CHAPTER 3. CURRENT TRENDS AND PROSPECTS FOR THE DEVELOPMENT OF NEOBANKING INSTITUTIONS IN THE CONTEXT OF GLOBAL DIGITAL CHANGE

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3.1. The Direction of Digital Transformation of the Global Banking Market

An analysis of the development of neobanks in developed European countries and Ukraine reveals a number of dynamic changes in the digital transformation of the banking sector, which is influenced by the advancement of technology and the financial sector. The following areas of rapid change can be identified:

– The transition from basic to sophisticated banking services, from isolated to recurring services, from standardised to bespoke services, from impersonal to personalised services, as evidenced by the shift from electronic communications (email) to instant messaging platforms, from websites to mobile applications, from Human Support to chatbots and artificial intelligence, which facilitate the delivery of digitally tailored, personalised banking services.

– The dynamic development of open banking is largely attributable to government regulatory incentives that define the requirements for the functioning of digital banks within the financial ecosystem. This ecosystem encompasses new financial sector entities, including licensed electronic service providers.

– Transition to new stages of digital transformation in the banking sector by creating digital business models of virtual banks, which are constantly being improved through the IT departments of neobanks integrated into the organisational structure or through outsourcing of IT services. Thus, the following components of the business models of neobanks can be distinguished: Digital channels, Digital products; a full cycle of digital services that allows scaling up banking activities with a minimum number of new staff; digital analytical centres or Digital Brain to study data by business segments, departments, product lines and services; a digital control centre or digital DNA, which involves the formation of a new management system for making strategic decisions throughout its life

cycle. The digitalisation of business models is changing the organisational structure and corporate governance of banking. Information and data are disseminated at a rapid pace, available instantly to every department that needs it. As a result, the decision-making process is accelerated, enabling the development of flexible banking management and rapid adaptation to new environmental conditions.

– Crypto-transformation, development of private cryptocurrencies of banking institutions, digital currencies of central banks for retail, wholesale and cross-border payments.

– Transformation of the regulatory environment through an ongoing process of discussion, studying the challenges of the digitalisation of the financial sector and developing a legal framework that encourages unbanking in line with the identified challenges.

– Development of the financial and technological ecosystem, transformation of the financial technology industry into an independent and rapidly developing sector of the economy, and improvement of its regulation at the supranational and national levels, in particular to ensure the implementation of new projects.

Within the EU, the European FinTech Association (EFA) and the European Securities and Markets Authority (ESMA) operate to create an ecosystem for the development of the financial technology sector. The European FinTech Association (EFA) represents more than 30 leading financial technology companies of various sizes in the EU, operating in various business areas; it actively cooperates with European institutions to create favourable legislative initiatives for the development of financial technologies, ensuring the benefits of safe and seamless digital financial solutions for consumers. The EFA and ESMA offer counsel to the European Commission and engage in empirical research pertaining to the EU financial market. Recent observations by these institutions indicate that the financial services landscape is characterised by fragmentation, a phenomenon that has become more pronounced during the course of the pandemic caused by the COVID-19. The fragmentation and narrow specialisation of financial technology companies in specific financial services ensures the delivery of high-quality services to consumers and facilitates future collaboration with other market actors, including banks, major technology firms, and other financial technology companies. Furthermore, the

fragmentation of the market will contribute to increased competition in the banking sector, resulting in a higher level of sophistication among consumers, who will have new opportunities to choose financial services. This, in turn, will facilitate the acceleration of innovation and the emergence of new technological solutions to address novel market challenges and problems [115].

To illustrate, Nubank, a Brazilian financial institution, provides credit cards and personal loans to 50 million customers, the majority of whom were previously unable to obtain a loan from traditional banking institutions due to a lack of credit history. However, the utilisation of Nubank's artificial intelligence technologies, customer behavioural data, and proprietary algorithms to assess customers' solvency has facilitated the resolution of the issue of a lack of credit history, whilst simultaneously reducing the bank's potential losses from insolvent customers [143]. Another example is the large technology companies Amazon and Google, which have started to offer financial services using their own networks, customer data and available technology, focusing on specific financial services. Traditionally, banks have been responsible for protecting customer data, particularly data needed to assess creditworthiness and solvency. In contrast, large technology companies are increasingly able to make such assessments using their customers' data. The traditional role of banks in ensuring confidentiality and privacy is therefore being challenged in this technological environment.

Increased competition in the financial sector due to digitalisation has led to the need for the development and launch of central banks' digital currencies (CBDCs). The introduction of digital currencies marks a significant advance in the digital transformation of the banking sector and has significant implications for monetary policy, financial stability, and the structure and functioning of the financial system. The key areas of impact of the introduction of CBDCs in the context of the digital transformation of banking services are highlighted in Figure 3.1.

Consider the areas of influence of the CBDCs in more detail:

Digital payments. Central bank digital currencies (CBDCs) have the potential to streamline financial transactions, reduce costs, and facilitate faster transactions by enabling convenient and seamless banking. Notably, this could enhance the accessibility of banking services, particularly in underdeveloped countries where access to traditional banking is constrained.

International payments. The advent of CBDCs has the potential to expedite cross-border transactions, which are currently constrained by the disparate nature of banking systems and time differences.

Financial stability. Central bank digital currencies augment the instruments available to central banks for influencing the money supply, thereby enhancing the efficacy of monetary policy and ensuring greater financial stability.

Security. Central bank digital currencies offer a high level of transparency and security, as they are often based on blockchain technology. The security and traceability of transactions can assist in the prevention of money laundering and other illicit activities. Furthermore, CBDCs have the potential to mitigate the incidence of fraud in banking transactions.

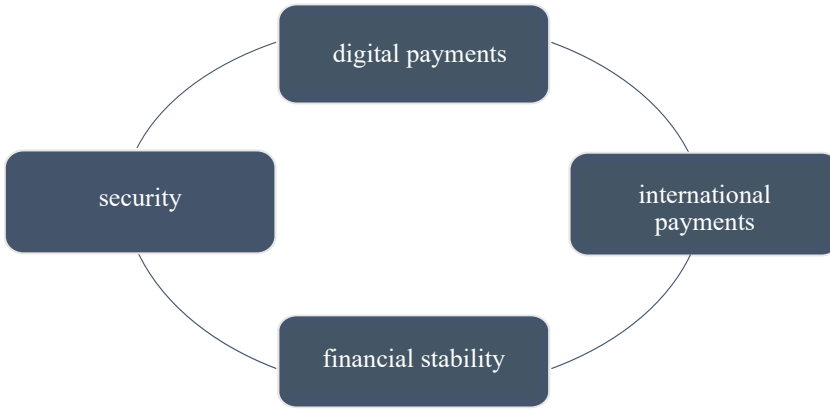

Figure 3.1. Key areas of impact of the introduction of the CBDCs

Source: author's own analysis

At the same time, the upcoming digital transformation involving CBDCs carries a number of risks for the financial system, namely:

1) The *risk of eliminating banks as intermediaries*. If users have access to CBDCs, this could reduce the need for banks and other financial intermediaries, which could affect banking business models and potentially lead to financial system instability.

2) *Privacy and cybersecurity risk*. The advent of central bank digital currencies may introduce new vulnerabilities to the banking system, increasing the risk of cyberattacks. Furthermore, the notion of enhanced transparency of transactions gives rise to concerns pertaining to the confidentiality and protection of client data.

3) The *risk of technical difficulties*. The implementation of CBDCs requires a qualitatively and quantitatively new level of technological infrastructure – both on the part of central banks and users. Accordingly, not all countries or territories have the necessary infrastructure.

While the introduction of CBDCs has the potential to significantly improve efficiency, transparency and inclusiveness in banking operations, it also presents a number of challenges in terms of security, privacy and infrastructure requirements. In particular, the effective implementation of CBDCs requires careful planning and regulatory oversight. The introduction of CBDCs requires an appropriate regulatory framework that balances the benefits of technological innovation with potential threats in this area. Given that many transactions are cross-border, this is particularly challenging. Moreover, the introduction of the CBDCs is part of a broader digital transformation of banking operations based on advanced technologies (blockchain, machine learning, artificial intelligence) to improve banking services and risk management.

According to the Atlantic Council [100], as of 2023, 119 countries are implementing digital currency projects. In particular, 11 countries have already launched central bank digital currencies (CBDCs), 17 countries are implementing pilot projects, 33 countries are developing projects, 39 countries are conducting research on digital currencies, 15 countries are inactive in this area, and 2 countries have cancelled projects. The potential for launching a digital currency is being explored in 114 countries, representing more than 95% of global GDP. For comparison, in May 2020, only 35 countries were considering implementing CBDC projects. At the present time, 60 countries are engaged in advanced research, encompassing the development, testing, and launch phases. Of the 11 countries that have fully launched digital currency, China's pilot project encompasses 260 million people, with the country intending to expand the digital currency in 2023. China's central bank digital currency (CBDC) – the digital yuan – is a fiat currency subject to government control,

with a predictable value and pegged to the same currency basket as the yuan. In contrast, cryptocurrency exchanges in the PRC were banned in 2017 and all other cryptocurrency transactions were banned in 2021, mainly due to regulatory and designation difficulties. Cryptocurrencies, such as bitcoin, operate on blockchain technology, which is largely decentralised, so there are significant risks of avoiding regulatory requirements set by the government. In addition, the value of cryptocurrencies is determined by relatively volatile supply and demand. The digital yuan provides "anonymity for small amounts, legal traceability for large amounts", and the central bank guarantees "reasonable needs of the public to protect personal information". User data will not be disclosed to public officials "unless otherwise provided by laws and regulations". However, Article 28 of the PRC Cybersecurity Law allows the government to obtain data from any Chinese organisation for 'national security' purposes, so in reality, anonymity is conditional and ambiguous [132].

Financial sanctions against a number of countries have prompted countries that have begun to use the dollar less to consider other payment systems. The development of regional cooperation has led to the need to implement test CBDC projects for cross-border payments. Therefore, today there are 9 cross-border CBDC projects in the wholesale sector and 7 cross-border projects in the retail sector, which is almost twice as many as in 2021. In 2023, more than 20 countries will take a number of important steps to launch CBDCs. Australia, Thailand, Brazil, India, and South Korea intend to continue or start pilot testing in 2023. The ECB will also start piloting a European digital currency in 2023, according to the official website of the European Data Protection Supervisory Authority (EDPS): "The European Central Bank, after studying possible scenarios for the development of a digital euro and consulting with stakeholders, has decided to launch the CBDC project with a research phase that will last from October 2021 to October 2023" [223].

As of December 2022, all Group of Seven (G7) countries have progressed to the development phase of CBDCs. The New York Federal Reserve's Project Cedar CBDC experiment has advanced the United States from the research to the development stage. Eighteen G20 countries are now at the advanced stage of CBDC development, with seven countries having launched pilot projects. In the latter part of 2023, almost every

G20 country demonstrated considerable advancement and allocated new resources to these projects [100]. In this context, it is pertinent to inquire as to the rationale behind the introduction of CBDCs. Are they intended to facilitate the digitisation of settlement operations through the utilisation of digital currencies, to supplant traditional banking institutions and their intermediary role in settlements and lending, or to establish a novel digital form of money that will continue to perform traditional functions?

According to a McKinsey study [138], the activities of powerful financial technology companies that offer customers a greater choice of financial services, convenience, speed, and simplicity are one of the challenges to the development of neobanks. The competition they pose to banking systems promotes and helps to modernise the financial sector ecosystem in several European countries, while at the same time posing risks to the functioning and operation of traditional banks.

According to a study by the International Labour Organisation, an increasing number of financial institutions are competing with other types of financial services institutions outside the regulatory environment, which poses a number of security risks. The value of this sector is estimated to have exceeded 50.9 trillion USD in 2018. Digitalisation is driving the dynamic growth of the financial technology sector and competitors in this area, in particular those operating on platforms. In addition to the creation of technology-based financial businesses, digitalisation has helped to ease traditional barriers to entry for other market players. Big tech companies have begun to integrate financial products into their businesses and services. Revenues from financial services account for almost 11.3% of revenues of enterprises in the big tech sector, which both compete and cooperate with traditional banking institutions, functioning as a distribution channel for third-party products, including wealth management and insurance products [124].

