

Technology-Intense Service Offerings in the Light of Economic Complexity: Establishing a Holistic Service Ecosystem

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Abstract

Crisis situations, like the COVID-19 pandemic, have historically been identified as times of enhanced innovation and entrepreneurial activities. Innovation actors are required to respond quickly to a new situation bearing in mind the effects of actions across their network of partners and competitors as well as rising economic complexity. Indeed, first indications suggest that this pandemic is no different and has facilitated the use of digital technologies. In order to assess these developments, this paper studies new service offerings based on

digital technologies using the example of three major Russian banks. We found that banks have now developed into technology platforms that use their experience to engage in areas like education, advanced robotics, and health care. Technologies developed by partner organizations, such as the integration of blockchain solutions, have spread rapidly. Thereby, banks have obtained a strategic advantage for launching innovations in the financial industry, including technology and knowledge transfers from other industries.

Keywords: banking; COVID-19; anti-crisis strategies; digitalization; diversification; economic complexity; service innovation; service offerings; technological platforms, fintech

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Introduction

The quality of service offerings at banks has been driven by increasing economic complexity over the last decade (Lapatinas, 2019) and rising income inequality (Hartmann et al., 2017) and financial innovation (Fan et al., 2015). This trend has resulted in the diversification of product lines (Tacchella et al., 2013). Service provision became more flexible, adaptable, more complex, and knowledge intensive. With the rising complexity and technological intensity of service development, the ecosystem-based approach inspired the development of technological platforms as collaborative tools in order to provide greater value for clients to meet their needs. Recent publications stressed the rise of economic complexity across a broad sample of high- and low- income countries (Nguyen et al., 2022; Nguyen, Su, 2021).

A specific case for the rising economic complexity marked the COVID-19 crisis, which dealt an exogenous shock to the economy (DesJardine et al., 2019; Kwong et al., 2019). Physical distancing, which was introduced as a preferred policy measure, proved disruptive to most established behavioral routines and switched the globalized economy into crisis mode (Nummela et al., 2020; Arner et al., 2020). However, the pandemic coincided with great technological change in the economy due to new production technologies, such as robotics¹, the rise of cyber-physical systems, and artificial intelligence (AI). Hence, a well-stocked toolbox stood ready to restructure established societal and economic processes.

The imposed lockdowns to fight the spread of COVID-19 also put a sudden stop to the physical connection between the clients of banks and the latter's brick-and-mortar outlets. Banking activities were reduced to digital channels, while digital payment options increasingly replaced the use of cash. The banking sector – historically at the forefront of technology uptake – could fall back on their innovation activities over the past decades which integrated technology platforms (especially software, hardware, and networks) into their business model. Digital technologies became part of the banks' technology portfolio through the reverse product cycle innovation as proposed by Barras (1990). In a nutshell, Barras suggested that – contrary to the innovation in manufacturing – service providers adopt new technologies to improve the efficiency of their business activities and later convert their experience into new products or services.

Banks took a lead role by driving the digitisation process of their business activities and thereby facilitating the uptake of new technologies across society. In order to do this, banks either developed their own digital offerings, or partnered with existing fintech companies (World Economic Forum, 2020). This is “squeezing” into routine (non-profitable) operations via remote channels that are cheaper than the job being done by an operator. In Western countries, the emergence of financial technologies in daily bank operations was a response to the rigidity of large banks with their legacy systems and heavy processes. In fact, in the past decade, banks have not only

facilitated technological development and provided credit lines, but they themselves also increasingly acted as technology providers and data centers. A recent study by McKinsey (2021) showed that over half of the respondents in the financial sector already use at least one AI capability, mainly robotic process automation for structured operational tasks, together with conversational interfaces and fraud-detection applications. AI was originally used by banks as scorecards for assessing the risk of a borrower's default and whether it is worth lending. Later it was used to detect fraud and fight money laundering based on large data sets (e.g., client risk profiling or credit scoring) (Aitken et al., 2020).

Although exogenous shocks tend to render many innovation trajectories ineffective, the first signs indicate that the pandemic is boosting the uptake and spread of digital technologies. Sectors at the forefront of digital business models, such as banks, especially speed up their innovation activities in order to take advantage of the new conditions. Thereby, the crisis acts as a facilitator in the digitalization of the economy. This paper asks if and how banks made use of their learning experiences around digital technologies to launch new technology-intensive services during the pandemic.

In order to shed light on these complex processes, this paper studies the rollout of new technology-intensive services by three banks in Russia during the COVID-19 pandemic. By means of the connection between technology uptake and the pandemic, we intend to show how leaders in digitalization used this exogenous shock to their technological advantage. Especially in atypical contexts, technological leadership is not well understood.

While there is widespread agreement that many of the introduced technologies will remain in place even after the pandemic, such as air disinfection, telemedicine, and online learning solutions, little is known about who introduced these technologies. Our analysis follows the body of literature that studies the role of technology-related services linked to greater social challenges. For example, the digital service offerings of banks were seen as a way to service the unbanked or underbanked populations.²

Thus, this paper widens the analysis of the impact of banking on the wider socioeconomic system, and thereby connects with the science and technology studies' perspectives on private and public engagement with science, technology, and innovation in a larger societal context.

Banks in Times of Crises

Historically, banking and finance stood at the forefront of technology-intensive service innovation: already in the 1960s, banks integrated the first electronic services with the use of ATMs, followed by card-based services in the 1970s. Banks were among the first to incorporate the World Wide Web and moved their services online. Subsequently, applications for the increasing use of smartphones were developed.

