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# Innovative techniques implemented in the Polish banking sector

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## ABSTRACT

The increasing availability of the Internet enables and even encourages the use of online services for digital products in banking sector. Consequently, the concept of FinTech has become a key term associated with the financial sector. The aim of this article is to present market practices related to the implementation of financial innovations in traditional banks, to explore banks' perceptions of FinTech companies, and to gain insights into the principles governing cooperation between banks and FinTech firms. The work identified the need for change in identifying market patterns that determine cooperation between banks and FinTech entities, assessing the strengths and weaknesses of such collaboration, and highlighting areas with potential for further development driven by market trends and regulatory requirements. The conducted empirical research contributed to a deeper understanding of the cooperation between banks and FinTech entities, helping to identify its main strengths and weaknesses. The results indicated that FinTech companies are playing a role in implementing technical innovations,and that organizations are interested in further collaboration. These conclusions were particularly significant in light of the regulation implemented in Polish law on January 17, 2025 namely, the Regulation (EU) 2022/2554 of the European Parliament and of the Council of December 14, 2022, on the digital operational resilience of the financial sector (known as the DORA Regulation). The main limitation of the study is its focus on the Polish market and its reference to the implementation of DORA in Polish legislation.

**Keywords:** FinTech, financial innovations, banking sector, DORA Regulation.

## INTRODUCTION

The acquisition and management of digital financial products are linked to technical solutions utilizing online tools [Czarkowska and Bagniewski, 2022]. The term "FinTech" has become a key concept associated with the financial sector. The development of innovative financial solutions is influenced by many factors; however, at the time of implementation, they must be current and attractive from the customers' perspective [Szpringer, 2017]. Nevertheless, this must be accompanied by a sense of security, stability, and ease of use [Kaźmierczak, 2008].

According to the 2023 Polish FinTech Map Report, the largest share of FinTech companies in Poland provides payment services (22.2%), followed by software providers (12.5%). Other notable sectors include companies assisting businesses in financial management (7.5%), insurtech (6.9%), personal finance management (6.9%), loans and credits (6.9%), as well as cybersecurity and identity verification (6.9%) [Map of Polish fintech, 2023].

The literature on the subject offers many definitions of technical innovation. The introduction of novelty into economic practice – a new solution or an improvement of an existing product, process, marketing method, or organizational approach [Klincewicz, 2011]. An enterprise's ability to create and implement innovations and the actual capability to introduce new and modernized products, production processes, or technological-organizational solutions [Pera, 2022]. An enterprise's orientation and ability to continuously seek new solutions and implement the results of R&D work, research findings, ideas, and prototypes into practice [Pera, 2022].

It should also be noted that innovative actions can result from an enterprise's independent activities, collaboration with other companies and suppliers, or the purchase of a product, service, or knowledge in material or immaterial form. Therefore, cooperation between banks and FinTech firms supplements the theoretical knowledge of technical innovation in the financial market. The literature defines entrepreneurship as a mode of action aimed at recognizing, creating, and seizing opportunities, particularly in the context of establishing new ventures [Glinka, and Kłobukowski, 2022]. A specific form of entrepreneurship is start-ups, which are characterized by proactivity, innovation, and risk-taking ability [Maciejewski, 2022].

The emergence of FinTech companies dates back to the mid-2000s with the first wave of start-ups. FinTech start-ups initially provided access to existing banking services, targeting banks as well as entities competing with banks or aiming to create entirely new financial service markets. FinTech has thus become an integral part of the entrepreneurial ecosystem, comprising organizations, public institutions, and entrepreneurial processes that interact and play various roles in relation to one another [Freeman, and Audia, 2006]. The subject literature extensively discusses the concept of the entrepreneurial ecosystem, first defined in 1993 by J.F. Moore in the context of business management [Moore, 1993]. According to his definition, communities are supported by organizations and public institutions that collectively generate goods and services for customers within the ecosystem. Enterprises create an ecosystem that also includes customers, suppliers, manufacturers, shareholders, service providers, business associations, government agencies, and other stakeholders. Within the entrepreneurial ecosystem, a broad and complex network of interactions is observed between various entities, and their success is interdependent. Entrepreneurial ecosystems can be analyzed across different dimensions and industries, including the broadly understood financial sector.

The term "FinTech" was introduced in the 1970s by L. Bettinger, Vice President of Manufacturers Hanover Trust [Bettinger, 1972]. The term was used to describe the combination of computer technology and modern management techniques utilizing banking expertise. FinTech is a blend of the words "finance" and "technology" [Zavolokina, et al., 2016] or an acronym for "financial technology" [Dorfleitner, et al., 2017].

