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INTEGRATING «GREEN» INFORMATION TECHNOLOGIES INTO MODERN BANKING

Shakizada Niyazbekova
«Financial University under the Government of the Russian Federation», Moscow, Russia
e-mail: shakizada.niyazbekova@gmail.com

Abstract. This study examines the key aspects of integrating «green» information technology into modern banking operations, exploring how this can drive the joint development of digitalisation and environmental sustainability within the financial sector. It reveals the conceptual foundations of Green IT, which involves designing, producing, using and disposing of information and computing systems in a way that minimises negative environmental impact. The research's scientific novelty lies in its comprehensive analysis of the role of «green» information technologies in the ESG transformation of the banking sector, where environmental criteria are integrated into financial institutions' IT infrastructure and business processes. The author convincingly demonstrates a paradigm shift from traditional digitalisation to sustainable technological transformation, where the implementation of digital solutions is accompanied by measures to improve energy efficiency and reduce the carbon footprint. This work's methodological value lies in its systematic identification of key areas for implementing «green» IT solutions, such as paperless technologies, cloud infrastructures, energy-efficient data centres, digital document management systems and remote service technologies. The study identifies the mechanisms by which digital and environmental innovations reinforce each other to create a synergistic effect of environmental and economic efficiency. The practical significance of the study is confirmed by a detailed analysis of successful case studies from leading Russian banks. It highlights the two-way impact of «green» IT on the banking sector: digital technologies reduce material and energy consumption, making banks more environmentally friendly, while a focus on environmental goals stimulates the adoption of cutting-edge digital solutions. The author justifies the development of a more sustainable and efficient banking model.

Keywords: «green»; information technology; sustainable development of commercial banks; greening of the banking sector; banking sector.

Introduction

In today’s environment, the banking sector is paying particular attention to the concept of «green» information technology («Green» IT) - the practice of developing and using environmentally sustainable computing technologies. The relevance of this topic stems from the need to reduce the negative environmental impact of banking activities whilst simultaneously improving the efficiency of business processes.

The digitalisation of financial services opens up new opportunities for making the banking sector more environmentally friendly:

– on the one hand, the adoption of digital technologies makes it possible to reduce paper-based document flow, optimise the operation of data centres and lower energy consumption;

– on the other hand, the growth in data volumes and computing demands a careful approach to energy conservation and reducing the carbon footprint. Thus, green information technologies in the banking sector represent an important area at the intersection of digital transformation and sustainable development, enabling the achievement of a synergistic effect of environmental and economic efficiency.

Materials and research methods

The methodological and informational basis for this work was provided by the works of scholars on the subject of «green» technologies and the banking sector, including A.K. Bakharev [1], B.B. Rubtsov [2], S.E. Dubova [3], L.A. Maisigova [4], G.A. Buryakov [5], T.Ya. Aleksandrova [6], E.Sh. Zhumaksanov [7], S.E. Prokofiev [8], D.E. Morkovin [9], M.Kh. Khalilova [10], E.I. Vorobyova [11], O.G. Blazhevich [12], M.A. Abramova statistical data for recent years from official sources (Bank of Russia, World Bank, OECD), as well as reports on sustainable development and ESG initiatives from leading banks.

Research results

The concept of «green» IT encompasses a range of approaches to the design, manufacture, use and disposal of information and computing systems, with a view to minimising their negative impact on the environment. In other words, «Green» IT implies that at every stage of the IT equipment and processes' life cycle - from the selection of materials and energy consumption of equipment to the management of electronic waste - technologies and methods are applied that ensure environmental sustainability. In the banking sector, the adoption of «green» information technologies has become part of a broader ESG (Environmental, Social, Governance) strategy and «green» banking, aimed at reducing the carbon footprint of financial institutions and supporting the principles of sustainable development. International initiatives, such as the UN Principles for Responsible Banking and the Paris Agreement on Climate Change, are encouraging banks to integrate environmental criteria into their operations, including their IT infrastructure and business processes.

It is important to emphasise that «green» information technologies form part of the banking sector's sustainable development paradigm. The balanced implementation of digital («digitalization») and environmental («greening») innovations enables banking organisations to simultaneously improve service quality and reduce environmental damage. Researchers note that the harmonious development of the digital economy and the «green» economy create a synergistic effect, contributing to sustainable growth. For banks, this means that digital transformation (the shift to remote services, big data, cloud solutions, etc.) is accompanied by measures to improve energy efficiency and reduce emissions, so that digital progress does not lead to an increase in the carbon footprint.