An important factor in the development of neobanks and the digitalisation of the banking sector is the dynamic growth of digital platforms as intermediaries between banks and customers. Platforms make it easier for users to obtain financial services and provide a new level of interaction between banks and their customers. For example, some platforms allow customers to compare offers from different banks and then choose the best option for receiving services. Banks, in turn, use platforms to attract more

customers. In this case, customer data is collected by the platform, not the bank, and this situation is leading to a trend towards selling products and services created by banks through platforms or apps. One example is the German financial technology company N26, discussed in Chapter 2, which, despite having 7 million customers in 24 countries, has ceased to provide services in the United States and the United Kingdom. However, the estimated high market value of N26 indicates that its revenue and profitability are expected to grow in the future.

Some studies have concluded that the future dynamic digitalisation of banks and their integration into the digital space will be driven by, among other things, the establishment of partnerships with innovative non-banks throughout the value chain [104]. The financial and technology sector and high-tech enterprises offer additional interfaces to customers based on the banking payment infrastructure, thus reaching market segments or customers that were previously unbanked or did not have bank accounts (e.g., through lending platforms) [152], including through the provision of domestic and international money transfer services, and partnerships with existing credit institutions. In certain instances, the confluence of innovation and competition from new entrants to the financial sector has compelled traditional financial institutions to leverage technology to expand their services and penetrate hitherto untapped market segments. This has entailed the deployment of digital identification and user-friendly interfaces to attract consumers with lower levels of financial literacy.

Consumers are increasingly accepting and approving of the use of technology, which is contributing to the development of neobanks. According to the EY Global FinTech Adoption Index [144], in 2019, the level of financial technology adoption among digital consumers was 73% in the Netherlands, 71% in Ireland and the UK, and 64% in Germany, Sweden, and Switzerland, all of which are equal to or higher than the global average of 64%. In the UK in 2015, only 14% of consumers in the financial services sector had a positive perception of digital services. In 2017, this figure was already 42%, in 2019 – 71%, which indicates a fivefold increase in the level of adoption in four years. Other European countries are also seeing an increase in consumer acceptance of digital services: for example, in Belgium from 13% to 42%, in France from 27% to 35% in 2017-2019. In the context of the COVID-19 pandemic, the level of acceptance of technology

and digital payments has increased due to distance restrictions. According to Pentti Hakkarainen, a member of the ECB Supervisory Board, the COVID-19 pandemic has had a significant impact on the digital transformation of banks, creating a direct need for banks to communicate with their customers through digital channels such as platforms and applications in the context of social distancing. Therefore, since the beginning of the pandemic, the number of digital users has increased by 23% [143].

In 2020, more than 60% of Europeans said they were ready to use digital banking solutions instead of traditional banking services in the near future. For comparison, in 2017, the readiness rate was less than 50% [195]. In 2021, Europeans working in payments, e-money, and lending institutions were generally positive about open banking. According to a survey conducted from February 25 to March 27, 2021, 71.1% of European respondents had a positive attitude towards open banking. In some countries, attitudes were more positive than in others: Belgium, the Netherlands, and the UK had the highest proportion of positive perceptions of unbanking [211]. In 2021, the most important goals of open banking, according to employees of payment institutions, e-money institutions, and credit institutions in Europe, were to improve customer experience, launch new digital services, and increase revenue. According to 35.7% of respondents, the most important goal of neobanking is to improve customer experience [181].

Concurrently, the increase in the number of digital banking customers during the pandemic has resulted in a series of challenges associated with remote banking. In order to meet the competitive challenges presented by the banking sector, traditional banks continue to invest in digital technologies. This enables them to balance the needs of their customers in branches with the provision of advice. At the same time, the 2022 Retail Banking Radar survey, based on a survey of more than 7,500 consumers in 13 countries [139], found that although COVID-19 has led to a change in the digital behaviour of most consumers, some consumers are still partially returning to the benefits of personal banking. However, digital channels of interaction between banks and customers are creating new competitive advantages as banks seek to provide a variety of services to their customers. Consequently, there is an inclination towards an even distribution of

banking service channels, comprising one-third online, one-third offline and one-third a hybrid channel of online and offline formats.

Across all products, around half of Europeans prefer to use digital channels to 55% for checking their bank account or card online, 49% for checking savings and consumer loans and 46% for looking for a mortgage. The products most frequently registered via digital channels are transactions (48%), savings (45%) and consumer loans (43%). A mere 39% of consumers conclude mortgage loans online, largely due to the intricate nature of the requisite paperwork and the necessity for counsel. The mortgage sector experienced the greatest decline in digital sales during the 2021-2022 period, with 21% of EU citizens reporting that they never visit bank branches and conduct all banking transactions remotely. This figure more than doubled during the pandemic, rising from 12% in 2019 to 24% in 2021. Concurrently, over a quarter (26%) of respondents indicated that they visit a branch no more than once a year [139].

It is also important to note positive trends in the payment sector that will affect the digitalisation of banking services. According to the European Central Bank, the following trends in non-cash payments were observed in 2021 [194]:

– The total number of non-cash payments in the Eurozone increased by 12.5% to 114.2 billion, while their total value increased by 18.6% to 197.0 trillion EUR. In the structure of non-cash payments, card payments accounted for 49% of the total, credit transfers – 22%, and direct debit transfers – 20%. In the Eurozone, the number of credit transfers also increased by 8.6% to 25.1 billion in 2021, and the total value by 19.3% to 184.2 trillion EUR. It is worth noting the trend towards an increase in the relative importance of the number of credit transfers initiated electronically. Concurrently, the ratio of electronic transactions to those initiated via paper was approximately sixteen to one in 2021. The number of direct debit transfers in the Eurozone increased by 5.8% to 23.2 billion, while the total value also increased by 11.1% to 7.3 trillion EUR in 2021.

– The number of payment cards in circulation increased by 4.6% to 637.7 million, equating to approximately 1.9 payment cards per resident of the Eurozone.

– In 2021, about 50 billion transactions were processed by retail payment systems in the Eurozone, worth 41.1 trillion EUR.

– In 2021, the number of card transactions grew by 17.3% to 56.3 billion, and the corresponding total value increased by 14.4% to 2.3 trillion EUR.

This figure illustrates the dynamics of the utilisation of fundamental payment services within the Eurozone over the period from 2000 to 2021. In 2021, there were notable discrepancies in the perceived importance of basic payment services across Eurozone countries (Figure 3.2).

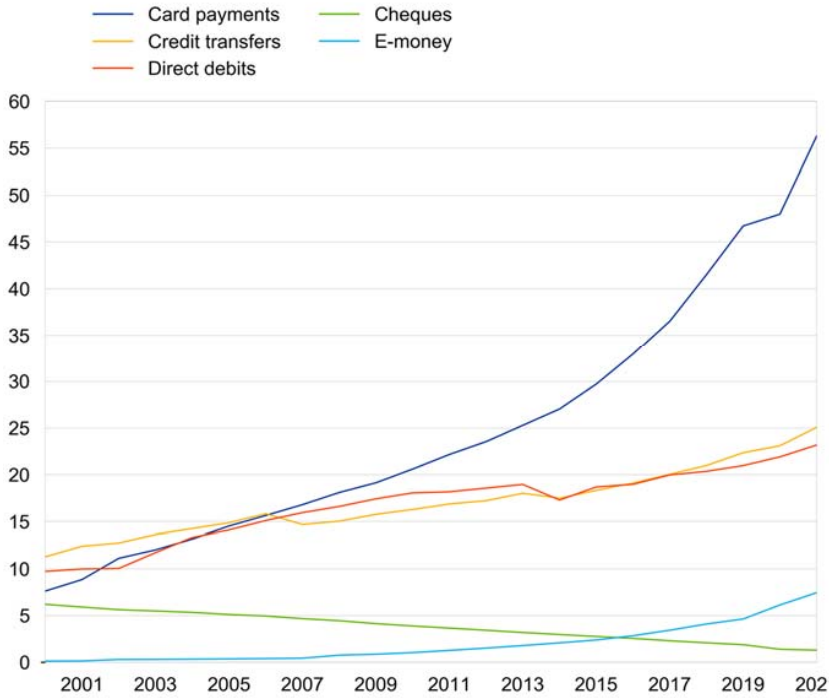

Figure 3.2. Dynamics of the use of basic payment services in the Eurozone in 2000-2021

Source: [194]

For example, Portugal has the highest share of card payments (72%) of total non-cash payments in 2021 at the national level. Finland has the highest share of credit transfers at approximately 38%, and Germany

has the highest percentage of direct debits at approximately 43% of total non-cash payments in 2021. In 2021, the total number of ATMs in the Eurozone decreased by 4.2% to 0.28 million, while the number of POS terminals increased by 9.8% to 13.5 million.

Differences in the structure of the use of payment services in EU countries are due to different institutional, legal, political, market, cultural, and historical conditions of EU countries, which determine the differential efficiency of financial ecosystems. Therefore, there is a gap in the development of the financial sector, institutions, and the legal framework for its regulation within the EU Member States. The key factors affecting the ecosystem and strategic prospects of the banking sector are as follows:

1. *Market structure and maturity* (Annex H), which partly depend on cultural, historical and ethnic factors, which in turn affect both the level of trust in traditional banking and the level of trust in nonbanking. In order to address this issue, the EU is establishing a unified institutional and legal framework through the harmonization of legislation and the establishment of a common financial market. One of the challenges facing the EU is to establish a unified legal framework for regulating the financial and technology sectors in accordance with their respective maturity levels.

2. *Access to capital,* in particular, the uneven growth of financing for financial technology in Europe over the past five years. At the early stages of financing, less than 20% of all capital raised is used for the financial technology sector. At the same time, the lack of financing for late-stage FinTech projects in more than a third of European countries, most of which are located in Eastern Europe, is a problem. Large European money funds, such as pension and life insurance funds, tend to be underutilised due to more restrictive regulations than in the US.

3. *Regulatory and legal framework.* To illustrate, the regulatory environment in France, Switzerland, and the Netherlands is notably conducive to innovation. Nevertheless, it is evident that the extant regulatory frameworks for supporting, founding, growing and valuing FinTech companies are in need of improvement. The European Payment Services Directives on data exchange in the financial sector may facilitate the emergence of novel opportunities for FinTech companies. Updates to the Directives will permit FinTech companies to access customer data from all financial institutions in Europe, thereby facilitating the development

of new business models and increased collaboration. Notable examples include the United Kingdom, which has been at the vanguard of open data initiatives in the financial sector.

4. *Mobility*. A significant deficit in digital sector skills is evident in Europe, compounded by a general dearth of talent attributable to visa requirements and onerous bureaucratic procedures pertaining to work permits in certain countries. The latter represents a significant obstacle to the migration of labour resources to countries that are in need of IT specialists.

5. *Requirements for scaling and internationalisation*. In order to facilitate the growth and diversification of FinTech firms, it is imperative that regulators devise strategies that enable these firms to venture beyond their domestic markets. Even within a single market, such as the European Union, the existence of linguistic, regulatory, cultural and, on occasion, currency-related barriers to entry must be acknowledged.

6. The *level of customer openness* is contingent upon the country's digital maturity, the availability of digital infrastructure, and a number of structural advantages. It can be reasonably deduced that the existence of pertinent openness issues in certain countries may serve to impede the growth of the financial technology sector and the advent of online banking (Annex I). These issues may impede the growth of neobanking, affording traditional banks a competitive advantage due to their established reputation and higher level of public trust compared to the financial technology sector [138].

In general, despite the identified trend towards the development of the regulatory framework, it is worth noting that in countries with medium or low penetration of online banking, the legal framework is correspondingly less developed. Therefore, among the future directions of digital transformation, it is also worth highlighting the slow development of the legal framework for regulating and stimulating innovation in countries with a medium or low degree of neobanking development. The latter leads to an increase in the level of risks associated with fraud and money laundering, the cryptocurrency market, which is still poorly protected by state regulatory mechanisms, especially in developing countries. Therefore, in the second section of the paper, the analysis reveals lower levels of online banking penetration in developed EU countries: Germany – 50%, Poland – 52%, Portugal – 53%, Croatia – 56%, Hungary – 56%, Slovenia – 57%, Slovakia – 58%. The share of online banking usage is low in Bulgaria at 15% and Romania at 15%.