The literature research conducted by Artha, and Jufri [2020] on Fintech from many aspects: data-centric techniques, object and hardware development, application designs, service model deployment, and security and privacy protection; big data and company size; policy direction; Internet of Things; agriculture sector; banking; innovation; artificial intelligence; risk; regulations; user acceptance; and stock returns. FinTech can be examined in multiple dimensions, including products and services, technology and systems, as well as business processes. From an institutional perspective, FinTech represents a new market sector [Narodowy Bank Polski, 2020]. These companies are not traditional banks or financial institutions but leverage technological innovations to provide products and services that meet customer needs. They specialize in offering a narrow range of services or solutions to clients. According to the financial stability board (FSB), FinTech encompasses technologically driven financial innovations that may result in new business models, applications, processes, or products with a significant impact on financial markets, institutions, and financial services [Bank for International Settlements, 2018]. Depending on the adopted business model, FinTech firms may offer financial products and services through their own sales models, as products or services delivered via financial institutions, or as technological support, particularly for banks and other financial institutions. The FinTech concept includes innovations introduced by traditional banks, new market entrants, and large technology companies. In order to compete in a highly competitive environment, banks are also expanding their businesses based on technological and digital foundations. The most crucial aspects to consider are innovation, responsiveness, and the continuous development of banks' technological services aimed at competing in the digital world [Artha, Jufri, 2020].

## MATERIAL AND METHODS

According to the authors, the relationship between banks and FinTech entities has not been sufficiently explored in the existing literature, particularly in the context of qualitative research.

This type of research focuses on interpreting human motivations, needs, and behaviors. It is especially useful when the researcher aims to describe phenomena and the meanings attributed to them by study participants. Qualitative research also serves to explain phenomena by identifying dependencies, relationships, and mutual interconnections [Glinka and Kłobuszewski, 2022]. Qualitative studies do not assume predefined hypotheses, categories, or variables. The researcher enters the process with an open analytical perspective, often referred to as an anthropological state of mind. The objective is to provide the most accurate and natural description of the investigated reality. This methodology is dominated by an inductive approach based on empirical findings, their analysis, and the iterative formulation of the research problem and scope. Theoretical generalizations emerge as a result of a staged research process involving the collection of empirical data, interpretation of the material, and final preparation of research outcomes.

The research was conducted in two stages. The first stage involved analyzing source data – both financial and non-financial reports of banks included in the stock index of the Warsaw Stock Exchange (WSE): WIG-Banks. As of the research period (2022), the WIG-Banks portfolio included the shares of the following banks: PKO BP S.A., PEKAO S.A., Santander Bank Polska S.A., ING Bank Śląski S.A., mBank S.A., Bank Millennium S.A., Alior Bank S.A., Bank Handlowy S.A., BNP Paribas Bank Polska S.A., UniCredit SpA, BOŚ S.A., Getin Holding S.A., Getin Noble Bank S.A. and Banco Santander S.A. The conclusions derived from the desk research informed the preparation of questions for in-depth interviews, which enabled further exploration of the research questions. The research sample consisted of senior-level managers responsible for decision-making related to the implementation of technical innovation within the operational areas of banks. A total of 15 interviews were conducted with representatives of five banking institutions. The order of the questions was modified depending on the responses provided, in line with the logic of semi-structured interviews.

In the second stage, the research employed individual interviews with banking experts. The field study was conducted from Q3 2022 to Q2 2023 among senior managers from five banks operating in the Polish market. The research results pertain to the practical aspects of the bank–FinTech relationship. It appears that this topic has not received much attention in academic literature based on qualitative studies. Therefore, qualitative research methods semi-structured, focused interviews were used to achieve the research objectives and answer the research questions. The collected opinions provided insights into the awareness of FinTech industry development, the current and potential cooperation between FinTech's and banks, and possible gaps in banks' innovation activities that could be addressed by technological entities, particularly within middle-office functions.

The research questions demonstrated that when introducing technical innovations, banks are particularly focused on implementing projects that will provide convenience to bank customers. The implementation of new solutions in terms of new functionalities, new applications, new products for customers results from the "user experience" approach. The results of the conducted research indicated practices in the implementation of innovative digital product in banks, with the participation of companies from the FinTech industry. The above conclusions become particularly significant in the context of the regulation implemented in Polish law as of January 17, 2025, specifically the European Parliament and Council Regulation (EU) 2022/2554 of December 14, 2022, on the operational resilience of the financial sector, known as the DORA Regulation.

The aim of this article was to study market practices related to the implementation of technical financial innovations in traditional banks, the perception of FinTech companies by banks, and the principles of cooperation between banks and FinTech firms. The research will contribute to a better understanding of the collaboration between banks and FinTech entities, as well as identifying its strengths and weaknesses.