¹ We should clarify what can be meant by robots in banks. Actually, there might be three types of robots (Shabbir et al., 2022). First, banks use physical robots to optimize internal processes, most often for related business areas: logistics, storage, etc. Of course, there are robots for bank branches, but this is mainly used for entertaining the clients, rarely something valuable in terms of functionality. Second, there is a separate term «robotics» as the optimization of routine processes performed by employees, due to easily (low code, no code) customizable IT platforms. Such solutions significantly reduce the mechanical load on the performers and improve the quality and speed of the processes. For fraud detection, cyber-physical systems are widely used. Moreover, “robotization” is not related to AI, since the “robot” performs a step-by-step procedure instead of an employee, for example, text recognition and phased entry of data into the service registration forms. Third, AI is usually understood as an algorithm that can work autonomously within the rights granted to it, i.e., functions including decision making. The algorithm is also capable of self-learning (the accumulation of statistics of correct and incorrect decisions and conclusions from them). AI is such that the algorithm itself can interact with the client. Typically, banks use AI in conjunction with big data, when the algorithm uses the accumulated large database of customer interaction history from different IT systems for self-learning or predictive and retrospective analysis.

The COVID-19 pandemic has put the resilience of the world's healthcare and economic systems through an unprecedented stress test. Throughout the global economy, public administration and privately held companies were labeled as essential for the continuation of the provision of goods and services. Banks, as financial intermediaries, also perform a central function in the economy, as businesses require access to capital and private customers require transaction settlements. These institutions must maintain their clients' trust and the continuation of service provision - even under the most challenging conditions. The term used for the continuation of services even under the most disruptive circumstances is 'operational resilience', describing the ability of a system to adapt successfully to changes in response to stress or any other transition without losing any function, structure, or identity (Walker et al., 2004). The Bank of England² defines operational resilience, which is considered a priority issue for the financial sector, as "the ability to prevent, adapt and respond to, and recover and learn from technology, cyber-related and any other operational incidents."

Natural disasters or pandemics limit the ability of banks to continue their business activities. In the first case, banks themselves either are stricken by natural disasters or are no longer able to diligently analyze and evaluate loan applications. Hosono et al. (2016) studied the effect of the lending capacity of banks with regard to loan requests from firms after the Great Hanshin-Awaji (Kobe) earthquake, which hit the area around Kobe City and Awaji Island in western Japan in January 1995. Their findings show that bank lending capacity affects the activity of client firms even in an economy with well-developed financial markets and institutions. Berg and Schrader (2012) analyzed the effects of volcanic eruptions on borrowing from a microfinance institution in Ecuador, while De Mel et al. (2010) conducted a series of surveys of enterprises in Sri Lanka, following the 2004 tsunami, and examined their recovery from the disaster. Studies of pandemics and banking are very rare, and some early studies inspired by COVID-19 focus on policy responses from central banks, such as the People's Bank of China (Funke, Tsang, 2020), the impact on the banking industry in India (Mainrai, Mohania, 2020), or in Germany (Flögel, Gärtner, 2020).

Innovation in the Service Industry

Innovations, irrespective of their appeal, are adopted at different speeds by different actors in an industry. Some industries follow longer investment cycles, while others suffer from a "functional fixedness", a preference for established ways of doing business (Adamson, 1952; Adamson, Taylor, 1954). Other users actively seek innovations and benefit from a first-mover advantage in technology adoption. Von Hippel (1986) introduced the term "lead user" to describe the group of actors seeking a solution for their needs in their quest for high returns. Due to their ongoing search for a solution, they are already using advanced technologies and act on the edge of the knowledge frontier. In order to move further, lead users develop their own versions of existing technologies or significantly modify a type of product which has been empirically proven (Urban, von Hippel, 1988; Franke, Shah, 2003; Lüthje,

2004). Lead users are of great relevance to innovation management as their current demand for a technological solution will subsequently be experienced by other market participants. For example, Morrison et al. (2000) showed that IT solutions developed by libraries could be sold to other users, and Lüthje (2003) came to a similar conclusion about the surgical innovations developed by surgeons at German university clinics.

If the environment in which a product or service is offered changes radically, the established solutions might no longer be suitable to serve customers' needs. New offerings will appear that adjust better to the new circumstances through a recombination of existing technologies, thereby opening new innovation trajectories. Corresponding to the extreme environment in which users search for solutions, von Hippel (2005) described this highly experimental and failure-tolerant group as 'extreme user innovators'. Should the new normal prove lasting, extreme user innovators will benefit from their head start (Christensen, 1997). Otherwise, their efforts result in a learning curve which often proves beneficial when re-considering practices in the context of business-as-usual. The hardship of WWII and concomitant shortage of resources resulted in 'lean management' techniques applied by Japanese industry (Womack, Jones, 2005). Humanitarian emergencies and the need to work around destroyed infrastructure gave rise to radically new ways of logistics, communications, and healthcare (Ramalingam et al., 2009).

In this regard, Bessant et al. (2015) stress the role of entrepreneurs and the brokering role they take in recombining technological trajectories. Crisis situations, such as COVID-19, thus offer opportunities that entrepreneurs will likely pursue. Many of these opportunities will emerge due to the inability or unwillingness of actors (both state and private) to respond quickly enough to emergency situations (Gümüşay, Harrison, 2020).

During the second half of the 20th century, services became an increasingly important driver of economic growth. Service providers ranked among the most profitable firms in the economy, which attracted a rising number of well-trained manpower - and showed increasing demand for technologies. This shift in the economic paradigm attracted interest from scholars, such as Barras, who studied the service revolution (Barras, 1986a; Barras, 1986b) from a historic perspective. Barras drew similarities between the early 19th century phases of industrialization in England and the rise of the service industry. Both periods of steep economic growth were characterized by an "enabling technology" (Barras, 1990) that was readily available and cost-effective. While advances in mechanics resulted in increasingly powerful machines that gave rise to factories and manufacturing, it was the microchip and the resulting computational advances that supported the service industry. The true economic impact, though, is less an outcome of the properties of an emerging technology or the technology supply, but instead relies much more on its productive use. In order to change the economic paradigm, the presence of "vanguard sectors" in the economy is of paramount importance as they can successfully integrate these enabling technologies into their business activities. Once these sectors have proven the profitability of the new technologies,

² <https://globalfindex.worldbank.org/>, accessed 07.11.2022.