According to McKinsey's 2022 report on the potential of Europe's financial and technology sector, the key challenge remains the regulatory insecurity of neobanks, which causes a number of risks and a lack of trust in the use of their services, especially in developing countries. According to the EU Ranking of Financial and Technology Sector Development and Efficiency by Key Performance Indicators 2021 (Annex C), the most developed countries in terms of financial and technology sector efficiency include the United Kingdom, Sweden, Malta, Luxembourg, Switzerland, Estonia, Ireland, the Netherlands, and Denmark (the first group of countries). It is in these countries with a highly developed financial and technological industry that the highest levels of internet banking penetration are observed. According to the analysis, these countries also have the most developed neobanks and the legal framework for their regulation. In these countries, virtual banks are responsible for the risks associated with cyber threats by constantly improving data protection technologies. In contrast, in less developed EU countries, the lack of sufficient state protection, institutional regulation of the financial sector, and effective, efficient mechanisms for protecting consumers' digital funds limit the use of internet banking. Accordingly, the second group of developed countries in terms of online banking should include: Germany, Cyprus, Lithuania, Finland, Austria, France, Latvia, Spain, Belgium, and Portugal. The third group of countries includes: Italy, Hungary, Slovenia, Czech Republic, Croatia, Poland, Greece, Bulgaria, Romania, Slovakia [138]. Furthermore, the European financial technology market is segmented by service offering (money transfers and payments, savings and investments, digital lending and loan markets, online insurance and insurance markets, other services) and country (UK, Germany, France, and the rest of Europe) [151]. A mere handful of European countries hold sway over the Global Innovation Index in 2022 (for example, Switzerland, Sweden, the United Kingdom and the Netherlands [157]), and according to analytical forecasts, by 2025, further technological infrastructure in these countries will provide 5G coverage for 75% of the region's population, and will ensure the formation of an innovative, technological, corporate environment favourable to the development of neobanking. In 2020, during the COVID-19 pandemic, the European financial technology sector raised 9.01 billion USD. It is the transition to digital technologies and

the growing interest of banks in new infrastructure that has ensured the recovery of the EU banking sector. By June 2021, the European financial technology sector had attracted 11.16 billion USD, compared to 9.98 billion USD in 2019 [151]. Amid the rapid growth in the use of digital solutions by banks in the EU and consumers during the pandemic (online stores, digital platforms, online banking, etc.), government regulation lags far behind the dynamics of financial and technological innovation. The challenge for EU regulators is to ensure the protection of personal data, maintain confidentiality, and reduce the risks of fraud and financial terrorism in the context of growing consumer demand for digital solutions. Some EU countries are implementing regulatory measures to address these risks, in particular by introducing a large number of additional controls to improve the security of the most vulnerable areas. These include measures to strengthen cybersecurity, ensure business continuity and develop privacy and confidentiality-based products. Although technology companies have commenced the development of digital solutions to address these challenges, the regulatory framework in these areas remains significantly behind the curve, creating a multitude of operational obstacles for European FinTech companies seeking to expand their operations within the EU. In order to address this issue, the EFA proposes the introduction of a comprehensive risk-based approach, with the objective of developing an innovative and competitive legal environment for the European financial technology sector. This approach, in particular, involves cooperation between partner financial institutions and third parties to assess risks related to cybersecurity, data protection, and privacy. This will help to create equal conditions and rules for the operation of financial and technology companies, regardless of their size, and increase competition. This approach also envisages focusing regulation and the regulatory framework on activities rather than goals, which will ensure a more favourable market position for small financial sector companies. The principle of "same activity, same risk, same rules" can ensure targeted regulation, thereby enabling careful risk control while promoting competitiveness. Consequently, the potential exists for the creation of an innovative digital single market for financial services within the EU. The European Commission's Digital Finance Strategy outlines a series of measures designed to operationalise this approach to regulation [115]. In order to develop the regulatory environment for digital

banking, ING Group CEO Ralf Hamers proposes to update the framework for digital financial services [166], in particular for the following:

– Addressing the problem of fragmentation of supervision at the EU level to support the European financial and technological ecosystem, addressing financial stability and integrity issues arising from the unbundling of banking services.

– Institutional promotion of innovation through an individual supervisory regime for internal innovation projects of digital banks, financial and technology companies that do not pose financial risks to the parent company of the banking group.

Addressing the problem of fragmentation of supervision at the EU level requires the development of legislation to regulate the financial technology sector, which often does not fall under the supervisory requirements of traditional banks. New market entrants have transformed banking activities, with FinTech companies focusing on only small parts of the financial services value chain and outsourcing other services. Traditional banking services remain unchanged, while payments and finance businesses are optimised to provide targeted, highly specialised financial services in a more convenient and cost-effective way. To illustrate, payment start-ups are typically initiated under a sandbox regulatory framework overseen by a national regulator, subsequently expanding through various licensing frameworks in accordance with the EU regulatory framework. The licensing ladder commences with a payment service provider evolving into an e-money institution, subsequently progressing to a partially licensed bank (e.g., an institution offering deposits to consumers but not lending) and ultimately culminating in a fully licensed digital bank. This proportionate activity-based licensing framework, which gradually increases the regulatory requirements for expanding a firm's services, creates a favourable environment for new entrants while ensuring a level playing field for banks.

Thus, the analysis allowed to identify the following areas of digital transformation of the banking sector: 1) transition from simple to complex banking services, from one-time to renewable services, from standardised to individualised services; 2) dynamic development of open banking, in particular, due to government regulatory incentives; 3) transition to new stages of digital transformation in the banking sector by creating digital business models of virtual banks; 4) crypto transformation, development of

private cryptocurrencies of banking institutions, digital currencies of central banks; 5) transformation of the regulatory environment; 6) development of the financial and technological ecosystem, transformation of the financial technology industry into an independent sector of the economy. At the same time, among the key challenges and obstacles to the digital transformation of the banking sector, the author identifies the fragmentation of the financial services landscape, which became more noticeable during the COVID-19 pandemic. Fragmentation and, at the same time, narrow specialisation of financial technology companies in certain financial services ensures the provision of high-quality services to consumers and will facilitate the expansion of cooperation with other market players, including banks, large technology companies or other financial technology companies in the future. Fragmentation will also contribute to increased competition in the banking sector, a higher level of consumer sophistication, and more choice in financial services. In turn, increased competition will accelerate innovation and the emergence of new technological solutions to address new market challenges and problems. In particular, the monograph reveals a tendency towards an even distribution of banking service channels, which also affects the digitalisation of the banking sector, as banks are increasingly focused on consumer needs. The author identifies positive trends in the payment sector that will affect the digitalisation of banking services: an increase in the total number of non-cash payments in the Eurozone, an increase in the number of payment cards issued and non-cash transactions.

At the same time, the author identifies the fragmentation of the financial services landscape as one of the main challenges and barriers to the digital transformation of the banking sector, which became more apparent during the COVID-19 pandemic. The fragmentation and, at the same time, the narrow specialisation of financial technology companies in certain financial services ensures the provision of high-quality services to consumers and will facilitate the expansion of cooperation with other market players, including banks, large technology companies or other financial technology companies in the future. Furthermore, the phenomenon of fragmentation will contribute to increased competition within the banking sector, a higher level of consumer demand, and a greater range of financial services available to consumers. Consequently, heightened competition will

stimulate innovation and the advent of novel technological solutions to address emerging market challenges and issues. In particular, the study reveals a tendency towards an even distribution of banking service channels, which also affects the digitalisation of the banking sector, as banks are increasingly focused on consumer needs. The author identifies positive trends in the payment sector that will affect the digitalisation of banking services, including an increase in the total number of non-cash payments in the Eurozone, an increase in the number of payment cards issued and non-cash transactions.

At the same time, the author identifies the following constraints to the digitalisation of the banking sector in the EU: different market structure and maturity; different potential for access to capital, including the uneven growth of financial technology financing in Europe over the past five years; fragmentation and differences in the regulatory framework within the EU; the problem of labour mobility and the skills gap in the digital sector; requirements for scaling and internationalisation; and openness to customers, which is determined by the level of digital maturity. The principal challenge that neobanks face is the lack of regulatory clarity, which gives rise to a number of risks and a dearth of trust in the use of their services, particularly in developing countries.

The analysis permits the conclusion that over the past few years, one of the most significant and dynamic areas of digital transformation has been that of crypto-transformation. At this juncture, a distinctive feature of this phenomenon is the direct involvement of central banks in not only the formulation of regulations pertaining to private cryptocurrencies but also in the active development and implementation of central bank digital currencies. The characteristic general features of CBDCs are as follows: CBDCs are based on the use of blockchain (Distributed Ledger) technology with modifications in accordance with the set goal; the issuer of CBDCs is the relevant state represented by the central bank; the administrator of CBDCs is the central bank or its authorised body; after its issue into circulation, it is legal tender and an equivalent form of national currency; the stability of CBDCs and trust in it is ensured by the central bank through monetary policy in a similar way to the stability of the national currency; unlike private cryptocurrencies, the structure of CBDCs is more transparent and does not provide for complete anonymity

of ownership and transfers, which allows the state to exercise the necessary control functions.

In this context, it is also worth noting the unstable nature of private cryptocurrencies. In particular, the existing cryptocurrencies are characterised by significant fluctuations in quotations, which may make them an undesirable instrument. On the other hand, CBDCs that are linked to the national currency of a country will ensure higher stability of banking operations. Accordingly, this aspect will make CBDCs a more attractive alternative for banking operations, international investments, and settlements.

In the context of CBDCs development, it should be noted that significant changes in the landscape of digital transformation of banking operations may limit the development of private cryptocurrencies and neobanks. First and foremost, regulation and control are important drivers of influence in the context of cryptocurrency displacement by CBDCs. After all, central banks that operate CBDCs generally have greater public trust than private financial institutions involved in private cryptocurrency transactions. Accordingly, compared to cryptocurrencies, which are characterised by a high level of risk, CBDCs may be considered more reliable and stable. Consequently, the demand for private cryptocurrencies may fall significantly, as users will trust CBDCs as a means of payment more than cryptocurrencies, which may lead to their gradual displacement due to economic and regulatory factors.

In this regard, the widespread adoption of CBDCs is a key factor that will stimulate their effective use in banking operations. Accordingly, it is crucial to strengthen the compatibility of CBDCs with banks' core business models, as well as their integration into the banking sector's infrastructure. As a result, CBDCs can be used as the basis for key products and services of banking institutions, as well as interact with the existing banking infrastructure and payment systems. The main aspect in this issue is the recognition of CBDCs as legal tender, which is a key difference compared to private cryptocurrencies.

In the context of this issue, the importance of the privacy factor should be emphasised. It is worth noting that despite a certain demand from the target audience for such a characteristic of cryptocurrencies as anonymity, this situation potentially creates a significant risk. Accordingly,

CBDCs are inherently able to provide less privacy, but much more security and transparency for users, which may prove more attractive in the context of banking operations in the modern environment. At the same time, it should be noted that the effectiveness of the implementation of the CBDCs and its final outcome are not predictable and depend on a number of variables, such as technological developments, legislative changes, market dynamics and public perception of the CBDCs.

3.2. Scenario Analysis of the Development of Neobanks in the Context of Global Digitalisation

Digitalisation is changing the approaches and ways of providing financial services, promoting the development of the non-banking financial sector alongside the traditional banking sector, while at the same time increasing a range of financial risks (credit, liquidity, etc.). As demonstrated in Section 3.1 of this study, the level of digitalisation and development of neobanking is influenced by a number of factors, including historical, cultural, political, social, economic, and technological, which are closely related and differ depending on the characteristics of each country, including within the EU. Prior to examining the potential scenarios for the evolution of a virtual bank, it is prudent to ascertain the prevailing conditions and the status of the banking system within the European Union, as these factors will undoubtedly influence the future trajectory of neobanking.

The analysis of the state of the unbanked reveals that new financial innovations have had a significant impact on the development of the banking sector. In particular, the emergence of new service providers that collaborate with banks has led to an increase in competition within the market. The financial technology sector is experiencing rapid growth, with companies specialising in specific services and collectively offering a wide range of options. Companies operating through platforms ensure their own competitiveness by taking advantage of data analytics, artificial intelligence, external network effects, following a market coverage strategy and moving from non-financial to financial services. As a result, existing traditional banks are facing competition in various business areas, and their refusal to intermediary may lead to a loss of business scale. It can be argued that financial technology companies do not impinge upon the operational and managerial activities of banking institutions. Concurrently, banking

institutions proactively engage IT specialists and financial innovations to guarantee competitive advantages and sustain market positions. Both large technology companies and banking institutions have the option of either forming a partnership or a joint venture, or alternatively, of establishing their own subsidiaries within the financial services sector, with the aim of increasing their scale.

Potential scenarios for the development of unbanking are influenced by the fact that digitalisation has created significant non-financial risks for both banks and financial technology and large technology companies, arising from: 1) a greater focus on emerging technologies for core services, such as cloud computing; 2) the increased use of artificial intelligence (AI) in finance; 3) overly automated or IT-oriented services that may be more vulnerable to cyberattacks; 4) reliance on advanced technology that may suddenly become obsolete; and 5) a false sense of security from the overuse of information and AI.