## RESULTS

### Financial innovations

The banking sector has undergone a "digital revolution" in many areas of its operations, driven by shifts in strategy and the redefinition of business models. Today, banking strategies are built around customer needs (client experience). Market trends highlight the critical role of technological innovations, especially in cognitive economy sectors, sector convergence, mobile solutions, cryptocurrencies, and distributed virtual ledgers. The world's fastest-growing corporations are those that have capitalized on the opportunities provided by technical innovations [Szpringer, 2017]. Banks are striving to implement the new digital products that allow them to maintain leadership in financial services, address customer needs, and reduce costs. A key challenge for banks is determining how to identify, aggregate, and consolidate massive amounts of data from diverse sources. This creates an opportunity for collaboration with FinTech firms.

Financial and non-financial reports from banks highlight the innovations they have implemented. These reports indicate that the most significant area of innovation in banks involves implementing or expanding remote services to enhance customer convenience. All examined banks introduce services that facilitate customer access to banking products and services. The most developed area is remote customer service. The analysis of financial and non-financial reports from banks found that 80% of implemented innovations were aimed at improving remote banking services for customers (Figure 1).

The another area of innovation is the automation of customer service processes, which contributes to cost reduction. The reports examined provided limited details on innovations related to back-office process automation. Based on an analysis of the studied sample, 204 innovations implemented in banking activities were identified. In their 2021 financial reports and ESG reports, banks disclosed the scope of implemented innovations in their operations. The introduced improvements are based on the development of remote and mobile services, process automation, and robotization. The most significant changes aim to enhance customer convenience when using online banking platforms. The most developed area of implemented innovations in banks is the introduction or expansion of remote services designed to provide customers with greater convenience. In particular, banks are focusing on developing remote services within their product offerings, improving online service login processes, and enhancing additional services (Figure 2).

Among remote services for customers, the most implemented improvements are in banking digital products such as financial management, online payments, financing, and currency exchange (Figure 3).

The results of the conducted desk research indicate that banks are implementing technical financial innovations, particularly in the area of customer service. These financial innovations primarily involve the expansion of remote services. There are three main drivers for implementing technical innovations in banks: improving customer convenience in remote services, automating customer service processes, and automating internal banking processes. The desk research shows that banks primarily introduce innovations aimed at enhancing customer convenience. The implementation of new functionalities, applications, and digital products for customers follows the user experience approach and aims to help banks build stronger customer relationships. In the long term, these innovations may lead to increased customer satisfaction, a higher number of clients and transactions, as well as reduced operational costs, ultimately having a positive impact on banks' financial performance. These conclusions are supported by the authors of the Deloitte report "Realizing the Digital Promise: Call to Action" [Report Deloitte, 2021], which highlights that the development of financial technologies and evolving consumer needs drive innovation, including in the banking sector.

## FinTech entities

The literature indicates that the nature of cooperation between banks and FinTech

