.

The results indicate that technology-based risk management is not a monolithic concept but a constellation of practices varying in complexity, integration, and institutional ambition. Risk is no longer seen as a constraint to innovation but as a design variable that must be embedded into digital architecture from the ground up. A critical insight from this study is the importance of socio-technical alignment: the degree to which technology, human capabilities, and institutional norms are coordinated. Institutions that succeed in this alignment show higher agility and resilience in managing digital risks. Furthermore, while technology offers enhanced precision, it does not eliminate uncertainty. Instead, it shifts the focus of governance from certainty to adaptability, requiring continuous recalibration of tools, teams, and strategies.

CONCLUSION

This study set out to explore how financial institutions are adopting technology-based approaches to risk management in response to the challenges and opportunities presented by fintech innovation and open banking. Through a qualitative descriptive methodology, drawing insights from industry professionals across the banking and fintech sectors in Indonesia, the

research reveals a multifaceted transformation in risk governance driven by technological integration. The findings underscore that digital transformation is not merely a technological shift, but a deep organizational and cultural reconfiguration. Risk typologies have evolved—from traditional credit and operational risks to more complex forms such as cyber threats, algorithmic biases, and third-party dependencies. As such, institutions are increasingly relying on sophisticated tools like AI, big data analytics, and blockchain not only to detect and prevent risks but also to strategically reimagine risk management as a dynamic, real-time, and predictive function. However, the success of these innovations depends heavily on internal readiness, including cross-functional collaboration, upskilling of personnel, and agile organizational structures. The absence of these capabilities poses significant barriers to effective implementation, especially for smaller institutions or those still reliant on siloed legacy systems. Furthermore, while technology offers new possibilities, it also generates new vulnerabilities. The study highlights how the regulatory environment plays a dual role—acting as both a catalyst and a constraint. Regulatory ambiguity, especially in data governance and API standards, creates uncertainty, yet forward-looking institutions are engaging in collaborative dialogue with regulators to shape adaptive compliance frameworks. Ultimately, this research shows that effective technology-based risk management requires more than deploying digital tools. It demands a holistic alignment between technological systems, institutional cultures, and regulatory ecosystems. As financial services continue to digitize, institutions must evolve not only in their technological capabilities but also in their governance philosophies—moving from risk avoidance to risk agility. This study contributes to the growing body of literature on digital risk governance and provides practical insights for policymakers, financial institutions, and fintech innovators seeking to navigate the complexities of risk in an increasingly interconnected financial ecosystem. Future research could extend this inquiry through comparative cross-country analysis or by employing mixed-methods approaches to capture both behavioral and quantitative dimensions of technological risk management.

BIBLIOGRAFI

- Abubakar, Lastuti, & Handayani, Tri. (2022). Penguatan Regulasi: Upaya Percepatan Transformasi Digital Perbankan Di Era Ekonomi Digital. *Masalah-Masalah Hukum*, 51(3), 259–270. <https://doi.org/10.14710/mmh.51.3.2022.259-270>
- Aprilia, Elvina. (2018). Peran Teknologi Dalam Manajemen Risiko Dan Inovasi. *Jurnal Pendidikan Agama Islam*, 2(2), 94–100.
- Bahri, S., Marchella, V., & Hendra, J. (2025). Lingkungan Pemasaran Bank. *Journal of Business Inflation Management and Accounting*, 2(1), 328-333.
- Bakri, Asri Ady, Hasanah, Niswaton, & Lasmiatun, Kmt. (n.d.). Financial Technology Innovation And Banking Industry Transformation (A Literature Study On Financial Markets). *Multifinance Jurnal Ekonomi, Manajemen Dan Perbankan*, 230–238. Retrieved from <http://altinriset.com/journal/index.php/multifinance>
- Bakri, Asri Ady, Hasanah, Niswaton, & Lasmiatun, Kmt. (n.d.). Financial Technology Innovation And Banking Industry Transformation (A Literature Study On Financial Markets). *Multifinance Jurnal Ekonomi, Manajemen Dan Perbankan*, 230–238. Retrieved from <http://altinriset.com/journal/index.php/multifinance>
- Cahyati, C., Sukmalika, F., & Putri, J. (2025). Analisis Pengaruh Inflasi Terhadap Tingkat Pengangguran di Negara Berkembang. *Journal of Business Inflation Management and Accounting*, 2(1), 33-40.
- Ferozi Ramdana Irsyad, Filja Azkiah Siregar, Jonatan Marbun, & Hasyim Hasyim. (2024). Menghadapi Era Baru : Strategi Perbankan Dalam Menghadapi Perubahan Pasar Dan