³ <http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/treasury-committee/it-failures-in-the-financial-services-sector/written/97231.html>, accessed 22.01.2023.

other industries follow suit. Latecomers benefit from increased investor interest and simultaneous investments in the necessary infrastructure.

Still, manufacturing and services follow different innovation logics. In classic manufacturing, the uptake of technologies leads to product innovation followed by subsequent radical, though incremental, process innovations. Innovation in the service industries, in contrast, follows a “reverse product cycle” (Barras, 1986b). Here, new technologies are initially adopted to achieve improved process innovation - and thus assure a benefit from increased productivity. The experience gathered is then converted into more radical process innovation and subsequently results in new or significantly improved products. In Barras’ words: *“these [new service products] in turn shift the competitive emphasis to product differentiation and performance, as firms in new and transformed industries strive to open up and capture new markets.”* Mostly, these new offerings replace existing offerings (Bhagwati, 1984).

Today, banks perform three basic functions: the creation of financial products, operational accounting of cash transactions, and regulatory reporting. Profits can be derived from maintaining operational accounting (investments, processing, cash operations center, settlement depository, etc.) and from the sale of various financial products. Digital financial products still allow financial institutions to capture a consumer niche due to their easy access through online distribution channels. In addition, financial institutions are issuing customized products by cooperating with actors from various industries and with large online merchant service enterprises (e-merchants) in the set-up of the service ecosystems.

The adoption of digital technologies has increased the cost-effectiveness of banks and enabled the global provision of services (Schmiedel et al., 2006; Beijnen, Bolt, 2009). While the number of people employed in the banking sector is decreasing, physical distances between banks and their clients is increasing (Petersen, Rajan, 2002). Here, technology has played a major role in the continuous improvements of services (DeYoung et al., 2011).

The uptake of new technologies also changes the structure of firms due to the changed structure of organizing costs. Consequently, successful adopters will expand their activities and grow in size (Gershuny, 1978). The changed economics of the firms also facilitated the emergence of multinational organizations. Today’s banking sector, though, is increasingly shaped by actors who expand their services into banking and finance. Banks are increasingly experiencing competition from technology firms who benefit from their extended client base. Especially the markets for payment services have been under pressure. Another threat appeared in the form of new startups - the fintechs - that apply technology in pursuit of new business opportunities. Fintechs serve the last mile and can create custom products for narrow segments, which has a positive effect on customer loyalty and satisfaction. Banks cannot cut cohorts of clients so finely, but they give fintechs their infrastructure upon which they are hosted. When fintechs proved the effectiveness of their technological solutions in niche markets, banks partnered with them and acquired fintech companies with strategic value for them. Thereby, banks have felt the need to develop further new technologies in order to maintain their dominance. Against the background of rising consumer expectations, banks are incentivized to increase their speed of innovations and will strongly integrate third parties into their innovation journeys.

Methodology

Banks have historically stood at the forefront of innovation activities. The shift from brick-and-mortar-banking to the online provision of services has become a subject of a meanwhile extensive body of literature reporting on business and management studies. At its center stand analyses of the acceptance of technologies (Pikkarainen et al., 2004), attitude formation (Karjaluo et al., 2002), and of building up trust in a digital consumer relationship (Bhattacharjee, 2002). Meanwhile, banks stand at the forefront of service digitalization.

Most recent studies that looked into the uptake of technological solutions by banks limited their analysis to immediate technical solutions, such as live chats or video calling (Vessey et al., 2020; McCarty, 2020). Buehler et al. (2020) stress the limitations of interactions in remote services and propose a proactive communication strategy by banks to limit the reliance upon physical branches throughout all consumer segments, including the older population. Other contributions, such as Lewis (2020), have discussed the associated risks of potential fraudulent claims of applicants to access support schemes, as well as increasing data security risks.

In line with the research question of this paper, we studied the banks’ technology engagement in response to COVID-19 based on their communication with stakeholders via websites as well as other means of communication from January 2020 by October 2022. During the COVID-19-related lockdown, banks used their websites to inform their customers about opening hours, offered advice, as well as for the introduction of new services. Especially with the shift to more digitally offered banking services, corporate websites have become a prime means not only to offer services but also to communicate with clients – as, for instance, can be seen in the case of banks (Arora et al., 2016). These forms of digital representation include the firms’ goals and financial information, public relations, and convey customer loyalty and service satisfaction. Using websites to analyze company strategy has become a well-established method. For example, Ertem-Eray (2020) studied ESG principles of two US giants – Amazon and Walmart – by conducting content analysis of their websites.

We additionally analyzed recent consulting reports on building and activating operational resilience in the wake of the COVID-19 pandemic. Further information was gathered from the “Press Releases” section of the banks’ websites. In order to triangulate the findings, we consulted independent news coverage, such as Google News or industry experts, etc.

We analyzed the activities of the three banks according to three categories: “Technological development”, “Changes in business strategy of banks”, and “Support for clients and society”. The category “Technological development” includes three sub-categories: “Products and services based on new technologies”, “Technology-related events and organizations” and “Cybersecurity”. The category “Changes in business strategy” includes two sub-categories: “Working conditions” (physical appearance of the office and remote working) and “HR strategy” (everything from staff support programs to agile initiatives). The last category, “Support for clients and society”, combines four sub-categories: “Healthcare initiatives”, “Raising COVID-19 awareness”, “Charity”, and “Survival products and education initiatives for clients”. The series of activities of the three banks are presented in the Figure 1.