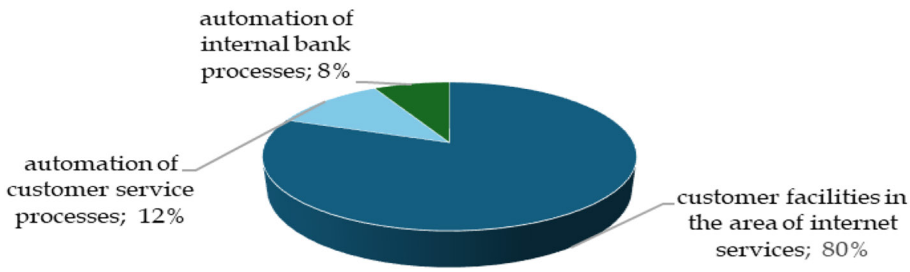


**Figure 1.** Areas of technical financial innovations implemented by banks

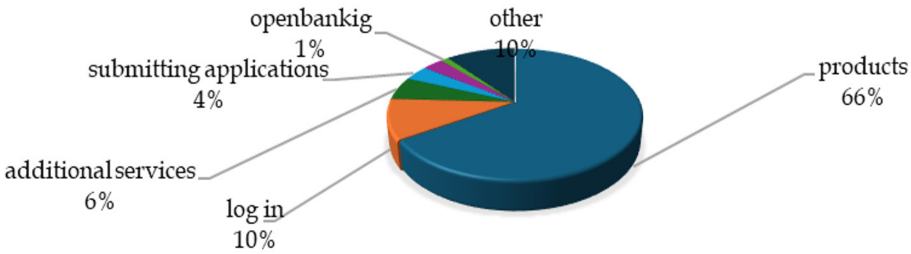


**Figure 2.** Areas of application of digital products in banks

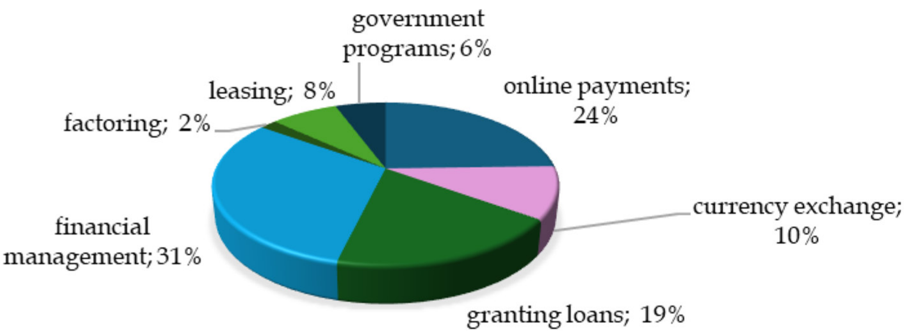


**Figure 3.** Expansion or implementation of digital banking products

companies depends on the needs expressed by the banks [Harasim, 2021]. In the phase of establishing contact, banks seek firms for cooperation through innovation hubs or hackathons, where they can familiarize themselves with new ideas, projects, and innovations offered by FinTech companies. Incubators and accelerators enable banks to collaborate with FinTechs in providing solutions. The most advanced form of cooperation is banks investing in FinTech companies through indirect and direct investments. Banks may be minority or majority shareholders. Through these investments, the banking capital groups expand to include FinTech entities, which can create solutions for the needs of other entities within the group.

In the non-financial reports of the examined banks, seven of them provided information that within their internal structures, they have organizational units responsible for implementing innovations. The tasks of these units are broad: ranging from IT tasks, implementing new business models, to cybersecurity. Four banks pointed to the advanced competencies of these departments, i.e., cooperation with external suppliers in obtaining innovations, ideas, and solutions from external entities, including FinTech companies. The most popular collaboration model among banks is accelerators – platforms for cooperation between banks and FinTech companies: "The bank is a corporate partner of the Warsaw Booster - a city-based accelerator program for innovative projects and startups. The program supports teams that develop ambitious technical solutions and improve business competencies" [ESG Report presenting non-financial information of BNP Paribas Bank Polska S.A. and the BNP Paribas Bank Polska S.A. Capital Group for 2021], "In 2021, the Bank […] together with Huge Tech launched a call for startups and technology companies to join the Idea Global accelerator […] piloting submitted projects that will accelerate the Bank's digital transformation process. The effect of participating in the program was the acceleration of four startups" [Non-financial information statement of the Pekao S.A. Capital Group for 2021]. Accelerator programs allow banks to familiarize themselves with new FinTech solutions and select those that seem to be the most beneficial or needed for the bank. Through accelerator programs, banks cooperate with FinTechs in the business area, without equity participation in these companies: "Thanks to Let's Fintech, together with the start-up firm, we implemented the first commercial service based on blockchain technology – the Permanent Carrier" [https://fintech.pkobp.pl/wspolpraca-ze-startupami/]. "The bank holds regular meetings with startups to search for innovative ideas and solutions to expand the bank's offerings. As a result of these meetings, the bank collaborates with nuDelta, enabling the implementation of a solution that allows for reading and using data from text visible in images or document scans" [ESG Report presenting non-financial information of BNP Paribas Bank Polska S.A. and the BNP Paribas Bank Polska S.A. Capital Group for 2021]. Banks can also make direct investments in technology companies: "The bank is a 100% shareholder of […] Business Services S.A. The company offers innovative business services beyond traditional banking" [Management Report on the activities of the ING Bank Śląski S.A. Capital Group], making the FinTech a part of the bank's capital group. It continuously provides services and becomes a permanent element of the bank's ecosystem: "[...] The bank owns several startups that provide products and services to the bank" [Management Report on the activities of the Alior Bank S.A. Capital Group for 2021]. Banks also invest indirectly in the FinTech sector through investment funds in which they are investors: "The CVC Fund is an investment fund established by the bank as a closed-end investment fund of 200 million PLN. It invests in banking technologies and derivatives" [https://fintech.pkobp.pl/wspolpraca-ze-startupami/], "mAccelerator is a venture capital fund aimed at the development and commercialization of the latest technologies. Its capitalization is 50 million EUR, or over 200 million PLN. The fund invests in minority equity stakes in technology startups, and as a venture builder, it also establishes and develops technology companies" [Management Report on the activities of the mBank S.A. Capital Group for 2021]. The bank's indirect investment allows for the creation of a much larger scale and the ability to invest in many FinTech startups, while also reducing the bank's risk. In case of an investment failure, it will not directly affect the bank's financial results.