In view of the above, the European banking system is facing fundamental structural changes and challenges that will shape its future and ability to serve the financial needs of the real economy. Among the challenges is the "excessiveness" of the banking sector in the EU due to low interest rates, which can be seen, in particular, in the high share of value added by financial corporations in the EU in 2011-2021 (Annex J). Consequently, the share of income derived from labour and capital of financial corporations in the EU was 60.9% in 2021. In general, the EU financial system is based on and oriented towards banking. As a result, the development of the regulatory framework for the financial and technology sector, and the challenges associated with its activities, remains a significant challenge. This is the reason why the process of digitalisation and the development of a banking system based on digital infrastructure are experiencing a slowdown in the EU.

The development of neobanking in the context of digitisation has been influenced by a number of factors and the state of the EU banking system before the COVID-19 pandemic. From early 2008 until the outbreak of the COVID-19 pandemic, the long-term stability of the system was affected by a number of interrelated factors related to structural, economic and political characteristics: the important role of banks in financing the real economy in Europe, the challenges posed by the aftermath of the global

financial crisis and the European sovereign debt crisis (2009-2012), bank profitability and cost inefficiencies.

Banks in the EU play a pivotal role in the provision of financial services to the real sector of the EU economy, maintaining a dominant position within the financial system. Some academic studies have demonstrated a correlation between the EU banking sector and the size of the economy, thereby underscoring its scale in terms of income, household wealth, bond and equity markets. In the EU, for instance, the equity capital market represents the primary source of funding for non-financial corporations, which rely extensively on debt to finance their operations. Since 2015, the size of the EU banking sector has exhibited a decline. Among the problems is the relatively high ratio of non-performing loans to total loans in the EU (5-10%). In 2016, the volume of non-performing loans reached a peak of over 1 trillion EUR. At the end of 2020, the total volume of non-performing loans was 468 billion EUR, and the total share of non-performing loans decreased from 7.48% in June 2015 to 1.79% in September 2022 (Figure 3.3) [141]. At the same time, some banking institutions had high levels of non-performing loans and a slow decline in them.

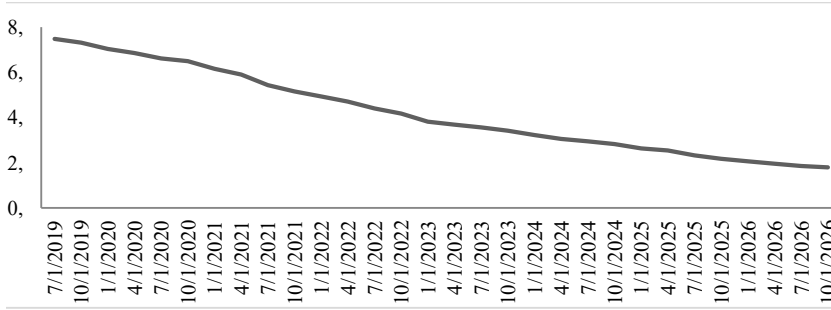

Figure 3.3. Dynamics of the share of non-performing loans in the EU for the period 30.06.2015-30.09.2022

Source: [141]

In recent years, the EU has also experienced low profitability in the banking sector for a number of reasons (Figure 3.4). After 2008, the EU

introduced a mandatory leverage ratio, which indirectly limited the return on equity. As a result, the stock market prices of the EU banking sector followed a downward trend, signalling relatively low market confidence in the medium-term profitability of the sector. The persistence of low profitability in EU banks over such a long period may indicate the existence of structural factors related to the low level of interest rates and the complex cost structure of EU banks.

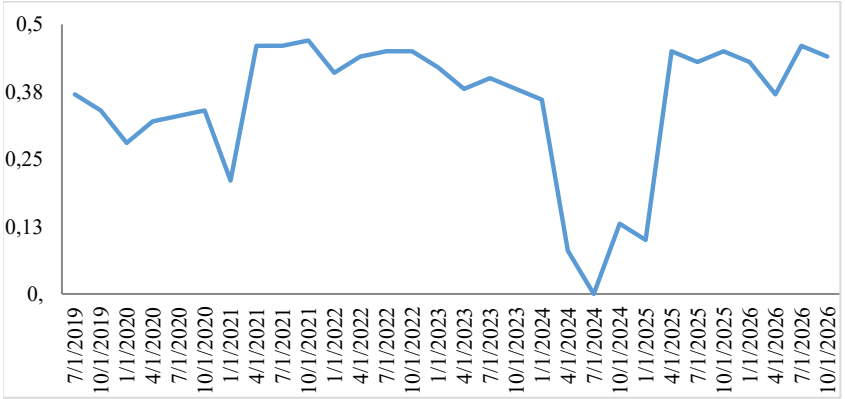

Figure 3.4. Dynamics of return on assets of the EU banking sector for the period 30.06.2015-30.09.2022 %

Source: [142]

Among the problems faced by EU banks are outdated IT systems and infrastructure issues. According to several studies, most European banks in the EU are still using some technologies from the 1960s. This puts banking institutions at a disadvantage in the marketplace compared to new competitors such as financial technology companies [214]. An assessment of the state of play of banks' IT systems, carried out by the ECB's banking supervisors, points to a few risks associated with the operation of the infrastructure [130]. Outdated IT systems are one of the significant challenges to ensuring the growth of profitability in the EU banking sector, risk management and the introduction of innovative technologies. Bank profitability is growing in the context of digitalisation of back offices,

document management processes, automation of lending decisions, and the use of big data analytics. In its 2020 report, the European Banking Authority indicates that only a small percentage of European institutions use solutions such as big data analytics to achieve business goals.

The war in Ukraine and the growing instability of the geopolitical situation in the world have significantly increased cybersecurity risks. According to publicly available data, the frequency of cyber incidents affecting all areas of activity increased significantly in the first Q1 of 2022 compared to the same quarter of 2021. The increasing prevalence of cyber threats and the potential for cyberattacks may have a detrimental impact on major financial institutions, their operations, and the banking system as a whole. Considering the ongoing digitalisation of the financial sector, cyberattacks have the potential to result in a range of consequences, including business disruption, reputational risks, liquidity risks, and the compromise of consumer data [170].

Amid the war in Ukraine, the market for cryptoassets and related products, which were actively sold in May and June 2022, is declining, investment risks are increasing, and instability in the stablecoin market is growing. These challenges require an immediate response to maintain financial stability. The geopolitical situation proves the importance of developing legislation to ensure the digital operational resilience of the EU banking system. Accordingly, the EU has proposed a relevant regulatory document – the Digital Operational Resilience Act (DORA), which aims to create a comprehensive digital operational resilience framework for EU financial institutions, consolidate and update the ICT risk requirements that apply to financial services legislation (e.g., PSD2, MiFID, NIS). In the financial sector, the risks associated with digitalisation and cyber threats are deemed to be significant and are exhibiting an upward trajectory. In the banking sector, cyber risks are perceived to be exceedingly high by banks and supervisory authorities. While cyber incidents and disruptions outside of Ukraine and Russia have been relatively limited since the onset of the war, the potential for such incidents in the future remains considerable.

The report of the European Systemic Risk Board's Scientific Advisory Committee analyses the factors affecting the European banking system (climate change, the growing role of non-banks, and the use of banking

services in the context of COVID-19). The conclusions offer three hypothetical scenarios of the impact of digitalisation on the banking sector [108], which should be analysed in detail as basic prospective options for the development of neobanking. Based on the first scenario of the European financial system in 2030, banks will occupy a dominant position in the market, retaining a central role in money creation and financial intermediation. FinTech companies will focus on specific market niches, cooperating with banks (in some cases, banks may buy out FinTech companies), thus securing a larger share in the financial ecosystem. If circumstances require it, banking institutions will implement robust strategies to address threats emanating from beyond the confines of the extant banking system. Such strategies may encompass technological adaptation, the acquisition of financial technology companies, and the advocacy of constraints on banks' access to central bank clearing and payment systems. A notable proportion of non-bank financial intermediation (referred to as the "shadow banking system") will persist in maintaining connections with banks while developing its own structure. Large technology companies will offer payment services to customers but will not have access to central bank settlements and payment systems available only to commercial banks. Some large technology companies will offer intermediation services through financial subsidiaries, and it is possible that some FinTech companies will obtain banking licences. Competition between banks may intensify as banking institutions cooperate with large technology companies that offer their platforms for customers to choose financial service providers. There is also potential for expanding partnerships between traditional banks and large technology companies to provide credit services, with the former providing their own balance sheet and the latter providing their data for customer verification and monitoring.

Personal data will become an important basis for the provision of credit, insurance and other financial services, and the focus of consumer protection will change. Ownership of and access to personal data will be important for financial service providers and customers. Current data rules will need to be changed as they do not benefit banks, which are forced to provide personal information and do not have access to data held by large technology companies. In conclusion, the first scenario entails the modernisation of the banking system, encompassing the integration of novel providers and

products. Financial and technological solutions will become integrated into the banking system. Financial risks will persist in being concentrated within the banking system, as well as in non-bank financial institutions that are linked to the banking system. However, an increasing number of non-financial risks will be concentrated in a small number of IT service providers, which may give rise to new sources of risk. Regulatory measures should focus on the relationship and cooperation between banks, on the one hand, and financial and large technology companies, on the other. Regulators will need to adapt macroprudential monitoring and policy tools to different structures and platforms and focus more on non-financial IT service providers as systemically important.

In the second scenario, the EU will see a decline in banking activities, with large technology companies becoming leaders in the lending market, leading to structural changes in the financial system. The author believes that given the potential cooperation between the financial and technology sectors, technology companies and banking institutions, traditional banking will be replaced by hybrid banking, combining different channels and methods of providing financial services, due to the impossibility of instantaneous changes in consumer behaviour.

It can be reasonably deduced that the role of financial technology and large technology companies in payment services will increase. It is likely that large tech companies will offer financial services through regulated subsidiaries and capture the market for data- and transaction-based lending. Conversely, traditional banks will increasingly focus on relationship-based services at both the high end (investment banks) and the low end (commercial banks) of the market. This implies a reduction in the size of the banking system, especially of medium and small banks, which will no longer be able to benefit from economies of scale due to the unbundling of financial services and/or economies of scale due to their limited size. The transition to a smaller traditional banking system will increase the risks of instability due to the necessary deleveraging and exit of existing banks. Changes in the mechanisms and methods of providing financial services will create new sources of financial risks and challenges for macroprudential regulation. Firstly, there will be an increase in the number of investment opportunities for retail depositors, both within and beyond the financial system network. Investing in financial institutions

operating outside the regulatory environment may result in an elevated risk of instability (as evidenced by the 2022 experience with cryptoassets), potentially leading to failures in financial market regulation and necessitating the expansion of security measures on a provisional basis. Secondly, the growing role of large firms and platforms may lead to concentration and large risks of failure, as well as transition risks, as one dominant platform firm is replaced by another. Thirdly, the general move towards harder and less soft information may make credit cycles even more pronounced and create additional macroprudential policy challenges. Consequently, in the second scenario, there will be structural changes in the financial system, a reduction in the activities of traditional banks, and financial technology and large technology companies will assume a pivotal role in the financial system. Financial risk will be distributed among a diverse set of actors, and the issue of data protection devices and computer networks between financial and non-financial large technology and similar companies will become a matter of increasing importance. Non-financial risks associated with IT will play a more important role, and the concentrated provision of such services may create additional interconnections between banks and non-bank providers. Supervisory practices, data collection, and micro- and macroprudential instruments will need to be reviewed and modified in the face of a changing financial structure. In this scenario, regulation of the FinTech and big tech sectors will be a key issue, as will access to lender of last resort and deposit insurance coverage for new players.

According to the third scenario, the issuance of retail digital currencies by central banks will, under certain conditions, lead to a shift in financial intermediation from banks to central banks [99]. However, according to the author of this study, the latter scenario is unlikely to materialise in the next 10-15 years due to three key factors: 1) the slow development and improvement of the regulatory framework for the regulation of digital currencies; 2) the slow pace of research, development and launch of digital currency projects, with the exception of China; and 3) the tendency towards inertia in consumer financial behaviour, which is manifested in the use of digital channels for various transactions in about 50% of cases.

The third scenario involves changing the structure of the financial system by issuing retail digital currencies by central banks in different ways: as anonymous bearer instruments or registered to a specific owner.