We apply a case study approach for analyzing the product line of three leading banks operating in Russia with the focus on

Figure 1. Activities of banks in response to COVID-19 across their type of ownership

| Key activities | February – April 2020 | May – July 2020 | August – October 2020 | November 2020 – October 2022 |
|---|-----------------------|-----------------|-----------------------|------------------------------|
| Technological development | | | | |
| Products/services based on new technologies | ③ | ② ③ | ④ ② ② | ⑤ ④ ④ |
| Technology-related events/organizations | ① | | ① | ① ① |
| Cybersecurity | | ① | ① | ② ② ① |
| Changes in business strategy | | | | |
| Working conditions | ② ④ ① | ① | ① | ① |
| HR strategy | | ① | ① | ① |
| Delivery services | | | | ① |
| Support for clients and society | | | | |
| Healthcare initiatives | ③ ② ① | ① | ① ① | ① ① |
| Raise of COVID-19 awareness | ① | ② ① | ④ ① | ① ① |
| Charity | | ① ① | ① | ① |
| ‘Survival’ products for clients and education initiatives | ④ ⑤ | ① ① | | ① ⑥ ① |

Source: authors.

○ State-owned bank
 ○ Private-owned bank
 ○ Foreign-owned bank

digital services for retail clients. Thereby, we applied three different criteria: firstly, the banks have to be systemically important as defined by the mega-regulator. Secondly, we decided to include the cases, which have a distinction in digital offerings through a top-20 ranking of digitally oriented banks in Russia. Third, the sample consists of three banks with different ownership: private, state, or foreign owned banks for gathering insights from a diversified set of strategy development, corporate governance practices, and access to funds. Fourth, these three banks were public ones. This allowed us to use the non-financial reports (annual reports) and strategic documents, which were publicly available for investors.

Our study employs an exploratory and largely qualitative approach. Such an approach is widely applied in management studies where the aim is to explore new, emerging or rapidly evolving topics (Yin, 2009; Edmondson, McManus, 2007). This often forms a step prior to undertaking large-scale sample surveys and the like, where tests of statistical significance can be meaningful. This study is not, however, seeking to describe the distribution of particular practices in all the sectors being considered. Our key goal was to bring new insights on how banks respond to the pandemic based on their technology driven capabilities. For gathering the new insights, we use a multiple case study methodology (see e.g. Creswell, Poth, 2017; Yin, 2009).

We employ triangulation (Riege, 2003) by a) collecting the information from different sources – not only websites, but also from press releases, annual reports, and presentations to investors; b) comparing the collected data with those presented in media sources independent from the companies being examined. In addition, we employ the reflexivity (clarification of researcher bias) method (Lincoln, Guba, 1985) as the research team includes researchers of two different nationalities

and institutions, from different fields and with different experience (in terms both of career paths and durations). Thus, this allows us to critically reflect on, discuss, and minimize any impact caused by the values and beliefs of individual contributors. All the collected information was carefully coded, sorted, and systematically organized into a database (Lincoln, Guba, 1985) and analyzed in a systematic and structured manner (Golafshani, 2003; Riege, 2003).

Findings: Technology-Intensive Services during the COVID-19 Pandemic

Banks in Russia have gained considerable experience in the development of technologies for electronic service offerings. In response to the pandemic, banks introduced new services and products. Figure 1 provides an overview of these actions across the type of bank's ownership. Table 1 presents the typology of technologies used in financial services, based on a bank's technology adoption and dissemination. The focus on AI during the pandemic resulted in numerous projects such as AI chatbots, AI cashback recommendation technology, an AI voice assistant in the contact center, and services for diagnosing COVID-19 or pneumonia symptoms. The overview of technology-intensive service offerings is provided as a timeline by taking into account the impact of the pandemic on Russian banking.

First actions in 02/2020-04/2020: overcoming the negative consequences of the sudden quarantine and developing health monitoring systems

Figure 2 sums up the first actions taken by banks in responding to the pandemic. At the onset of the pandemic, banks started creating services and products to support clients and

Table 1. Three categories for the analysis of the banks' activities

| Category | Subsections |
|---------------------------------------|--|
| Technological development | <ul style="list-style-type: none"> • Products and services based on new technologies • Technology-related events and organisations • Cybersecurity |
| Changes in business strategy of banks | <ul style="list-style-type: none"> • Working conditions (physical appearance of the office and remote working) • HR strategy (everything from staff support programs to agile initiatives) |
| Support for clients and society | <ul style="list-style-type: none"> • Healthcare initiatives • Raise of COVID-19 awareness • Charity • Survival products and education initiatives for clients |

Source: authors.

society. Healthcare initiatives saw a rise during the pandemic: artificial intelligence was implemented in a free online test to check for COVID-19 symptoms (April 13, 2020).

Along with support for the clients and society, banks showed the results of technological development in response to the pandemic. Banks partnered with third-party service providers who had already gained considerable experience in the field of medical service provision. Together with a health start-up, the state-owned bank launched a COVID-19 testing service for people living in Moscow (April 17, 2020).

At the same time, banks provided support to society in overcoming the negative consequences of the sudden quarantine. As in most countries, Russia's education system struggled with the switch to distance learning. One of the private-owned banks reached out by launching a series of online programs on its education platform (April 28, 2020).

The game that addresses the challenges, with which clients were coping during the isolation period, was one of the first released services on April 30. The boardgame can be downloaded and printed and was developed by the state-owned bank. This team, which usually develops recruitment tools and customer engagement activities, now is producing a game that requires the smart use of medical masks, sanitizers, and electronic passes to complete the game.