Direct interviews confirmed the findings from the source document analysis regarding possible forms of cooperation between FinTech companies and banks. Over 40% of the respondents indicated that the bank, either independently or within a capital group, owns a FinTech company, with investments made through an investment fund or directly in a FinTech company. Thirty percent of the respondents indicated that the bank does not have investments in FinTech companies, citing the bank's organizational culture, strategy, and the risks associated with investing in such entities. All respondents confirmed that they use services provided by FinTech companies. The respondents emphasized that cooperation is established in two models. In the first model, banks actively seek FinTechs to collaborate on specific projects. The second model involves FinTechs presenting their offers, ideas, and solutions to bank representatives. Three respondents indicated that their bank has a unit responsible for cooperation with FinTech companies. These departments mediate the contact between banks and the financial innovation suppliers, gather offers, and search for FinTech companies to address specific project needs from the banks. Two respondents pointed out that they mainly search for FinTech companies to collaborate with on the market. In individual interviews, the respondents were asked about the role of FinTech in implementing innovations in the bank and the rules of cooperation between the organizations. The questions concerned the practices of cooperation between banks and the FinTech sector, as well as the perception of the FinTech industry by banks. The responses detailed areas of cooperation, which varied between respondents. The roles that FinTech companies play in collaboration with banks include technology suppliers or subcontractors, advisors, and "sources of inspiration." All respondents agreed that there is a high level of awareness about the development of the FinTech market within banks. One respondent pointed out that large consulting and advisory firms are also involved under the FinTech label. All respondents expressed interest in developing further collaboration with FinTech companies in their respective areas, highlighting the benefits of such cooperation. The respondents identified specific areas where they see opportunities for development and cooperation with FinTechs in their operations: unification of data sources and data acquisition, complementing existing bank systems, building models, including rating models, process automation, settlement processes, collateral valuation, exposure monitoring, and decision-making. All respondents indicated the potential for further collaboration. At the same time, the respondents pointed out challenges in collaborating with FinTechs. The main obstacles mentioned were legal regulations, particularly in outsourcing, public procurement law, and internal procurement procedures in banks. Additionally, the organizational culture of both organizations and the adopted strategies posed challenges in implementing joint financial innovation projects.

These conclusions are confirmed by the position of the Financial Supervisory Authority, which highlights regulatory barriers to the development of cooperation between FinTech companies and banks (Table 1).

Furthermore, the activity of FinTech companies becomes particularly relevant in the context of Regulation (EU) 2022/2554 of the European Parliament and of the Council of 14 December 2022 on digital operational resilience for the financial sector (DORA), applicable in Poland as of 17 January 2025. The regulation establishes a comprehensive framework for managing ICT-related risks across a wide range of financial entities, including banks, payment institutions, investment firms, crypto-asset service providers, insurance undertakings, and external ICT service providers. DORA introduces extensive obligations concerning ICT risk management, incident reporting, information duties, and contractual oversight of third-party ICT providers. Its adoption responds to the growing threat of cyberattacks and the increasing reliance of financial institutions on automation, robotics, and complex information systems, which heighten the risk of technical failures, human errors, and system disruptions. Such incidents may result not only in financial losses due to service unavailability but also in a loss of market confidence and threats to the stability of the financial system, particularly in the case of large-scale disruptions [KNF, 2024].

## Technological innovations

In the conducted interviews, the respondents identified the main motives for introducing new digital products as the assumptions of the banks' adopted strategies. Respondents also pointed out that technical innovations are a "must-have" element for every financial organization. An important motive for implementing innovations, although not the most important, was the convenience for the client. The results of the "desk research" of source documents – financial and non-financial reports – were corroborated by the interviews. The respondents confirmed that a significant portion of financial technical innovations is implemented in areas connecting the bank with customers, aiming to introduce conveniences for the client. These actions are intended to increase the customer base, maintain positive relationships with existing customers, and reduce the customer retention rate. In 40% of the statements, there was a clear indication of the above aspects visible to the client. The respondents also emphasized the aspect of automation, standardization, and simplifications in the middle-office/back-office areas of the banks. This aspect of the interviews produced different results than the source document research – financial and non-financial documents, where customer conveniences were the predominant aspect of the innovations implemented in banks (over 80%). In the direct interviews, 100% of the respondents pointed out the aspect of automation, robotization, and process improvements. A key motivator for implementing innovations is not the costs and their reduction due to the introduction of innovative solutions. In the interviews, attention was drawn to the possibility of utilizing human resources for other tasks in different areas after the innovation is implemented in a given area. Representatives of all the surveyed banks confirmed that banks implement technical innovations in all areas of the bank: front-office, back-office, and middle-office. The definition of innovation presented by the respondents varies. The respondents considered any new digital solution, product, or IT service that could lead to development as an innovation. Such diverse and broad perceptions of innovation are consistent with the OECD definition, which states that innovation is the implementation of a new or significantly improved product (good or service) or process, a new marketing method, or a new organizational method in market practices, organizational locations, or external relationships. The minimum threshold for innovation is considered to be the introduction of a product, service, or organizational method that is new or improved from the company's perspective, implemented for the first time within the company or adopted from other companies or organizations [OECD, 2005].