Central banks may impose quantitative restrictions on an individual's assets, and residents of the issuing jurisdiction may be subject to restrictions on the supply and ownership of assets. Central bank digital currencies may have a zero-interest rate, like cash, or they may have an interest rate. However, to ensure digital transformation, digital currencies cannot be anonymous, their supply must be elastic, and they should not be available only to residents of the jurisdiction that issued them, as such a restriction implies capital controls. It is important to note that this scenario implies the loss of the intermediation function of banks, but it is also possible that the intermediation function of banks in the financial system is preserved. The ultimate transformative impact of central bank digital currencies on the financial system depends to a large extent on the intermediation model chosen and the potential restrictions. In a hypothetical scenario in which a significant influx of retail depositors enters the financial system with a central bank digital currency, commercial banks will find themselves in a radically different environment, particularly with regard to the provision of interest to customers for investments in digital currencies. Banks will experience an increase in financing costs and a concomitant increase in funding volatility as the traditionally stable flow of retail deposit customers may shift to digital currencies (issued directly by the central bank or by authorised banks). At the same time, banks will maintain a certain amount of deposits and loans to customers. As the money creation function moves from commercial banks to the central bank (or newly authorised intermediaries), there would be a process of disintermediation from existing commercial banks, and the central bank would play an increasingly important role as an intermediary that will distribute funds raised using digital currency. At the same time, a variety of alternative financial service providers, including FinTechs and large technology companies, would offer tailored and specialised lending, asset management, and risk management services. In the event of such a hypothetical scenario, the volume of banking activities would be expected to decline, while the associated risk would be likely to increase. In such circumstances, financial market regulation should include the supervision of intermediation by central banks and other financial service providers that are exposed to a higher level of risk. Concurrently, the central bank can facilitate market stability through its dominant role and the issuance of digital money, and its lending role can expand considerably, supplanting

the extant, more decentralised, market-based process of credit allocation. The traditional banking system will no longer serve as a stable anchor in a financial system dominated by the central bank and new players, except during periods of systemic crisis. The issuance and circulation of digital currencies may precipitate an increase in bank runs during systemic banking crises, given the availability of safer alternatives to bank deposits. In the absence of a sufficient level of reliability of the currencies of certain countries, such countries may experience a significant cross-border outflow of funds. In such circumstances, traditional banks will mobilise all available resources and unite to expand cooperation and the utilisation of resources.

In consequence, the first scenario is most likely to be dominated by traditional banks, which will reinforce their technological component, while financial technology companies will provide specialised financial services. Central banks will increase cooperation with each other, share experiences and digital solutions in the development of digital market infrastructure to ensure more effective regulation of an increasingly digital financial environment, which is subject to growing risks of cyberattacks and threats, especially in times of war. The launch of digital currencies by central banks can address several issues related to the speed, simplicity, and transparency of retail and wholesale payments, especially in the context of increasing cross-border cooperation and globalisation. Nevertheless, the fragmentation of the digital financial environment and the regulatory framework for its regulation, which remains insufficiently effective in the face of growing risks of instability, may result in a relatively slow launch of digital currencies and subject it to certain technological, legal, and market obstacles. It seems probable that central banks will assume greater control over the digital financial environment, which already encompasses the monitoring of IT systems, payment systems, and the development of digital infrastructure. Central banks can use the latest technology to optimise the IT systems of systemically important banks, for example, as they have done with the distributed ledger technology DLT used to launch digital currencies. The latest technology is also needed to protect against new types of cyber threats.

In the context of Ukraine, the author, on the basis of the conducted research, identifies prospective trends in the evolution of virtual banking as a consequence of digitalisation. These trends are presented in the

context of the development of a digital financial market integrated into the EU; development of market and digital payment infrastructure with enhanced supervision of payment infrastructure; supervision of payment infrastructure and its reliability in connection with potential cyber threats; cooperation between central banks and ministries to address cross-border problems in the circulation and exchange of funds; expansion of the network of technological branches of banks to increase the level of customer self-service, closure of non-profit branches; expansion of partner networks of commercial banks to reduce operating costs. Consider the highlighted trends in more detail.

Trend 1. The development of an EU-integrated digital financial market, regulated by the central bank in cooperation with other central banks and other EU institutions, to control and monitor the activities of participants, especially new financial intermediaries operating on platforms and mobile applications, to ensure their compliance with regulatory requirements. Given the growing risks of fraud in the virtual space, the central bank is compelled to monitor the players in the financial ecosystem. Examples include the application of enforcement actions to financial service providers for non-compliance with business requirements [19], revocation of licences of financial companies, and so forth [56]. In accordance with the EU-Ukraine Association Agreement, the NBU persists in its endeavours to reform Ukraine's financial sector. The overall implementation rate for the financial services sector is projected to reach 67% by the end of 2022. The key areas of standardisation in accordance with EU requirements were as follows: implementation of legal acts (in the areas of payment services, regulation and supervision, consumer protection, insurance); sustainable financing, freedom of capital movement; expansion of international cooperation and establishment of cooperation with EU institutions (EC, ECB, European Banking Authority and European Insurance and Pensions Authority); consideration of the conditions for integration into the Single Euro Payments Area (SEPA) [38].

Trend 2. The development of market and digital payment infrastructure, and the strengthening of supervisory measures over payment infrastructure, are key objectives. In consequence, the NBU is implementing a series of initiatives in the domain of payment and market infrastructure. Such initiatives include the development of the NBU's BankID system,

which provides Ukrainian citizens with stable and uninterrupted access to important public and financial services. During the war, uninterrupted access was of particular importance, as it enabled citizens to continue receiving public and financial services remotely. Those who were migrants or internally displaced were able to access the electronic documents and services of the state mobile application Diia without encountering any obstacles. Furthermore, citizens were able to open bank accounts remotely by utilising the BankID system to verify their identity. The NBU has been engaged in the active development of the BankID System over the past seven years, with a gradual modernisation of the system and an expansion of the range of participants. As of 2023, over 99% of individual customers of Ukrainian banks have access to the system, which enables them to utilise remote services from nearly one hundred service provider portals. The NBU BankID system currently comprises a total of 130 participants. A total of 39 identifier banks and 91 service provider subscribers are currently participating in the system. On a daily basis, approximately 100,000 electronic identifications are successfully processed within the system (32.8 million in 2022, representing a 9% increase from 2021). Furthermore, in the context of European integration and changes in legislation pertaining to trust services and electronic identification, the NBU is investigating the possibility of the BankID System being recognised as an electronic identification scheme. In particular, this will facilitate Ukrainian citizens' access to remote services within the European Union via the system [51].

Trend 3. Overseeing the payment infrastructure and its reliability in light of potential cyber threats. Based on the results of its monitoring of payment systems in 2022, the NBU identified a list of important payment infrastructure facilities in Ukraine. The only systemically important payment system in Ukraine is the electronic payment system (EPS) of the National Bank of Ukraine. Five payment systems are classified as important payment systems: "MasterCard", MasterCard International Incorporated, USA; "Visa", Visa International Service Association, USA; "NovaPay", NovaPay LLC, Ukraine; "Financial World", Ukrainian Payment System LLC, Ukraine; and "Postal Transfer", Ukrposhta JSC, Ukraine. Based on the results of its activities in 2022, the NBU identified important payment system participants for the first time: JSC CB PrivatBank

(NBU EPS, MasterCard, Visa); LLC FC Kontractovyi Dom (Financial World); Universal Payment Solutions LLC (Financial World). Based on the results of the 2022 monitoring, three important payment infrastructure service providers were identified: Ukrainian Processing Centre PJSC, LLC AC DC Processing, and LLC Tas Link. The NBU categorises payment infrastructure facilities according to their criticality, in line with international practice, in order to improve their reliability and efficiency and to bring their operations in line with international oversight standards. Thus, the NBU imposes stricter requirements on payment infrastructure facilities classified as critical in terms of management and organisation of operations, access to and participation in the payment system, risk management, settlement finality, cyber resilience and business continuity management. Previously, the NBU divided payment systems into systemically important, socially important, and important payment systems. Since 2022, the updated oversight procedure provides for the classification of payment systems as systemically important and important payment systems (the Law of Ukraine "On Payment Services" and Resolution of the Board of the National Bank of Ukraine No. 187 dated 24.08.2022) [10].

Trend 4. The collaboration between central banks and ministries represents a promising avenue for addressing cross-border challenges in the circulation and exchange of funds. In this context, the emergence of digital currencies issued by central banks is a noteworthy development. These digital currencies have the potential to streamline the exchange and circulation of currencies, payments, and transactions between residents of different countries, thereby facilitating cross-border cooperation, including in the financial sector. It is worth mentioning the projects of cooperation between central banks: the NBU and the Ministry of Digital Transformation of Ukraine on the digitalisation of the Ukrainian banking system [53], and cooperation between the central banks of Poland and Ukraine on cash management in the field of payment and market infrastructure. The latter project was aimed at developing a mechanism for the emergency exchange of cash hryvnia for local currency for Ukrainian citizens who were forced to migrate to Poland together with 9 EU countries (Sweden, Switzerland, Germany, Lithuania, the Netherlands, Belgium, Latvia, Italy, and Malta). Citizens were able to convert up to 10,000 UAH per person at a time. The details of the agreements were worked out separately with each

partner central bank, based on the exchange model developed by the ECB on the basis of earlier agreements between the central banks of Ukraine and Poland [92].

Trend 5. Expanding the network of technological bank branches to increase the level of customer self-service, closing non-profit branches where business processes are labour-intensive and time-consuming [4]. Commercial banks will continue to compete for customers and simplify the provision of banking services through further digitalisation of branch operations and partnerships in the face of a reduction in the number of banks in Ukraine and the number of their branches (see Annex D, Key performance indicators of Ukrainian banks in 2016-2023). This trend was fuelled by the pandemic, which drove digitalisation and the development of remote banking. The number of banks in Ukraine decreased by 49 between 2016 and 2023, including 11 banks with foreign capital. During this period, banks' assets increased by 1,074 billion UAH, or 83%, driven by a 26% increase in foreign currency assets, a 184% increase in cash, a 176% increase in term deposits, and a 17% increase in retail loans. It is worth noting that the volume of cash grew particularly strongly in 2021-2023 – by 73% cumulatively. Banks' liabilities grew by 101%, while banks' commitments increased by 81%, corporate deposits by 179% (including in foreign and national currency), and retail deposits by 129%. The return on assets of banks in the period 2016-2023 increased from -0.81% to 7%, and the return on equity from -9.7% to 78.25% [59]. The number of bank branches also decreased between 2016 and 2023: in JSC Ukreximbank by 54 units, in JSC Oschadbank by 2982 units, in JSC BANK ALLIANCE by 33 units, in JSC Raiffeisen Bank Aval by 245 units, in JSC CB PrivatBank by 1378 units, and in JSC KredoBank by 33 units [37].

Trend 6. Expansion of partner networks of commercial banks to reduce operating costs. For example, JSC Bank Credit Dnipro started cooperation with JSC CB PrivatBank and expanded its partner network of self-service terminals to simplify banking operations and make terminals accessible to customers [3], and expanded its network of partner ATMs by starting cooperation with JSC Oschadbank [2]. The latter project expanded the total number of ATMs in the partner network of JSC Bank Credit Dnipro to about 4,600 ATMs, and the Bank's clients were able to make

cash withdrawals in Ukraine through two partner ATM networks. Another illustrative example is the creation of Power Banking, a joint network of bank branches throughout Ukraine during the war, which was joined by commercial banks of Ukraine to facilitate the continuity of services to customers [85].

In order to ascertain the relationship between the indicators of neobank development and the principal variables that impact their activities, it is advisable to conduct a correlation and regression analysis, which will yield an econometric model that reflects the quantitative and qualitative relationships through the application of mathematical and statistical methods. The construction of econometric models necessitates an assessment of the reliability of the resulting modelling data. This assessment should encompass the stability, bias and efficiency of the estimates. In order to achieve this, the statistical methods presented in Table 3.1 are employed.

To assess the impact of a set of factors on the dependent variable, a multiple regression dependence model is built:

$$Y_i = \beta_1 + \beta_2 * X_1 + \beta_3 * X_2 + ... + \beta_n * X_n + u_i \quad (3.1)$$

The estimated values of the regressor (dependent variable) can be presented as follows:

$$Y_i = b_1 + b_2 X_i \quad (3.2)$$

Y_i are estimated values depending on the dynamics of the independent variables. The difference between the actual values of the regressor and the estimated (modelled) values is called the residual:

$$e_i = Y_i - Y_i \quad (3.3)$$

The value of Y_i is the value of the dependent variable in the observation i (*i=1, 2, ..., n),* which depends on $\beta_1 + \beta_2 * X_i$ where β_1 and β_2 are constant values called model parameters, and X_i is the value of the explanatory variable in the observation *i*, and on the random variable u_i. The existence of a random variable is primarily attributable to the inherent impossibility of establishing an exact correspondence between the values of the dependent variable and those of the explanatory variable [117].