Introduced services and products in response to the continuing pandemic---05/2020-07/2020: supporting clients and society, monitoring the macro-data and developing blockchain technologies

The activities of three banks in the category "Support for clients and society" included a series of initiatives (Figure 3), like a partnership with the health start-up which resulted in a free service to support older people during the COVID-19 pandemic (May 13, 2020).

The private-owned bank developed a corona index to monitor the development of Russia's economy during the pandemic, starting from May 21, 2020. Large banks in Russia are engaged in the development of educational technology. In response to COVID-19, a state-owned bank further increased its focus on education initiatives. During the first few months of the pandemic, it launched webinars on financial and digital literacy during the pandemic (May 29, 2020). On June 3, 2020, another privately owned bank, which is also involved in development of educational technology, launched a free online lecture discussing the work of IT companies, the tasks of product managers and analysts, and which IT tools are beneficial for other professions, etc. Furthermore, the foreign-owned bank intensified the focus on SMEs and published its research study regarding the behavior of small businesses before and after the pandemic (June 9, 2020).

For wealthier clients, an interactive online travel map was created to indicate "where to fly after the coronavirus" (June 18, 2020). In addition, this service incorporated gamification elements and certainly contributed to the well-being of its travel-starved clientele.

An AI-application that interprets CT scans was launched by the artificial intelligence department of a Russian state-owned bank and is related to the sub-category "Survival products and education initiatives for clients" (July 14, 2020). Users can upload their lung scans and receive a diagnosis regarding pneumonia.

Technological development was also the category where new services and products were introduced during the reviewed period. One of the selected banks, which is foreign owned, played a significant role in blockchain development in Russia. It launched Russia's first blockchain automation project integrating two blockchain platforms – its own and the oil trader petroleum-trading platform. Thereby, the automated

Figure 2. Health monitoring systems come first

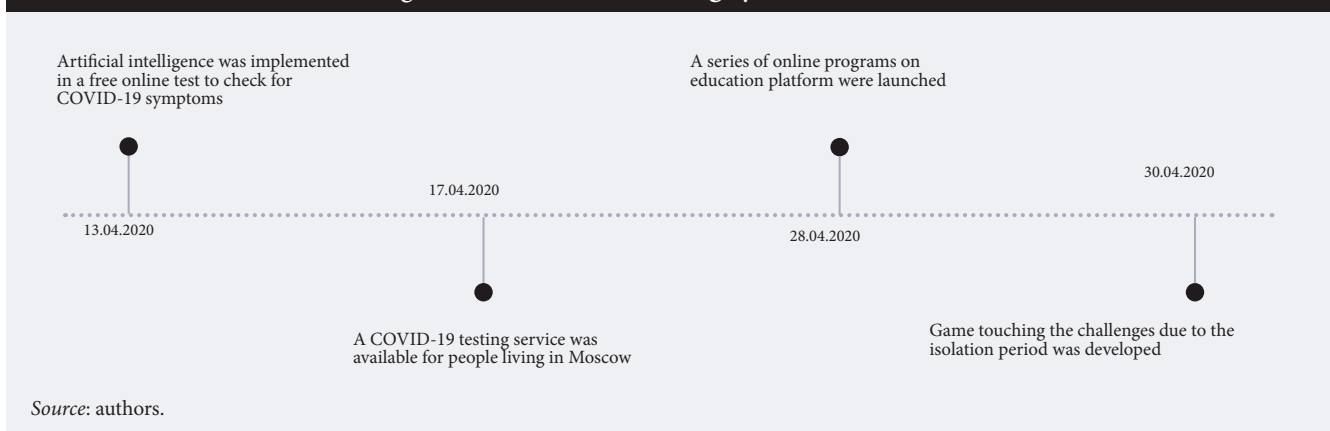
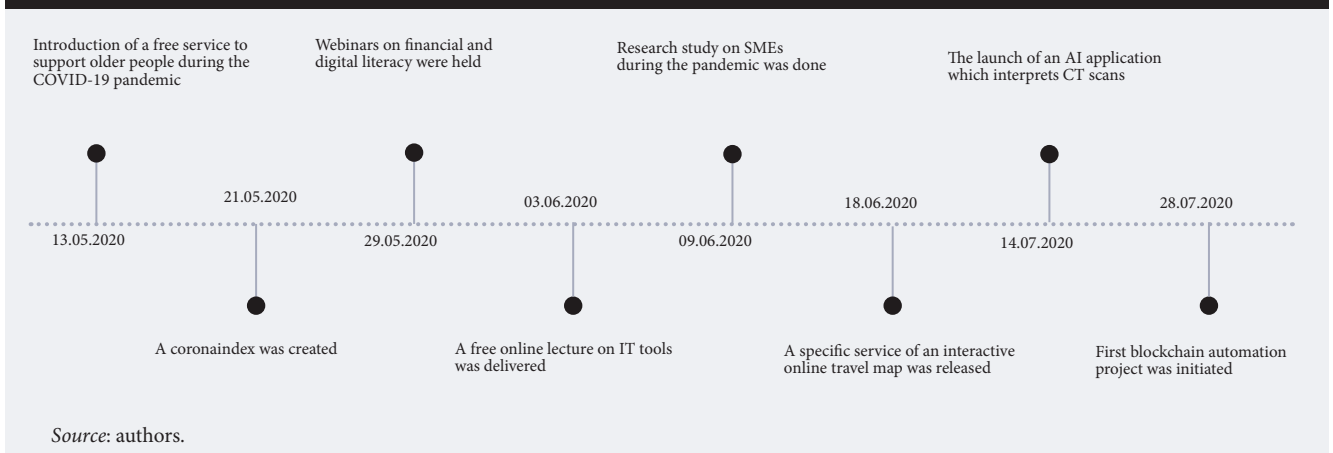


Figure 3. Actions to support clients and society



payment settlements for petroleum trading should be faster and more transparent (July 28, 2020).