## FinTech companies in the banking sector

All the respondents recognize the strengths of FinTech companies, although they categorize them into several areas. The most frequently mentioned advantages are agility, flexibility, and dynamism in their operations. Other strengths highlighted include the absence of regulatory and legal constraints in their activities, the focus on a specific goal resulting from the small size of the company, specialization in one specific service and striving for leadership in its delivery,

**Table 1.** Barriers to development of cooperation between FinTech companies and banks

| No. | A legal provision/ position that constitutes a barrier | What the barrier consists of? | Proposal for change |
|---|---|---|---|
| 1 | Limited possibilities for electronic money institutions from other EU countries to open a bank account with a domestic bank. | Banks choose not to enter into bank account agreements with payment service providers from other EU member states for the purpose of providing cross-border payment services. | A desirable instrument could be a supervisory authority's position addressed to banks regarding the principles of maintaining bank accounts for non-bank entities. This need is particularly evident in the context of banks providing account services for providers operating cryptocurrency trading platforms. The supervisory authority's position should include, among other things, a list of financial security measures constituting a positive premise for entering into a bank account agreement. |
| 2 | Written form of direct debits. | Article 63d of the Banking Law identifies direct debit as one of the forms of cashless settlements. Such a settlement is very convenient; however, its high level of formalization results in relatively low popularity. Considering that a significant portion of banking transactions is conducted online, it seems reasonable to amend the regulations in such a way that direct debit could also operate outside the written form within a digitized customer service process while maintaining a high level of customer security. | Introduction of a digitalized form of direct debits |
| 3 | Fragmentation of regulations on the use of bank accounts. | The regulations governing the use of bank accounts and settlements involving these accounts are currently found in three laws: the Civil Code, the Banking Law, and the Payment Services Act. The fragmentation of these regulations and the lack of fully precise determination of their interrelations often raise doubts at the stage of applying these provisions. | Incorporating a comprehensive regulation defining the obligations related to maintaining a bank account within a single legal act, while retaining a reference to the Payment Services Act for matters related to executing payment transactions. |
| 4 | Article 7 of the Banking Law Act - Client's statement of intent related to performing banking transactions, which may be made electronically. | In order to arrange with the Bank's Client to use electronic form, the Bank must fulfill the requirements specified by the Act and regulations. One of the requirements is an agreement between the Bank and the Client to conclude contracts in electronic form (e.g., by including appropriate provisions in the terms and conditions). Barrier: Additionally, there must be information specifying which exact technology will provide the electronic signature (e.g., on a tablet or through SMS authorization). | Waiver of the requirement to specify the exact technology used for the electronic signature when agreeing with the client on the electronic form. This will allow us to avoid the obligation to constantly adapt and update the agreement between the Bank and the Client (e.g., in the terms and conditions) when implementing new technologies supporting eSignature. |
| 5 | Article 6a, paragraph 7 of the Banking Law Act. | Limited possibilities for banks to use sub-outsourcing. | Removal of restrictions, particularly regarding one level of sub-outsourcing and the bank's consent given in writing. |
| 6 | Article 6b, paragraph 1 of the Banking Law Act. | No possibility of limiting the responsibility of the insourcer. | Removal of the barrier and allowing the parties to the agreement to establish the rules of liability at the contractual level, according to the estimated risk. |
| 7 | Article 6d of the Banking Law Act. | The need to obtain the consent of the Financial Supervision Authority (KNF) to conclude an outsourcing agreement. | Removal of the barrier. Other entities subject to KNF supervision do not have the same requirement to obtain KNF's consent. |
| 8 | Article 6a of the Banking Law Act. | The requirement to sign outsourcing agreements in the case of testing cooperation with external entities such as FinTechs or implementing projects like MVP (Minimum Viable Product). | Liberalization regarding the testing of solutions for short-term and validation-type agreements. |
| 9 | The Payment Services Act. | Lack of regulation on sub-outsourcing - a literal interpretation of the regulations assumes that the absence of regulation means sub-outsourcing is prohibited, which is unmarket-oriented and systemically inconsistent (a stricter regulation than, for example, in banks). | Allowing sub-outsourcing, including chain sub-outsourcing. |