- Teknologi Di Indonesia. *Transformasi: Journal of Economics and Business Management*, 3(2), 29–46. <https://doi.org/10.56444/transformasi.v3i2.1594>
- Ferozi Ramdana Irsyad, Filja Azkiah Siregar, Jonatan Marbun, & Hasyim Hasyim. (2024). Menghadapi Era Baru : Strategi Perbankan Dalam Menghadapi Perubahan Pasar Dan Teknologi Di Indonesia. *Transformasi: Journal of Economics and Business Management*, 3(2), 29–46. <https://doi.org/10.56444/transformasi.v3i2.1594>
- Indrayani, Eka, Berlian, Sucma, & Lestari, Rina Puji. (2025). Peran Digitalisasi Dalam Meningkatkan Kinerja Perbankan Di Era Transformasi Teknologi. 4(3), 293–301.
- Indrayani, Eka, Berlian, Sucma, & Lestari, Rina Puji. (2025). Peran Digitalisasi Dalam Meningkatkan Kinerja Perbankan Di Era Transformasi Teknologi. 4(3), 293–301.
- Isman, I., Hidayat, S., Narwanto, N., & ... (2024). Transformasi digital BMT Surya Madani: Integrasi e-banking dan financial technology menuju implementasi open loop LKMS 2025. *BEMAS: Jurnal ...*, 5(September 2024), 84–95. <https://doi.org/10.37373/bemas.v5i1.1119>
- Isman, I., Hidayat, S., Narwanto, N., & ... (2024). Transformasi digital BMT Surya Madani: Integrasi e-banking dan financial technology menuju implementasi open loop LKMS 2025. *BEMAS: Jurnal ...*, 5(September 2024), 84–95. <https://doi.org/10.37373/bemas.v5i1.1119>
- Ngamal, Yohanes, & Maximus Ali Perajaka. (2021). Penerapan Model Manajemen Risiko Teknologi Digital Di Lembaga Perbankan Berkaca Pada Cetak Biru Transformasi Digital Perbankan Indonesia. *Jurnal Manajemen Risiko*, 2(2), 59–74. <https://doi.org/10.33541/mr.v2iiv.4099>
- Sadiqin, Amin, Komariyah, Fitri, & Prasetyo, Hendra Dwi. (2024). Pengaruh Penerapan Teknologi Finansial (Fintech) Terhadap Efisiensi Operasional Perbankan di Indonesia. 1(1), 11–18.
- Saprudin, M., Sofiyanto, S., & Hendra, J. (2025). Implementasi Digitalisasi Upaya Mempermudah Bank Syariah Indonesia Dalam Melakukan Forecasting. *Journal of Business Inflation Management and Accounting*, 2(1), 299–305.
- Sari, Zika Puspita, & Huda, Nurul. (2024). Analisis Peran Fintech dalam Mendorong Inovasi Keuangan Modern : Studi Kasus pada OVO di Indonesia pada Tahun 2024.
- Sari, Zika Puspita, & Huda, Nurul. (2024). Analisis Peran Fintech dalam Mendorong Inovasi Keuangan Modern : Studi Kasus pada OVO di Indonesia pada Tahun 2024.
- Satrio Ronggo Buwono, Abubakar, Lastuti, & Handayani, Tri. (2022). Kesiapan Perbankan Menuju Transformasi Digital Pasca Pandemi Covid-19 Melalui Financial Technology (Fintech). *Jurnal Poros Hukum Padjadjaran*, 3(2), 228–241. <https://doi.org/10.23920/jphp.v3i2.764>
- Satrio Ronggo Buwono, Abubakar, Lastuti, & Handayani, Tri. (2022). Kesiapan Perbankan Menuju Transformasi Digital Pasca Pandemi Covid-19 Melalui Financial Technology (Fintech). *Jurnal Poros Hukum Padjadjaran*, 3(2), 228–241. <https://doi.org/10.23920/jphp.v3i2.764>
- Sriyono, Maretha, Sindy Diva, & Devi, Anintya Kurnia. (2023). Memahami Implikasi Open Banking Terhadap Privasi Konsumen Dan Perlindungan Data Di Industri Fintech. *Ensiklopedia of Journal*, 5(4), 406–411.
- Sriyono, Maretha, Sindy Diva, & Devi, Anintya Kurnia. (2023). Memahami Implikasi Open Banking Terhadap Privasi Konsumen Dan Perlindungan Data Di Industri Fintech. *Ensiklopedia of Journal*, 5(4), 406–411.