Introduced innovations during 08/2020-10/2020: automated services, online education, and improvements in the remote working format

During the second quarter of the pandemic (autumn 2020), banks mostly concentrated their attention and efforts on improving their remotely delivered services and designed online education products for setting up regular communication with the youngest within target client groups (Figure 4). As an example, one bank completely moved its fintech educational program online (August 5, 2020). At the same time, the bank linked up with airlines' blockchain platform to automate its own-settlement system and allow its clients to pay instantly for tickets and services (September 2, 2020). Later, on September 14, there was a three-month free online course that taught students about the innovations in financial technologies, AI banking, the development of financial and IT ecosystems, and so on to provide insight into the creation of applications at large technology companies. Besides educational initiatives, banks also introduced other services and products beneficial for society as well. The map of "post-quarantine tourism 2020" was published (September 15, 2020).

Technological development was crucial when the pandemic increased in scale. One of the Russian state-owned banks adopted robotics as a key technology and this facilitated the logical progression of automated banking services, such as ATMs with facial recognition and an updated biometrics system in its newly opened "Phygital" branches (September 28, 2020). For example, updated biometrics in these offices made it possible to serve clients without passports, while ATMs with facial recognition allow customers to approve withdrawals by a smile.

Regarding the changes in business strategy, the "Future of Work" project was launched to develop and implement the best of remote and office work formats at one of the selected banks that is foreign owned. The declared objective was to find the best mixture of team flexibility and employee wellbeing. More than 5,000 of the bank's 9,000 employees participated (October 1, 2020).

Later, a free training course "Becoming an Entrepreneur" to guide young people from 14 to 25 years of age who plan the start of their own business was initiated (October 15, 2020).

Banks continued introducing new technologies into their services and products 11/2020 – 10/2022: toward sustainability through digital products for clients and changes in business strategy

Active launches of new products and services continued in the last observed period of the pandemic (Figure 5). Thus, new applications of robotics appeared: a robot-dog to study the behavior of robots and the Cognitive Agro Pilot — an autonomous control system for agricultural machinery.

The need for talent in the fields of internet marketing, programming, machine learning, and artificial intelligence theory led the Corporate University of the state-owned bank to expand its "Personal Digital Certificates" project – which are part of the wider "Digital Economy" national project – by launching four advanced training programs in the fields mentioned above (November 2, 2020). Another major service was the implementation of its invoicing system for payments by QR-code managed by a Telegram-bot for SMEs. This is one of the earliest solutions on the Russian market that support invoicing directly from smartphones (November 25, 2020).

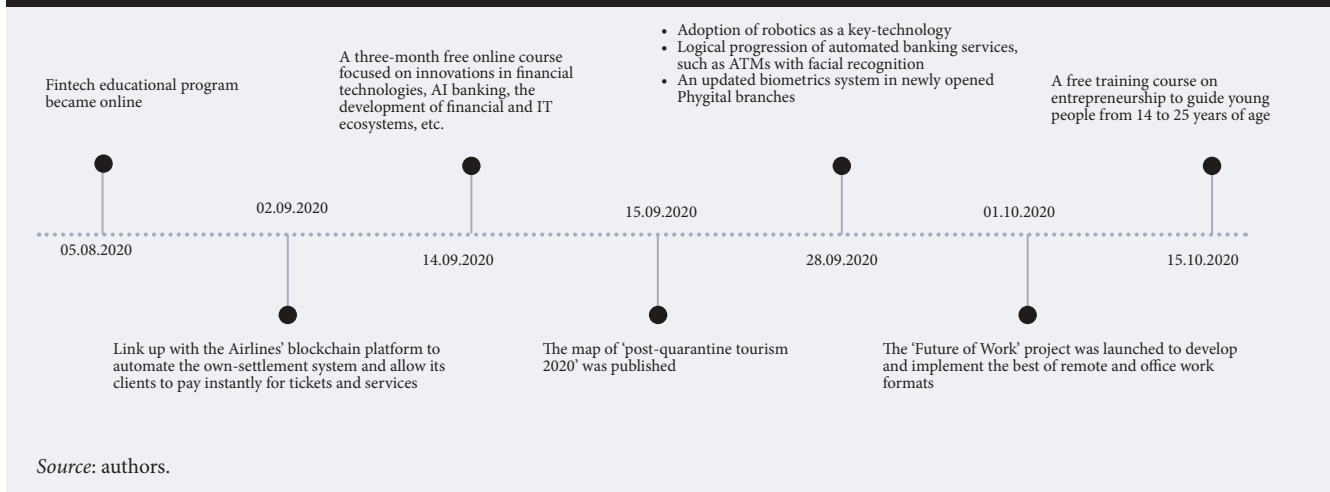
In cooperation with the broadcast and media players, a series of online lectures were created on numerous topics – cinema, fashion, ecology, beauty, editing – for clients wishing to study at home (December 8, 2020). Any one program (on one topic) consists of three interactive Zoom lectures with homework to be completed in two weeks' time.

A day earlier, one of the largest Russian banks presented its first robot-disinfector of rooms. For this achievement, this bank was for the first time named one of the world's leading service robot developers – according to the annual report "World Robotics, Service Robots 2020" by the International Federation of Robotics⁴ (December 14, 2020).

The state-owned bank announced plans to delve further into the application of its cloud-based medical services and now plans to develop a common AI ecosystem for healthcare purposes (December 18, 2020). This bank also implemented

⁴ <https://ifr.org/ifr-press-releases/news/record-2.7-million-robots-work-in-factories-around-the-globe>, accessed 17.11.2022.