**Note:** KNF, https://www.knf.gov.pl/dla_rynku/fin_tech/Zespol_roboczy_FinTech.

creativity stemming from the characteristics of the people employed in FinTech companies, cheaper and faster access to clients, and larger data resources. These strengths, mentioned during interviews, allow for collaboration between companies. The symbiosis between organizations enables the development of both entities. On one hand, banks gain access to new technologies, innovations, and modern solutions, while on the other hand, FinTechs sell their products and services, securing resources for growth through access to financial, human, or infrastructural resources. Only in three interviews did respondents mention that the development of the FinTech market could threaten the future of traditional banking. However, one interview specifically highlighted that this concern relates to the development of the payment flow market. In the remaining interviews, participants emphasized that FinTechs do not pose a threat to traditional banking but rather complement and support it. Respondents indicated that banks' advantage lies in their regulatory oversight and legal requirements. Banks are subject to stringent regulatory standards, which ensure customer security. Additionally, respondents identified banks' market presence and customer base as an advantage. FinTechs operate in different target markets than banks, primarily offering their services to traditional financial institutions rather than directly to end customers. Respondents also recognized the advantage of banks' employees and their expertise. As a weakness of FinTechs, respondents most frequently pointed out that these are young, inexperienced organizations operating in a challenging legal environment. Interviews also noted that the weaknesses of FinTech companies include their early stage of development, low equity, low return rates for investors, lack of organizational and market experience, including a lack of experience in adapting to banking requirements, such as outsourcing regulations, a lack of market solutions to protect FinTech clients, market competition, and the lack of a comprehensive offer for target customers, which may ultimately reduce FinTech companies to the role of technological solution providers for banks. At the same time, this could form the basis for establishing, developing, and maintaining cooperation with banks. For bankers, FinTech companies represent a complement, support, and symbiosis with traditional banking, which forms the foundation for cooperation.

## CONCLUSIONS

The issue addressed in this article was the acquisition of knowledge regarding the principles and possibilities of technical collaboration between banks and FinTech companies. The research findings also presented practices in implementing innovative digital financial products in banks – whether banks introduce innovations "in-house" or collaborate with external companies like FinTechs. We stated that FinTech companies participated in implementing of innovative techniques and that organizations are interested in furthering collaboration.

Regarding collaboration with external providers, the DORA Regulation includes requirements concerning the security of networks and systems operating within financial organizations. The regulation defines the principles of identifying, classifying, and documenting processes and resources supported by information technologies, including external providers. Financial institutions are required to identify gaps in these areas and determine how to address them in line with the regulation's requirements. To effectively manage ICT risks from external providers, including FinTechs, financial entities should develop and review their strategy for managing risks from external providers, develop and implement policies for using ICT services supporting critical or essential functions provided by external vendors, and conduct risk assessments regarding agreements with ICT service providers supporting critical or essential functions. The regulation thus obligates banks to assess contracts with technology, service, and information system providers in terms of the materialization of ICT risks, including determining whether the contract supports critical processes or essential functions and whether supervisory, monitoring, and protective processes are in place.

## REFERENCES

1. Bank for International Settlements. Sound Practices Implications of fintech developments for banks and bank supervisors. 2018. https://www.bis.org/bcbs/publ/d431.pdf (access 07.03.2023).
2. Artha B., Jufri A. Fintech: A Literature Review, Jurnal Proaksi, 2020; 59, https://www.researchgate.net/publication/359353344_