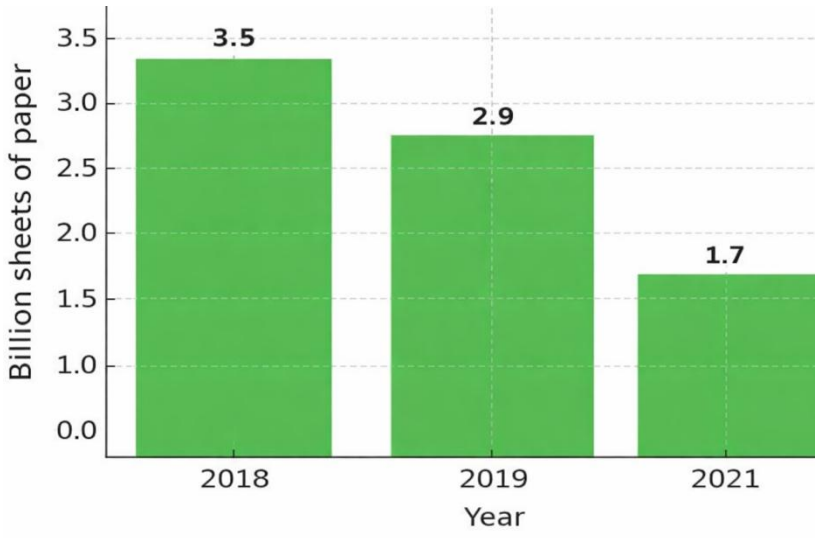
In Russia, the digitalisation of the banking sector has been progressing rapidly in recent years, and at the same time, the largest banks have begun implementing programmes to reduce the environmental impact of their operations. Let's look at a few examples of successful initiatives.

Example 1: Sberbank – reducing paper-based document flow and environmental programmes. As the country's largest bank, Sberbank has launched a large-scale initiative to transition to paperless technologies across all possible processes. As a result, between 2018 and 2019, the bank achieved a significant reduction in office paper consumption. Whereas in 2018 Sberbank used around 3.5 billion sheets of paper, by the end of 2019 this figure had fallen to 2.9 billion sheets – a reduction of 596 million sheets (equivalent to saving around 50 000 trees). The savings continued: in the first half of 2020, the bank reduced its paper consumption by a further 263 million sheets (saving around 22 000 trees).

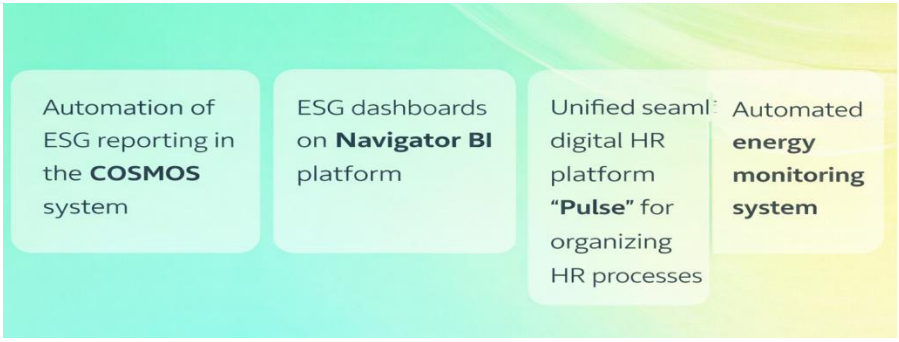
Sberbank has set a target for 2021 to reduce its annual paper consumption to 1,7 billion sheets (8 500 tonnes) - more than half the 2018 level, which will save around 102 000 trees per year.

The 1,34 billion sheets saved over two years amount to 6 700 tonnes of paper, or 110 000 trees saved from felling. This trend is illustrated in Figure 1.

Next, we present the key IT solutions for Sber's ESG transformation (Fig. 2).



1- Figure. Paper consumption at Sberbank: 2018 vs 2019 and the target for 2021 (billion sheets) (compiled from data)



2- Figure. Key IT solutions for Sberbank's ESG transformation (Sberbank's 2024 Sustainability Report)

It should be noted that Sberbank is also implementing other «green» IT solutions. Internal documents are being converted to electronic format wherever possible (using an ECM – Enterprise Content Management – system for managing digital documents), and convenient digital services have been developed for customers, enabling them to dispense with paper statements and forms. Representatives of the commercial bank note that today paper is used only where required by law or at the request of customers; in all other cases, electronic interaction technologies are in place. Furthermore, Sberbank is investing in the modernisation of its engineering systems and data centres: smart climate and cooling control is used in server rooms (supplying cold air strictly as needed, using energy-efficient free-cooling systems), mechanical energy storage systems have been installed to replace batteries, and the voltage in power supply systems has been increased to 20 kV to reduce losses, etc.

According to the commercial bank, such measures not only reduce environmental damage but also yield tangible economic benefits through savings in electricity and resources. Sberbank is actively promoting green energy: in 2022, it announced plans to source part of its electricity from renewable sources, aiming to reduce indirect energy-related CO_2 emissions by 4% in 2022 alone. Sberbank's climate strategy sets out targets to achieve full carbon neutrality for its operational (Scope 1 and 2) emissions by 2030, with an interim target of reducing Scope 1 emissions by 5% and Scope 2 emissions by 15% from 2019 levels by 2023; these steps enable Sberbank to strengthen its

image as an environmentally responsible company and a leader in ESG transformation in the Russian Federation.