The dependent variables are two key indicators that characterise the development of neobanks in the dynamics of European countries, including Ukraine (Annex I):

1. Share of those who have an account with a financial institution or a mobile money service provider (share of the population aged 15 and over).

2. Share of respondents who have made or received a digital payment (share of the population aged 15 and older).

Table 3.1

Statistical methods for checking the reliability of modelling results

Method	Calculation formula	Meaning and application
Descriptive statistical methods		
Average value of a series	$x = \frac{1}{N}\sum_{i=1}^{N} x_i$	To compare panel data values.
Dispersion	$s_x^2 = \sum_{i=1}^{N}$	To estimate the deviation from the mean. Deviation of a random variable from the mean value.
Standard deviation	$\sigma = \sqrt{s_x^2}$	To estimate the deviation from the average value.
Variation coefficient	$V = \frac{s_x^2}{x}$	To assess the level of data homogeneity, no more than 33%. A more homogeneous sample provides better reliability of the modelling results.
Correlation	$\rho = \frac{s_{xy}}{\sigma_x \sigma_y}$	To determine the direction of the relationship between the variables (forward, backward), 0 - 1.
Statistical methods for checking the significance of parameters and model results		
Student's t-test	$t = \frac{\beta_n}{\sigma}$	To test the significance of parameters (coefficients on variables) and the significance of the relationship between variables.
Coefficient of determination R^2	$R^2 = 1 - \frac{\sum_{i=1}^{n} e_i^2}{\sum_{i=1}^{n}}$	It explains the level of variation of the dependent variable from the independent variables, i.e., the extent to which the factors explain the change in the regressor.
Fisher's F-criterion	$F = \frac{R^2 (k-1)}{}$	To explain the adequacy of the model (reliability of the coefficient of determination).

Source: compiled by the author on the basis of [117]

The dependent and independent variables for the construction of econometric models were chosen based on the availability of data for 32 European countries, including Ukraine, for the period 2011, 2014, 2017, 2021: these are the years when data for 32 countries characterising the dependent variables are available. All the indicators for the modelling were selected from the World Bank database [234], except for the share of respondents who made or received a digital payment. The latter indicator is contained in the World Bank's Global Financial Inclusion Index Database, which has been maintained since 2011 and is the definitive source of data on global access to financial services (from payments to savings and borrowing). The data were collected from nationally representative surveys of approximately 128,000 adults in 123 countries. These surveys included indicators on access to and use of formal and informal financial services and digital payments [225]. In the initial phase of constructing the econometric models, descriptive statistics were calculated for the variables in order to ascertain the homogeneity of the sample. The results are presented in Annex F. The second stage of the study involved a correlation analysis of the links between the indicators of neobanks' development and the factors influencing them. The results of the correlation analysis (Table 3.2) indicate an average degree of direct correlation between the indicators of the development of neobanks and GDP per capita, gross domestic savings (% of GDP), and the share of high-tech exports. An inverse low correlation was found between the indicators of neobanks' development and inflation. A low direct correlation was found between the indicators of neobanks' development and imports of ICT goods.

The results of the correlation analysis (Table 3.3) indicate a high degree of direct correlation between the indicators of neobanks' development and the number of fixed broadband subscribers (per 100 people) and the number of people using the Internet (% of the population).

The results of the correlation analysis (Table 3.4) indicate a high degree of direct correlation between the indicators of neobanks' development and all indicators of governance effectiveness.

At the third stage of the modelling process, multiple regression models were constructed with the objective of determining the dependence of the indicators of neobanks development and the identified factors influencing them. As demonstrated in Table 3.5, at the 1% significance level, it can

be inferred that with an increase in GDP per capita and gross domestic savings, as well as a rise in the proportion of the population with an account at a financial institution or a mobile money service provider, there will be a corresponding growth in the number of respondents who will make or receive digital payments (the share of the population aged 15 and older).

Table 3.2

Results of the correlation analysis: performance and development indicators of neobanks and indicators of socio-economic development

	1.1.	1.2.	2.1.	2.2.	2.3.	2.4.	2.5.	2.6.	2.7.
1.1.	1,000								
1.2.	0,973	1,000							
2.1.	0,004	0,068	1,000						
2.2.	0,640	0,668	-0,017	1,000					
2.3.	0,613	0,641	0,207	0,676	1,000				
2.4.	-0,415	-0,308	0,021	-0,348	-0,358	1,000			
2.5.	0,514	0,534	0,040	0,597	0,607	-0,229	1,000		
2.6.	0,169	0,200	0,095	-0,059	0,405	-0,092	0,435	1,000	
2.7.	0,266	0,317	0,106	0,125	0,496	-0,086	0,511	0,924	1,000

Source: calculated by the author

Table 3.3

Results of the correlation analysis: performance and development indicators of neobanks and indicators of communication/ICT and infrastructure development of banks

	1.1.	1.2.	3.1.	3.2.	3.3.	3.4.	3.5.
1.1.	1,0000						
1.2.	0,9726	1,0000					
3.1.	-0,1671	-0,2129	1,0000				
3.2.	0,7655	0,7752	-0,1224	1,0000			
3.3.	0,2863	0,2501	0,3607	0,3153	1,0000		
3.4.	0,8147	0,8369	-0,3871	0,8141	0,0183	1,0000	
3.5.	0,0979	0,1122	-0,1560	-0,0601	-0,1849	-0,0021	1,0000

Source: calculated by the author

Table 3.4

Results of the correlation analysis: performance and development indicators of neobanks and governance performance indicators

	1.1.	1.2.	4.1.	4.2.	4.3.
1.1.	1,0000				
1.2.	0,9726	1,0000			
4.1.	0,7691	0,7949	1,0000		
4.2.	0,7882	0,7978	0,9584	1,0000	
4.3.	0,7069	0,7334	0,9345	0,9262	1,0000

Source: calculated by the author

Instead, with rising inflation, the development indicators of neobanks will also decline. The modelling results revealed a statistical insignificance of the relationship between the development indicators of neobanks and the ICT sector. The R-squared of the regression models is 0.5061 and 0.5280, respectively, so the variation in the development indicators of neobanks is explained by changes in the indicators of socioeconomic development by 50% and 51%, respectively. Fisher's F-criterion proves the adequacy of the calculations.

As demonstrated in Table 3.10, at a significance level of 1%, it can be inferred that as the number of fixed broadband subscribers (per 100 individuals) and the number of individuals utilising the Internet (share of the population) increases, the proportion of the population with an account at a financial institution or mobile money provider will rise, and the proportion of respondents who will engage in digital payments (share of the population aged 15 and above) will expand. Instead, in the absence of growth in these communication and ICT indicators, only the share of the population with an account with a financial institution or a mobile money service provider will increase. The R-squared of the regression models (Table 3.6) is 0.6948 and 0.7266, respectively, so the variation in the development of neobanks is explained by changes in the development of communication/ICT indicators by 69% and 73%, respectively. Fisher's F-test proves the adequacy of the calculations.

Table 3.5

The results of building multiple regression models: indicators of neobanks development and indicators of socio-economic development

Regression statistics				
			1.1.	1.2.
Multiple R			0,7114	0,7266
R-squared			0,5061	0,5280
Normalised R-squared			0,4858	0,5086
Standard error			13,1117	0,1404
Observations			128	128
F			25,000	27,292
The value of p			0,0000	0,0000
	Ratios	*Standard error*	*t-statistic*	*P-value*
For indicator 1.1.				
Y	65,906	3,892	16,933	0,000*
X 2.2.	0,000	0,000	3,498	0,001*
X 2.3.	0,402	0,195	2,060	0,042*
X 2.4.	-1,393	0,525	-2,654	0,009*
X 2.5.	0,254	0,247	1,027	0,307**
X 2.7.	0,245	0,462	0,529	0,598**
For indicator 1.2.				
Y	0,532	0,042	12,756	0,000*
X 2.2.	0,000	0,000	4,398	0,000*
X 2.3.	0,005	0,002	2,215	0,029*
X 2.4.	-0,004	0,006	-0,695	0,489**
X 2.5.	0,002	0,003	0,621	0,536**
X 2.7.	0,007	0,005	1,329	0,186**

Source: calculated by the author

** statistically significant coefficients at the 1% significance level*

*** statistically insignificant coefficients*

As demonstrated in Table 3.11, at the 1% significance level, it can be inferred that an enhancement in the quality of the regulatory environment (X4.2) will lead to an increase in the proportion of the population with an account at a financial institution or mobile money service provider, as well as in the proportion of respondents who will engage in digital

payments (among the population aged 15 and above). As the level of government effectiveness increases, the proportion of respondents who will engage in digital payments, defined as the proportion of the population aged 15 and older, will correspondingly increase. The R-squared of the regression models (Table 3.7) is 0.632 and 0.652, respectively, indicating that the variation in the indicators of neobank development is explained by changes in the indicators of communication/ICT development by 63% and 64%, respectively. The results of the Fisher F-test demonstrate that the calculations are appropriate.

Table 3.6

The results of building multiple regression models: indicators of neobanks' development and indicators of communication/ICT and bank infrastructure development

Regression statistics				
			1.1.	1.2.
Multiple R			0,8335	0,8524
R-squared			0,6948	0,7266
Normalised R-squared			0,6899	0,7222
Standard error			10,1823	0,1056
Observations			128	128
F			142,287	166,077
The value of p			0,0000	0,0000
	Ratios	*Standard error*	*t-statistic*	*P-value*
For indicator 1.1.				
Y	16,846	4,857	3,469	0,0007*
X 3.2.	0,584	0,164	3,563	0,0005*
X 3.4.	0,677	0,101	6,676	0,0000*
For indicator 1.2.				
Y	0,036	0,050	0,710	0,4789**
X 3.2.	0,006	0,002	3,459	0,0007*
X 3.4.	0,008	0,001	7,576	0,0000*

Source: calculated by the author

The correlation and regression analysis confirmed the link between the indicators of neobanks' development and indicators of socio-economic development (in particular, GDP per capita, gross domestic savings, and

inflation), indicators of communication development (number of fixed broadband subscribers per 100 people) and the number of people using the Internet (share of the population aged 15 and older), and indicators of governance effectiveness (government effectiveness and regulatory environment).

Table 3.7

The results of building multiple regression models: indicators of neobanks' development and indicators of governance efficiency

Regression statistics				
Multiple R			0,795	0,808
R-squared			0,632	0,652
Normalised R-squared			0,623	0,644
Standard error			11,226	0,120
Observations			128	128
F			70,982	77,526
The value of p			0,000	0,000
	Ratios	*Standard error*	*t-statistic*	*P-value*
For indicator 1.1.				
Y	71,914	2,821	25,488	0,000*
X 4.1.	6,287	4,126	1,524	0,130**
X 4.2.	18,232	5,008	3,641	0,000*
X 4.3.	-7,991	4,755	-1,680	0,195**
For indicator 1.2.				
Y	0,669	0,030	22,256	0,000*
X 4.1.	0,104	0,044	2,359	0,020*
X 4.2.	0,142	0,053	2,654	0,009*
X 4.3.	-0,065	0,051	-1,276	0,204**

Source: calculated by the author

The analysis of the factors influencing the European banking system thus allowed to consider three hypothetical scenarios of the impact of digitalisation on the banking sector. According to the first scenario, in 2030 the European financial system will be dominated by banks, which will play a central role in money creation and financial intermediation. In the second scenario, the EU will see a decline in banking activity, with large technology companies taking the lead in the credit market, leading to

structural changes in the financial system. In the third scenario, the issuance of retail digital currencies by central banks will, under certain conditions, lead to a shift in financial intermediation from banks to central banks. The author of the study believes that the first scenario is the most likely, with traditional banks dominating the financial market, strengthening their technological component, and financial technology companies providing specialised financial services. Central banks will expand cooperation with each other, share experiences and technological solutions in the development of digital market infrastructure to ensure more effective regulation of the increasingly digital financial environment, which is subject to growing risks of cyberattacks and threats, especially in times of war. The introduction of digital currencies by central banks can solve a number of problems related to the speed, simplicity and transparency of retail and wholesale payments, especially in the context of increasing cross-border cooperation and globalisation. However, given the fragmented nature of the digital financial environment and the regulatory framework for its regulation, which remains inadequate in the face of growing risks of instability, the introduction of digital currencies may be rather slow and subject to certain technological, legal and market barriers. It seems probable that central banks will extend their remit to encompass the monitoring and supervision of the digital financial environment. This will entail the supervision of IT systems, payment systems and the development of digital infrastructure. Central banks will be able to deploy the latest technologies to optimise the IT systems of systemically important banks. One example of this is the use of distributed ledger technology (DLT) to launch digital currencies. The latest technology will also be required to protect against new types of cyber threats.