Figure 4. Actions to automate banking services and remote delivery



blockchain applications. For example, it was the first Russian bank to join the Federal Tax Service blockchain platform with the goal of helping businesses. Moreover, its collaboration with renewable energy players secured the first Russian green energy deal due to its cloud-based blockchain platform (December 28, 2020). The platform, developed by the bank, uses green Renewable Energy Certificates (REC) to verify the origin of energy.

In terms of support for clients and society, one of the reviewed banks introduced an algorithm analysis which diagnosed COVID-19 by means of having the client cough (January 12, 2021). In addition, one of the private banks announced the launch of a new free three-month IT courses open to the public (January 13, 2021).

Along with technological development, changes in business strategy also took place. The project, a browser-based game with 12 programming languages for hiring IT staff, unites gaming, EduTech, and HR initiatives at the state-owned bank.

While playing, candidates are required to write code which the underlying system analyzes automatically and thus rates all the candidates. Moreover, "Health Day" was established as an annual event (March 12, 2021). Regarding expanding partnerships, a training program for entrepreneurs was developed jointly with Google (March 31, 2021).

AI-powered healthcare solutions aim at determining pneumonia sources in lungs through X-rays with the further prioritization of patients who are in need of treatment based on a model that evaluates the risks of severe symptoms in hospitalized patients (July 20, 2021).

Since the start of the pandemic, the amount of traffic at banks' call centers has increased. They handled over 20 million phone calls from retail clients per month, and this number continued to grow. The only way for them to cope with such a heavy load is through automation, when an IVR voicebot answers typical questions and people pick up the phone for complex and non-routine cases. The largest state bank contin-

Figure 5. Actions towards sustainability

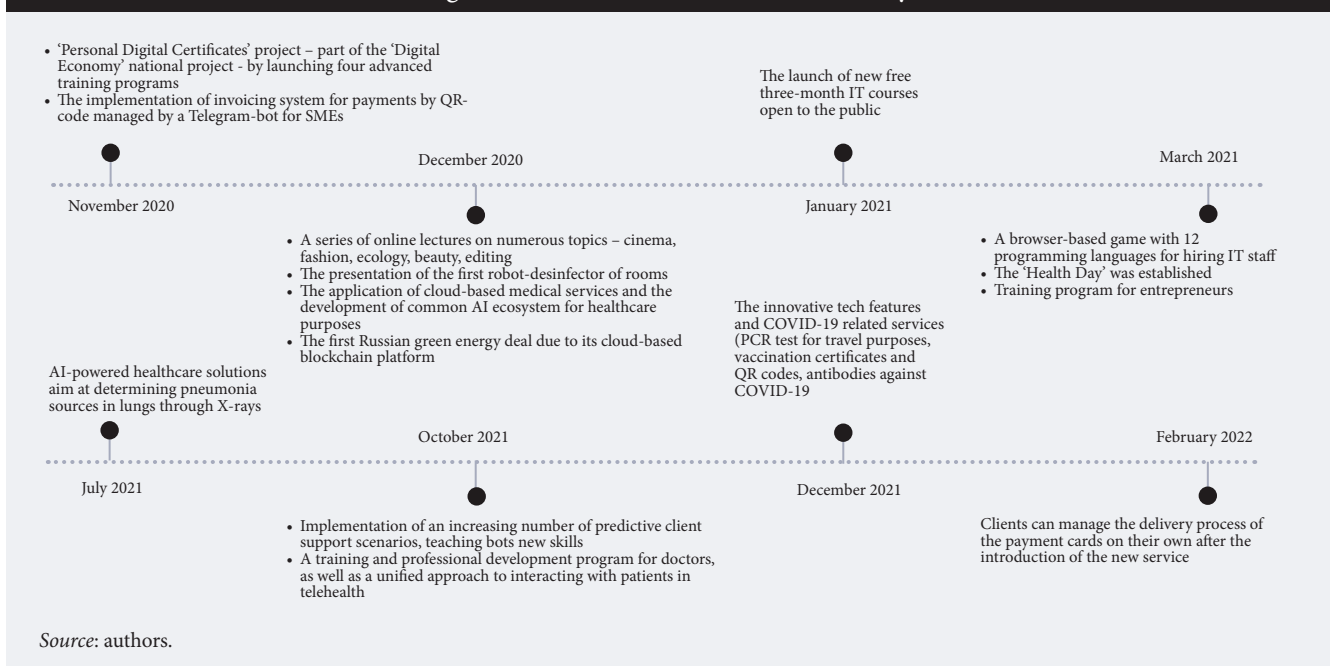


Table 2. The examples of technologies applied in offering financial services

| Nº | Types of technologies | Financial Services |
|----|--|---|
| 1 | End-to-end technologies , which are created by banks to improve the delivery of banking services. These technologies can be transferred to other industries. | <ul style="list-style-type: none"> • Remote identification (including Biometrics) • Bio-acquiring • Payments by QR-code managed |
| 2 | Enabling technologies , which banks adopted from IT services and IoT and incrementally transformed and disseminated them to other service industries. | <ul style="list-style-type: none"> • Artificial intelligence • Machine learning • Blockchain technologies • Cloud Computing • Big Data Analytics • Robotics (incl. achinery) • Ecosystems (Open API\ Open Data) • Chatbots and IVR voicebot |
| 3 | Disruptive technologies , which banks pursued to deliver services remotely based on IT solutions implemented in other service industries (distance education or telemedicine) | <ul style="list-style-type: none"> • Health monitoring systems • Ed-Tech • HR-Tech |

Source: author's classification.

ued to implement an increasing number of predictive client support scenarios, including voicebots and chatbots (October 8, 2021).

New digital technologies of the state bank are already being implemented at a number of medical institutions. These technologies help improve the quality of life and the effectiveness of medical assistance. One of the Russian medical universities in partnership with the bank developed a training and professional development program for doctors, as well as a unified approach to interacting with patients in telehealth (October 14, 2021).