3. Bettinger A. FINTECH: A series of 40 time shared models used at Manufacturers Hanover Trust Company. Interfaces, 1972; 2(4).
4. Czarkowska, M., Bagniewski, B. The impact of FinTech development on branches of banking institutions in Poland (in Polish). e-mentor, 2022; 5(97), 13–25. https://doi.org/10.15219/em97.1588
5. Dorfleitner G. Hornuf L. Schmitt M. Weber M. FinTech in Germany. Springer.
6. Freeman, J. H., Audia P.G., Community ecology and the sociology of organizations. Annual Rewiev of Sociology, 2006; (32)1.
7. Glinka B., Kłobukowski P. Entrepreneurship Research – methods, measurement, research approaches (in Polish). Pasierbek W. and Wach K. (Eds.) Słowniki społeczne. Przedsiębiorstwo, Wydawnictwo Naukowe Akademii Ignatianum w Krakowie. 2022.
8. Harasim J. FinTechs, BigTechs and Banks—When cooperation and when competition? Journal of Risk and Financial Management, 2021; 14: 614. https://doi.org/10.3390/ jrfm14120614
9. https://fintech.pkobp.pl/wspolpraca-ze-startupami/
10. Kaźmierczak A. Monetary policy in an open economy (in Polish). Wydawnictwo Naukowe PWN. 2008.
11. Klincewicz K. Diffusion of Innovation: How to succeed in commercializing new products and services (in Polish). Wydawnictwo Naukowe Wydziału Zarządzania Uniwersytetu Warszawskiego. 2011.
12. KNF, Dane i opracowania. Definitions and overview of duties in the area of duty management. (in Polish). 2024.
13. https://www.knf.gov.pl/knf/pl/komponenty/img/Definicje_i_przeglad_obowiazkow_w_obszarze_zarz%C4%85dzania_incydentami_90559.pdf
14. KNF, Dane i opracowania, Identification, review and adjustment of contracts (in Polish) 2024. https://www.knf.gov.pl/knf/pl/komponenty/img/Identyfikacja_przeglad_i_dostosowanie_umow_90560.pdf
15. KNF, Proposed barriers to the development of the FinTech sector, Working Group for the development of financial innovations (FinTech) (in Polish) https://www.knf.gov.pl/dla_rynku/fin_tech/Zespol_roboczy_FinTech
16. Maciejewski M. Start-ups as a special type of entrepreneurship (in Polish). Pasierbek W. and Wach K. (Eds.) Słowniki społeczne. Przedsiębiorstwo. Wydawnictwo Naukowe Akademii Ignatianum w Krakowie. 2022.
17. Map of Polish fintech (in Polish). https://www.cashless.pl/13778-mapa-polskiego-fintechu-2023-cashless-fintech-2023
18. Moore J. Predators and prey: A new ecology of competition. Harvard Business Review, 1999; 25(1).
19. Narodowy Bank Polski PayTech – innovative payment solutions on the Polish market (in Polish). Warszawa, https://nbp.pl/wp-content/uploads/2022/09/paytech.pdf (access 20.04.2023) 2020.
20. OECD, 2005. Oslo Manual, The Measurement of Scientific and Technological Activities, Guidelines For Collecting and Interpreting Innovation Data, A joint publication of OECD and Eurostat, Organisation For Economic Co-Operation and Development Statistical Office Of The European Communities OECD 2005, https://ec.europa.eu/eurostat/documents/3859598/5889925/OSLO-EN.PDF.pdf/60a5a2f5-577a-4091-9e09-9fa9e741dcf1?t=1414781154000
21. Pera B. Innovation in economics and enterprises – the concept of conditioning and measure (in Polish). Pasierbek W. and Wach K., (Eds.) Słowniki społeczne. Przedsiębiorstwo. Wydawnictwo Naukowe Akademii Ignatianum w Krakowie. 2022.
22. Report Deloitte. Realizing the digital promise. Call to action. A paper from the Institute of International Finance and Deloitte. 2021.
23. Regulation (EU) 2022/2554 of the European Parliament and of the Council of 14 December 2022 on digital operational resilience for the financial sector and amending Regulations (EC) No 1060/2009, (EU) No 648/2012, (EU) No 600/2014, (EU) No 909/2014 and (EU) 2016/1011. L 333 27.12.2022, https://eur-lex.europa.eu/legal-content/PL/TXT/?uri=CELEX%3A32022R2554content/PL/TXT/?uri=CELEX%3A32022R2554
24. ESG Report presenting non-financial information of BNP Paribas Bank Polska S.A. and the BNP Paribas Bank Polska S.A. Capital Group for the year 2021.
25. 2021 Annual Report of the PKO Bank Polski S.A. Capital Group.
26. Management Board Report on the activities of the ING Bank Śląski S.A. Capital Group, including the report on the activities of ING Bank Śląski S.A. in 2021, the report on non-financial information of the Capital Group, including non-financial information of ING Bank Śląski S.A. in 2021.
27. Management Board Report on the activities of the Alior Bank S.A. Capital Group for 2021, including the Management Board Report on the activities of Alior Bank S.A.
28. Management Board Report on the activities of the mBank S.A. Group in 2021 (including the Management Board Report on the activities of mBank S.A.).
29. Report on non-financial information of Bank Handlowy w Warszawie S.A. and the Capital Group of Bank Handlowy w Warszawie S.A. for 2021.

30. Management Board Report on the activities of the Getin Noble Bank S.A. Capital Group and Getin Noble Bank S.A. for 2021; Statement on non-financial information of the Getin Noble Bank S.A. Capital Group and Getin Noble Bank S.A. for 2021.
31. ESG Report of Bank Millennium for 2021 and the Bank Millennium Group for 2021.
32. Management Board Report of the Santander Bank Polska S.A. Capital Group for 2021.
33. Annual Report 2021 of Banco Santander, S.A.
34. ESG Report of Bank Ochrony Środowiska S.A. for 2021, Management Board Report on the activities of the Bank Ochrony Środowiska S.A. Capital Group in 2021, prepared jointly with the Management Board Report on the activities of Bank Ochrony Środowiska S.A.
35. Statement on non-financial information of the Bank Pekao S.A. Capital Group for 2021 (prepared jointly with the statement on non-financial information of Bank Pekao S.A.).
36. Szpringer W. New technologies and the financial sector. FinTech as an opportunity and a threat (in Polish). Poltext. 2017.
37. Zavolokina, L. Dolata M. Schwabe G. FinTech – What's in a Name? Thirty Seventh International Conference on Information Systems, Dublin, Ireland, 2016 December 11–14.