- Sukma, S., Syakila, D. A., & Avrilia, B. M. (2025). Kebijakan Moneter dan Dampak Terhadap Pertumbuhan Ekonomi Indonesia Tahun 2020. *JAMPARING: Jurnal Akuntansi Manajemen Pariwisata dan Pembelajaran Konseling*, 3(1), 189-200.
- Sutrisno, T. (2025). Dampak Keterlambatan Penyampaian Laporan Keuangan Terhadap Kinerja Keuangan Perusahaan Publik. *EMBER: Economic Management Business Research Journal*, 1(1), 14-19
- Syantana, A. V., Algifari, M., Jannah, N. W., & Hendra, J. (2025). Peran Stabilitas Ekonomi dalam Meningkatkan Pendapatan Rumah Tangga: Kajian Teoritis dan Empiris. *JAMPARING: Jurnal Akuntansi Manajemen Pariwisata dan Pembelajaran Konseling*, 3(1), 236-243.
- Toni, Wijaya, & Lukman, Habibul Umam. (2024). Tantangan dan Strategi manajemen pendidikan islam di era digital. *AN-NAJAH Jurnal Pendidikan Islam Dan Sosial Agama*, 03(03), 35-40.
- Toni, Wijaya, & Lukman, Habibul Umam. (2024). Tantangan dan Strategi manajemen pendidikan islam di era digital. *AN-NAJAH Jurnal Pendidikan Islam Dan Sosial Agama*, 03(03), 35-40.
- Tsakila, Nur Fazri, Wirahadi, M. Arya, Fadilah, Azwar Alif, & Simanjuntak, Henri. (2024). Analisis Dampak Fintech terhadap Kinerja dan Inovasi Perbankan di Era Ekonomi Digital. *Indonesian Journal of Law and Justice*, 1(4), 11. <https://doi.org/10.47134/ijlj.v1i4.2787>
- Tsakila, Nur Fazri, Wirahadi, M. Arya, Fadilah, Azwar Alif, & Simanjuntak, Henri. (2024). Analisis Dampak Fintech terhadap Kinerja dan Inovasi Perbankan di Era Ekonomi Digital. *Indonesian Journal of Law and Justice*, 1(4), 11. <https://doi.org/10.47134/ijlj.v1i4.2787>
- Wahyuni, S. R., Ulfa, M., & Maisyarah, J. (2025). Analisis Dampak Financial Technology (Fintech) Terhadap Inklusi Keuangan dan Perkembangan UMKM di Indonesia. *JAMPARING: Jurnal Akuntansi Manajemen Pariwisata dan Pembelajaran Konseling*, 3(1), 244-249.
- Wandari, P., Rizki, M., & Hendra, J. (2025). Dampak Pertumbuhan Industri Betting Coin Terhadap Stabilitas Ekonomi di Era Kripto. *JAMPARING: Jurnal Akuntansi Manajemen Pariwisata dan Pembelajaran Konseling*, 3(1), 228-235.