The innovative tech features and COVID-19 related services (PCR test for travel purposes, vaccination certificates and QR codes, antibodies against COVID-19) became available in the financial super-app of one of the private banks (December 30, 2021). Banks continue to develop applications for new technologies. For example, clients can manage the delivery process of the payment cards on their own after the introduction of the new service (February 15, 2022).

Conclusion and Discussion

This paper studied the introduction of technology-intensive services by three major Russian banks during 2020 - the year of the COVID-19 pandemic. Russia's fintech penetration is one among the highest in the world - 82% according to EY data for 2019 (EY, 2019). Russia's banks have acquired the infrastructure needed to collaborate with highly innovative actors such as fintech start-ups. Also, the level of return from such investments in Russia until recently was significantly higher than comparable international economic activities.

The assumption was that the imposed restrictions were acting as a facilitator for the introduction of digital service innovations. Of particular interest was the connection to the pandemic that provided a major interruption for the banks' business models. In line with the model of Barras (1990), we studied whether banks would use their experience gained in digital technologies in order to roll out new technology-

intensive services.

All the banks investigated by this study have continuously increased their technology uptake in order to improve their service offerings, which had already been in place before the pandemic. During the period of observation, all three banks engaged extensively with new service offerings. Banks increased their online offerings and added more telephone-based services to engage with those clients who remained skeptical about online banking. Moreover, new digital technologies were introduced in order to support data-related tasks, such as fraud detection. All these key technologies in service automation are now used for streamlining client communications - mainly with the use of chatbots. Furthermore, gamification applications arrived some time ago to facilitate the recruitment process. Thus, the experience gained through their investment in digital technologies has been converted into new offerings that have allowed the banks to keep up with their business activities despite the imposed lockdown. Consequently, Russia has the necessary financial potential to build up their own research capabilities and to buy start-ups with innovative potential.

Banks obtain a strategic advantage in launching innovations in the financial industry, including for technology and knowledge transfers from other industries. By doing this, banks in Russia act as the drivers of technological innovation in society by achieving such strategic goals as profit, brand promotion, and the capture of promising business niches.

Banks have also benefitted from their experience with digital technologies in that their innovation ecosystem has become much more open. Hence, it has become easier to integrate other technologies developed by partner organizations, such as the integration of various blockchain-based solutions from tax agencies onto specialized trading platforms.

Furthermore, our observations revealed that, in addition to new service offerings as the continuation of the banks' traditional business activities and in line with Barras' model, banks also rolled out service offerings that were novel to their core business and were connected to the events of the pandemic. Chatbots became a key channel for communication with retail clients during the pandemic. However, banks are likely to move away from mobile phone apps and adopt a unified version of websites. This would free up IT talent. Still, the pandemic slowed down this process due to a decrease in financial activity, falling incomes, and general uncertainty. The retention of client's loyalty and personalization through mobile applications proved satisfactory with remote services compared to the less human oriented communication which clients used to observe. We might also expect that the pandemic might lead to a reduction in the number of riskier projects, therefore one may see instead a revision of banks' innovation projects toward a greater digitalization of services.

The first encounter with pandemic-related services was the download of an app in order to familiarize the user with pandemic-related behaviors. Here, the bank benefited from its gamification experience with regard to better user engagement and staff recruitment. Of particular interest is the engagement of banks with artificial intelligence for medical applications. Especially online services that benefit from an increased user engagement. Using the developed AI solutions to predict a COVID-19 infection either through checking symptoms or through an uploaded CT-scan is an interesting practice aimed at reducing the burden of already overwhelmed public or private healthcare organizations. The collaboration with other medtech services allowed for the offer of a tech-

nology-based solution to identify early symptoms and suggest treatment. Large banks are major employers which puts healthcare for employees high up on the priority list. Cough recognition algorithms are based on the same platforms like the remote personal identification through voice recognition already in place, so banks already had the technical means for the implementation of functionality: ready-made platforms, developers, and a developed user base.

An interesting observation is the increasing engagement of banks with online educational programs. This is an opportunity to offer existing content to an extended public who are now interested in such offerings. Especially in times when imposed lockdowns confined people to their homes, demand for online education was high. In certain areas, these offerings also supported the public education system that struggled with the move to online learning. These outreach activities remove communication barriers with talented graduates who seek employment in banking and finance. Furthermore, they are central to a bank's HR strategy with regard to a techno-economic paradigm change to speed up internal organizational learning processes. The key strategic goal of banks for supporting online education is seeking talented candidates for their own staff. LMS platforms have become separate products to sell and develop for external users.

Our results certainly do not represent the entire picture of the operational resilience response of the Russian banking sector

to the novel pandemic, as the research was limited to three major banking players only. Moreover, the study may reflect the positive 'skewness' of the gathered official news aimed at convincing clients and investors of the companies' credible reputation (Ageeva et al., 2020). Further research on the topic may involve a larger sample of Russian banks - or even be expanded to explore the operational resilience of banks in different countries.

This paper also does not make a deep-dive into cryptocurrency initiatives as they are still an open issue. For example, the Ministry of Finance talks about crypto, while the Digital Ruble, as the third type of national currency, rather has an effect on banks in the format of challenges to come up with new consumer products. It becomes relevant to retain a client who owns a digital currency, which he can essentially withdraw at any other bank, even though he initially was issued the cryptocurrency through conditional bank A. The Digital Ruble will affect the landscape of client financial services on the domestic market. Further, the legalization of the circulation of cryptocurrencies for external transactions is an unrelated factor, it is rather the direction of trust management services at commercial banks. Here is an important watershed that the Digital Ruble is not a cryptocurrency.

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