In the context of Ukraine, the author of the study identifies prospective trends in the evolution of virtual banking through digitalisation. The initial phase of development will entail the creation of a digital financial market that is integrated into the EU and regulated by the central bank in collaboration with other central banks and EU institutions. Secondly, the development of the market and digital payment infrastructure will occur, which will consequently result in an enhanced supervisory framework over the payment infrastructure. Thirdly, there is a need to supervise the payment infrastructure and assess its level of reliability in light of potential cyber

threats. In addition, it is the cooperation of central banks and ministries to solve cross-border problems in the circulation and exchange of funds, in particular, in this context, it is worth noting the trend towards the creation of digital currencies by central banks, which will significantly simplify the exchange and circulation of currencies, payments and transactions between residents of different countries, facilitating cross-border cooperation, including in the financial sector. Finally, it is the expansion of the network of technological branches of banks to increase the level of self-service for customers, closing unprofitable branches where business processes are labour-intensive and time-consuming.

3.3. Assessment of the Impact of Global Technological Changes on the Development of Neobanks

The contemporary technological revolution has also had a considerable impact on the infrastructure of the banking sector, with banks becoming increasingly automated and customer-focused as a result. These transformations in the industry are largely driven by the necessity to reduce costs, enhance the security of financial transactions, and guarantee that the service sector aligns with the evolving needs of society.

Financial innovation has constituted a pivotal aspect of the financial sector for decades, manifesting in the advent of novel products (e.g., new types of securities), technologies (e.g., credit scoring, ATMs) and institutions (e.g., venture capital funds, mutual funds). The advent of digitalisation has given rise to the emergence of novel forms of financial products, including digital platforms, cryptocurrencies, and neo-banks, among others. On the one hand, financial innovations often pose regulatory challenges and systemic risks for the state, but for businesses their potential offers cost savings, the ability to scale and develop operations and increased profitability, while for consumers they offer more convenient and easier-to-use services.

In 2018, approximately 70 per cent of banking executives surveyed indicated that the utilisation of financial technology and digital technologies to develop novel services represented a significant opportunity for banks. Investment in the financial technology sector has witnessed a notable expansion in recent years. In 2018, the global value of investments in financial technology companies reached approximately 112 billion USD, representing a record high for the sector. The annual value of global

venture capital investment in FinTech companies has demonstrated a growth trajectory, with a doubling of investment between 2017 and 2018. However, this growth trend experienced a slight decline in 2019. The global development of the FinTech sector is contingent upon its growth in individual markets, which exhibit considerable variation. As of February 2020, the most popular location for FinTech startups was North America. Nevertheless, the rate of financial technology adoption across various financial sectors indicates that consumers in the United States are lagging behind those in China [185].

Digital banks are considered unicorns or start-ups in the financial and technology sector, attracting significant amounts of venture capital: more than 1 billion USD. This is due, in part, to their growth potential, digitalisation and rapid customer acquisition. For example, as of February 2018, the financial company Revolut attracted 1.5 million customers, and as of 2022, it has already attracted 18 million customers. Dynamic growth in the number of consumers of digital financial services can also be seen in the German mobile bank N26, whose customer base reached 7 million as of January 2021, as well as Monzo [185]. Along with the growth in the number of digital banking customers, the funding of challenger banks is also increasing. As of February 2023, the total funding of the Berlin-based mobile bank N26 was over 1.7 billion USD. This has ensured its leadership in this sector in Europe. For example, the value of the financial technology company Revolut was more than 1 billion EUR as of April 2018, and 1.7 billion EUR as of August 2018. The financial and technology company raised a third round of venture capital in February 2020, which ensured its leadership in Europe [174]. The financial and technology company Revolut continues to attract significant amounts of investment: the value of the digital bank reached 1.7 billion USD in 2021. The value of the digital bank reached 1.7 billion USD in February 2023 [173].

Developments in financial technology include the introduction of new FinTech products and services specifically designed to perform specific functions within the financial ecosystem, such as RegTech (regulatory technology), InsurTech (insurance technology) and robotic advice. At the same time, technologies such as digital banking, artificial intelligence, open banking, microservices, mobile wallets and blockchain are rapidly developing and spreading in the practice of financial institutions

[88]. The most common types of technology-based financial innovations include: smartphone technology, the internet and application programming interfaces (APIs); artificial intelligence and big data technologies; and distributed ledger technology (DLT) [196]. Examples of implementations are highlighted in Table 3.8.

Table 3.8

Examples of the application of artificial intelligence in banking supervision

Bank	Application of artificial intelligence
Central Bank of Italy, Banca d'Italia	Exploring how credit default prediction can benefit from the use of machine learning (ML) algorithms using data from multiple sources.
Central Bank of Spain, Banco de España	Natural language processing (NLP) helps to process environmental, social and governance information from institutions to improve understanding of the internal green economy. Supervised ML helps with the detection of misconduct.
Central Bank of Thailand, Bank of Thailand	The use of an AI/ML system to analyse the minutes of board meetings of financial institutions, which is used by supervisors to assess the compliance of the regulatory body with the board and provide recommendations as part of ongoing supervision.
Central Bank of the Netherlands, De Nederlandsche Bank	ML uses transaction data to identify networks of related entities to assess financial institutions' exposure to networks of suspicious transactions.
ECB, European Central Bank	Machine reading of the "fit and correct" questionnaire helps to spot problems. ML helps in the early detection of distress in "less significant institutions". NLP and ML are used to search for information in supervisory review solutions to facilitate the identification of new trends and risk clusters.
Monetary Authority of Singapore	Working on a project where credit risk assessment by supervisory authorities is carried out using algorithms instead of sampling.
Central Bank of Austria, Oesterreichische Nationalbank	ML and deep learning algorithms are used to predict the likelihood that a data set contains errors that need to be corrected by the reporting entity.

Source: [196]

In 2022, the ECB took the following initiatives to assess the digitalisation of the banking sector at the European level. First, the ECB collaborated with consultants, banks, banking associations and technology companies to identify general trends in digitalisation in the market. Second, a survey of 105 large banks under the ECB's direct supervision was conducted in 2022 to assess the state of digital transformation. The results of the survey differ from bank to bank, but in general, a number of important trends were identified, including the following:

1. *Digital strategy and KPI management*. The majority of significant European institutions have a digital transformation strategy in place, exhibiting varying degrees of maturity. The primary objectives are to become more customer-centric, particularly in the context of offering products and services as a means of increasing revenues and improving efficiency through process automation and IT infrastructure modernisation. However, the majority of banks still encounter challenges in developing key performance indicators (KPIs) to monitor digital progress, quantify the impact of digital transformation on their profitability and track the effectiveness of implementation.

2. *Digital business*. Most digitalisation strategies focus on improving customer experience and offering digital services and products 24/7. However, tracking digital customers and sales remains a challenge.

3. *Investments and resources*. Most banks do not yet have a dedicated budget for digital transformation, but on average, one fifth of the IT budget is spent on digitalisation. The key factors for digitalisation success are the right amount of financial investment and talented staff.

4. *Governance and collaboration are key factors in digital transformation*. Banks recognise the importance of establishing top-down management and an effective internal control system. The availability of sufficient IT expertise both in the board and at the second and third levels of management remains a challenge.

5. *Application of innovative technologies*. The most commonly utilised technologies are cloud-based, which are regarded as the foundation for other technologies. Furthermore, application programming interfaces (APIs) and artificial intelligence (AI) are utilised by the majority of banking institutions, and their significance is increasing. Conversely, distributed ledger technology (DLT) is employed by a mere handful of banks, with cryptocurrency-related activities and risks remaining insignificant.

6. *Risks*. As banks develop their own IT infrastructure and increasingly rely on third-party providers, they are exposed to an elevated risk of third-party dependency, money laundering, fraud and cybersecurity. It is imperative that these risks be subjected to further monitoring and incorporated into banks' governance systems and risk tests. These risks are also among the supervisory priorities of the ECB's banking supervision for the period 2023-2025 [103].

In the context of digital banking, the financial sector is interested and responsive if a bank offers contactless payments, global payments, P2P transfers without transaction fees, and creates a platform for exchanging and buying bitcoin, Ethereum and other cryptocurrencies. According to CACI (California Analytics Center, Inc.), the growth of digital banks is expected to reduce the number of visits to banking offices by 36% between 2017 and 2022, which will significantly reduce administrative costs. Other benefits include: instant bill payments, real-time analytics, expense management, quick balance checks and PINs from home. According to Eurostat and other European agencies, more than half of EU citizens have switched to digital banking. This is also partly due to the trend towards a cashless society. The trend towards digital-only banking is expected to continue, as surveys show that two out of three bank customers plan to switch exclusively to digital banking at some point [88].

One of the most important areas of AI technology development is the automation of customer service processes. By intelligently distributing, analysing and automatically classifying banking data, banking institutions can easily solve problems with a large number of messages, checks and calls. Thanks to artificial intelligence technology, banks can use chatbots instead of human operators in call centres. Virtual bots are able to solve most consumer problems, answer questions and, if necessary, direct a person to a specific support department [29]. Artificial intelligence is one of the most promising areas for the further development of information systems and financial technologies. Some of the most important areas of technology currently being developed are machine learning (ML), natural language processing (NLP) and natural language generation (NLG). These technologies are based on learning algorithms that improve themselves by collecting and analysing huge amounts of data. The banking industry is a leading sector that is focused on the development and integration of artificial

intelligence for numerous tasks. A report from Autonomous Research, an independent research organisation specialising in the financial sector, has indicated that by 2030, the banking industry will be capable of saving approximately 1 trillion USD. This is due to the utilisation of artificial intelligence. The introduction of AI will permit financial institutions to reduce costs, enhance efficiency and income, boost productivity and improve the quality of services [90]. According to independent studies, AI is anticipated to reduce banks' operating costs by approximately 22% by 2030. ABI Research estimates that expenditure on AI and cybersecurity analytics will reach 96 billion USD by the end of 2021. According to forecasts, by 2023, banks will save approximately 447 billion USD. By developing and implementing artificial intelligence applications, banks are expected to save approximately 447 billion USD [88]. In addition, artificial intelligence makes it possible to make a transition to more personalised service provision, as certain services can be more successfully offered to customers based on the data obtained about them. One of the most popular areas of artificial intelligence is robot advice (Robo Advisors), as it can be used for various purposes, such as fraud prevention or risk management, and this type of service is much cheaper than classical financial advice [90].

According to a report by the Organisation for Economic Co-operation and Development (OECD), the COVID-19 crisis has accelerated and intensified the digitalisation trend that was already underway before the pandemic, particularly around the use of artificial intelligence. Global spending on artificial intelligence is projected to double between 2020 and 2024, from 50 billion USD in 2020 to more than 110 billion USD in 2024. The increasing adoption of artificial intelligence in the financial sector, in areas such as asset management, algorithmic trading, credit underwriting, or blockchain-based financial services, is driven by the abundance of available data and the increasing volume and availability of computing power [98].

Open banking is also one of the key components of online banking, which aims to make services more customer-centric. It is based on the use of an application programming interface (API) to allow third parties (developers) to access customers' banking data (with their consent). The main goal of open banking is to improve the quality of customer service and create new programmes and services based on customer data [90].

Open banking is a technology that connects banks, third parties and technology providers, allowing multiple institutions to create networks for data transfer. Open banking allows for the secure exchange of financial information about a customer with their consent, such as spending and habits. This technology allows third-party applications to control customers' banking and other financial data through data exchange using APIs and artificial intelligence. As reported by Allied Market Research, the revenue generated by open banking in 2018 was 7.29 billion USD. By 2026, this figure is projected to reach 43.15 billion USD, which will in turn stimulate increased investment in this technology [88].

In the period from January 2019 to December 2022, the number of registrations of authorised TPPs for the provision of open banking services in Europe increased, in particular, in 2020-2021, with a slowdown in the Q4 of 2022 [186]. As of December 2022, Sweden had the highest number of local authorised open banking service providers, with 38 registrations and a total of 153 such providers. Germany and Poland occupy the second position in this regard, whereas the United Kingdom leads in terms of the total number of authorised providers, which stands at 223 [187].

Blockchain is still considered one of the most important innovative technologies in various industries. In the banking sector, blockchain will make it possible to track every transaction and obtain accurate information from anywhere in the network. If banking institutions adopt this technology, they will be able to make payments faster and more accurately, significantly reducing their costs. Today, banking institutions are in the early stages of adopting blockchain, either focusing on developing their own blockchain strategy or working on researching the effectiveness of blockchain in general. Blockchain technology was first tested at Bank of Ayudhya in Thailand. In 2017, it successfully piloted a real-time international transfer from Thailand to Singapore using the advanced technology "Krungsri Blockchain Interledger" in collaboration with MUFG Bank, Mitsubishi Corporation and Standard Chartered Bank in Singapore. The innovation helped Mitsubishi significantly improve the efficiency of liquidity management and reduce costs [171]. FinTech-based payment innovations include a number of well-known elements, such as mobile payments, mobile (electronic) wallets, contactless payments, identity verification technologies, and artificial intelligence and machine learning for security. Mobile

wallets have almost replaced physical wallets. The wallet, which allows users to use credit cards, loyalty cards, etc., has significantly expanded its audience and gained popularity. In 2019, there were approximately 2.1 billion users of mobile wallets, with a total value of transactions reaching 154.4 billion USD. This figure increased to 214.7 billion USD in 2020 and further to 274.4 billion USD in 2021. As for mobile payments, their volumes increased dramatically in 2021. According to Statista, in 2018, about 440 million people used contactless payments, and in 2020, their number was about 760 million and is projected to grow [88].

RegTech represents a rapidly evolving field of financial technology that assists organisations in meeting and regulating novel legal requirements. RegTech furnishes companies with the requisite tools to address regulatory issues and comply with legal requirements, integrating the trade, fiscal, and financial acts of regulatory authorities. These technologies facilitate the expeditious and straightforward integration and adaptation of off-the-shelf solutions, ensuring comprehensive compliance with all financial regulatory standards. They are employed to combat money laundering. Banks perceive RegTech as an additional component of their customer identification system, interbank transaction monitoring, and cyber fraud protection infrastructure. In the financial sector, the demand for such technologies is driven by the costs associated with risk management for financial market participants. Nevertheless, the potential of RegTech is considerably greater. One of the key features of these technologies is speed. Financial organisations will be increasingly interested in RegTech because it allows them to be proactive: automatically generate and send reports, identify and eliminate risks, and effectively comply with ever-changing regulatory requirements [57].

In this context, it is valuable to consider the potential impact of CBDCs on the development of business models within the banking sector, including those of neobank entities. The introduction of CBDCs is likely to influence and have consequences in the following key areas:

– *Increased competition*. as central banks manage and regulate CSPs, this payment instrument has the potential to become a practical and safe substitute for cryptocurrencies, which may increase competition for neobanks from new business models in the banking sector. As a result, due to the special properties of the CUCC, it is likely that the bulk of the

banking market will shift from neobanks that deal with cryptocurrency instruments to new business models based on the CUCC;

– *Changing user preferences*. Since central banks manage and regulate CBDCs, this payment instrument has the potential to become a practical and safe substitute for cryptocurrencies, which may increase competition for neobanks from new business models in the banking sector. As a result, due to the special properties of the CBDCs, it is likely that the bulk of the banking market will shift from neobanks that deal with cryptocurrency instruments to new business models based on the CBDCs.

– *Regulatory challenges*. The potential widespread use of CBDCs may result in the development of new rules and compliance standards for banks. Accordingly, in the context of the introduction of CBDCs, banks should ensure that they comply with customer identification, transaction monitoring and anti-money laundering requirements. Banks may also need to establish direct links with central banks or payment infrastructure providers to support CBDC-based transactions.

– *Challenges of partnerships and cooperation*. As part of their work with CBDCs, banks may consider partnerships and collaborations with central banks to strengthen their embeddedness in the sector landscape in light of current technological developments. In practical terms, this could take the form of banks introducing CBDC-based wallets, incorporating CBDCs into their digital platforms, and working together on methods of verifying customer identity in the digital environment.

In conclusion, the influence of CBDCs on neobanks and existing business models in the banking sector will be contingent upon a number of variables, including the pace of CBDCs adoption, the evolution of the regulatory framework, and the capacity of neobanks to innovate and adapt in response to evolving market dynamics. It is important to note that the actual impacts may differ from one jurisdiction to another, as well as from the capabilities and specific practices of individual neobanks.

Thus, modern technologies implemented in the banking business help to improve the security of a number of operations and services, make them less vulnerable, and increase their reliability and speed. The main advantage of such technologies as blockchain, open banking, and artificial intelligence is the use of completely new algorithms and methods of organising databases that have a much higher degree of reliability

than the current ones, which helps to strengthen the economic security of banking institutions. In evaluating the impact of financial technologies on the evolution of banking in Ukraine, it is evident that banks must enhance their competitiveness in the digital domain, address the rising demand for superior, expedient, and transparent online services, and align themselves with prevailing trends in global banking. Consequently, it is crucial to augment investments in cutting-edge technologies and expedite the introduction of innovative services.

Conclusions to Chapter 3

Based on the results of the research conducted in Chapter 3, the following conclusions can be drawn:

– In light of the scenario analysis of the impact of global digital transformation on the European banking system, it seems prudent to identify three potential scenarios for the development of the European banking sector by 2030. These scenarios are set to have the following consequences: 1) the continued dominance of traditional banks in the development of the European financial system; 2) the ascendance of large technology companies and the concomitant reduction of banking activities, which will occasion structural changes in the financial system; 3) the transfer of financial intermediation from banks to central banks through the issuance of retail digital currencies by central banks. It is assumed that the most probable outcome is the first one, in which traditional banks retain their dominant position in the market, enhancing their financial and technological capabilities, while financial technology companies offer specialised financial services, including to banking institutions.

– Among the key challenges and obstacles to further digital transformation of the banking sector is the fragmentation of the financial services landscape, which became more pronounced during the COVID-19 pandemic. The fragmentation and narrow specialisation of financial technology companies in specific financial services ensures the delivery of superior quality services to consumers and facilitates future collaboration with other market participants, including banks, financial technology companies and major technology firms. Furthermore, the fragmentation of the financial services industry will contribute to increased

competition within the banking sector, a higher level of consumer sophistication, and a greater range of financial services available to consumers.

– Using the correlation and regression analysis, the study confirms the relationship between the indicators of development of neobanks and indicators of socio-economic development (GDP per capita, gross domestic savings, inflation), indicators of communication development (number of fixed broadband subscribers (per 100 people)), number of people using the Internet (share of the population aged 15 and older) and indicators of governance effectiveness (government effectiveness, state of the regulatory environment).

– Increased competition in the financial sector due to digitalisation has necessitated the development and launch of the CBDCs, which marks a significant advance in the digital transformation of the banking sector and has significant implications for monetary policy, financial stability, the functioning of neobanks, and the structure of the financial system. The launch of the CBDCs can address a number of challenges related to the speed, simplicity, and transparency of transactions, especially in the context of increasing cross-border cooperation and globalisation.

– In recent years, one of the most important and dynamic areas of digital transformation has been crypto-transformation, which is currently characterised by the direct involvement of central banks not only in the preparation of regulation of private cryptocurrencies, but also in the active development and implementation of the CBDCs.

– This paper outlines the general features and characteristics of CBDCs. CBDCs are based on blockchain (DLT) technology, with modifications made in accordance with the intended purpose. The issuer of CBDCs is the relevant state, represented by the central bank. The administrator of CBDCs is the central bank or an authorised body. After issuance, CBDCs become legal tender. The CBDC is an equivalent form of national currency. The stability and confidence in the CBDC is ensured by the central bank through monetary policy, in a manner similar to the stability of the national currency. In contrast to private cryptocurrencies, the structure of the CBDC is more transparent and does not provide for complete anonymity of ownership and transfers. This allows the state to exercise the necessary control functions.

Systematisation of the key areas of impact of the introduction of CBDCs in the context of digital transformation of banking services: 1) digital payments; 2) international payments; 3) financial stability; 4) security. The future digital transformation involving CBDCs also poses a number of risks to the financial system, namely: 1) the risk of eliminating banks as intermediaries; 2) privacy and cybersecurity risks; 3) the risk of significant technical difficulties.

In the context of Ukraine, the likely trajectories of virtual banking development through digitisation are outlined: 1) the development of a digital financial market integrated into the EU and regulated by the Central Bank in cooperation with other central banks and EU institutions; 2) the development of the market and digital payment infrastructure and the strengthening of supervision over them; 3) the supervision of the payment infrastructure and its reliability in connection with it; 4) cooperation between central banks and public authorities to resolve cross-border complications in the circulation and exchange of funds; 5) the expansion of the network of technological branches of banks to increase the level of self-service for customers, the closure of non-profit branches where business processes are labour-intensive and time-consuming.

CONCLUSIONS

The thesis offers a theoretical generalisation and proposes a solution to the current theoretical and applied task of in-depth study of the emergence and development of neobanks under the influence of global digital transformation and analysis of the activities, successful practices and models of neobanks in Ukraine and Western Europe.

The findings of the study allowed for the formulation of the following conclusions:

1. The analysis of the evolution of scientific methodologies employed in the conceptualisation of the "neobank" phenomenon culminates in the assertion that neobanks represent a substantial innovation within the banking sector. This is evidenced by the ongoing development and adaptation of their business models, which are designed to meet the evolving financial needs of customers in terms of affordability, speed and convenience. Furthermore, the evolution of approaches underscores the pivotal role of information technology in shaping the emerging paradigm of banking.

2. The results of the study demonstrate that the internal and external global financial environment exerts a considerable influence on the genesis and evolution of neobanking. Internal factors, such as innovations in technology and changes in consumer behaviour, as well as external factors, such as global economic trends and regulatory policies, contribute to the competitive advantage of neobanks over traditional banking institutions. This encourages the development of innovative financial services and facilitates the integration of digital technologies.

3. The concept of global digital transformation is the main driver of neobanks' development, emphasising the role of digitalisation in shaping the future of the financial sector. This transformation not only provides new opportunities for innovative financial products and services, but also requires neobanks to continuously improve their technology platforms and business processes. As a result, global digital transformation is helping to strengthen the market position of neobanks, opening up new prospects for growth and development.

4. The emergence of neobanks in Western Europe illustrates their capacity to exert a considerable impact on the financial market through the introduction of innovative, efficient, and convenient technologies within the

banking sector. This is largely attributable to their distinct positioning, well-defined development strategy, optimised organisational structures, and high degree of automation, which collectively foster heightened competition within the European financial market.

5. International regulation of neobanks, particularly in the EU context, focuses on consumer protection and safety, and promotes cross-border cooperation and digital interoperability in the financial sector. This reflects a desire to create a competitive, innovative financial environment while ensuring financial stability and consumer protection. However, the fragmentation of regulation at EU level poses challenges for the digital banking sector in terms of supervision and fostering innovation.

6. The analysis of the activities and development of neobanks in Ukraine reveals certain lags in innovation and competition compared to European countries, but there has been a significant increase in consumer interest in mobile online banking, especially during the pandemic. This underscores the need to intensify reforms and further digitalise the banking system in the context of Ukraine's integration into the EU, in particular through accession to the EU payment infrastructure and adaptation to European regulatory requirements.

7. The adaptation of traditional banking institutions to the digital transformation of the financial sector is a critical factor in their ability to survive and develop. A review of potential scenarios for the evolution of the European banking system up to 2030 suggests that traditional banking institutions that proactively integrate financial and technological innovations are well-positioned to maintain their competitive advantage. This highlights the significance of innovation and technological advancement in the banking industry, as well as the necessity for collaboration with FinTech companies to offer tailored services.

8. The process of digitalisation is intensifying competition and enhancing the quality of banking services. The increasing fragmentation of the financial landscape and the specialisation of FinTech companies are contributing to a rise in competition within the banking sector. This, in turn, encourages banks to innovate and enhance the quality of their services in order to meet the growing demands of consumers. Concurrently, the fragmentation of the financial landscape can act as an impetus for the emergence of novel forms of collaboration between diverse financial market actors.

9. The advent of CBDCs has the potential to usher in a significant transformation of the financial sector. The issuance of CBDCs addresses the requirements of the modern economy for expedient, transparent, and secure transactions, particularly in the context of accelerating globalisation and cross-border collaboration. The advent of CBDCs has the potential to facilitate the growth of digital financial services and promote financial inclusion. However, it also presents a number of challenges, including the possibility of a reduction in the role of banks as intermediaries and the need to address cybersecurity concerns.