Example 2: VTB – the «Paperless Bank» programme. Another leading Russian bank – VTB Bank (PJSC) Group – launched the «Paperless Bank» project at the end of 2020, aimed at the comprehensive digitalisation of document management and services. Over a two-year period (2021–2022), VTB Bank (PJSC) converted 97% of all internal documents to electronic format, implementing digital data storage and processing systems, and virtually eliminated the printing of customer forms and contracts. Today, 99% of the most popular transactions for private individuals are available remotely, without the need to visit a branch. The results are impressive: over two years of using paperless technologies, VTB has reduced paper consumption by 900 million sheets (over 4 500 tonnes), saving around 100 hectares of forest from being felled. The financial savings amounted to over 3, 5 billion roubles, achieved through reduced costs for paper procurement, printing and logistics. VTB reports that it will now save over 2 500 tonnes of paper annually thanks to the solutions it has implemented. For customers, this has resulted in simpler interactions: for example, a comprehensive service agreement now fits on a single sheet of paper, whereas previously it could run to dozens of pages. Digital signatures and transaction confirmation via a mobile app are widely used. VTB's programme demonstrates not only environmental but also operational benefits: customer service times have been reduced, document storage has been simplified, and the risks of data loss have been lowered. VTB publicly emphasises the environmental aspect of these changes, thereby enhancing its reputation among customers and investors as a «green» bank.

Example 3: «T-Bank» – its own energy-efficient data centres. It is well known that it was originally established as a digital bank with no branches, which in itself reduces its environmental footprint (no energy is wasted on maintaining a network of offices, fewer customer journeys by public transport, etc.). However, business growth has led to an increase in computing power requirements. In 2024, the «T-Technologies» group (the «Tinkoff» brand) announced the construction of its own network of large data centres from scratch, built to modern «green» standards from the outset. The project envisages the construction of two data centres in special economic zones by 2027, with a phased expansion to 3 000 server racks in each. The key feature is the use of Direct Free Air-Cooling technology in combination with traditional methods, which will be a world first for banking data centres of this scale. According to calculations, this solution will significantly reduce energy costs for air conditioning and achieve a PUE of ~1,15. Furthermore, the heat generated by the equipment is planned to be used to heat nearby urban buildings (so-called recuperative heating), which will further improve overall energy efficiency. Investments in this project will pay for themselves both through savings on premises rental (expected savings of ~26 billion roubles by 2030, according to the group's estimates) and through reduced operating costs - annual savings once the data centre reaches full capacity are forecast at 10 billion roubles.

«T-Bank» is therefore striving to combine its business objectives (providing its own rapidly growing ecosystem with a reliable IT infrastructure) with environmental goals - the new centres must minimise their carbon footprint and serve as the foundation for the company's carbon-neutral growth in the future. This case study illustrates that even digital-only banks without branches are paying attention to «green» IT, emphasising energy efficiency and the use of innovation as their digital platforms grow.

In addition to the examples given, other banks in Russia are also introducing elements of «green» technology. For example, Alfa-Bank and Gazprombank report that they have switched a significant proportion of their customer communications to electronic formats (e-statements, notifications via an app instead of paper letters), The Russian Agricultural Bank is implementing a «green office» programme (energy-saving equipment, separate waste collection, paper savings), etc.

As a mega-regulator, the Bank of Russia is making a huge contribution: in recent years, there has been accelerated development of remote banking services, instant payment systems and other digital services, which indirectly reduce the need for customers to visit branches and use paper. Statistics confirm this trend: the share of cashless transactions in retail turnover in the Russian Federation has risen from ~30% in 2016 to ~75% by 2024 (according to the Bank of

Russia), whilst the number of bank branches has fallen (a reduction in the number of branches means lower resource consumption for their maintenance). All these facts indicate that the digitalisation of the Russian banking sector is accompanied by a positive environmental impact, particularly where banks pursue a targeted policy on «green» information technologies.

Conclusion

Consequently, the following conclusions and recommendations have been drawn during the course of this study. «Green» information technology is becoming an integral part of the strategic development of the banking sector in the context of the digital economy and the global challenges of sustainable development. «Green» IT in the banking sector is a comprehensive concept encompassing the optimisation of internal processes (the transition to electronic document management, improving the energy efficiency of data centres, the use of cloud solutions, and the management of IT resources taking into account their life cycle) and the development of new technological approaches that reduce banks' environmental footprint.

The role of «green» IT in the digitalisation and greening of the banking sector is defined by a mutually reinforcing effect: when applied correctly, digital technologies can significantly reduce material and energy consumption, thereby improving banks' environmental performance, whilst a focus on environmental goals, in turn, encourages banks to adopt cutting-edge digital solutions (such as remote banking systems instead of physical branches). This two-way process leads to the development of a more sustainable and efficient banking model that meets ESG objectives.

Specific «green» IT solutions deliver tangible results. The switch to paperless technologies saves hundreds of millions of sheets of paper annually, saving tens of thousands of trees and reducing operating costs. The modernisation of data centres and the transition to «green» energy reduce energy consumption by tens of per cent, cutting carbon emissions and costs. Cloud technologies and virtualisation enable the optimisation of banks' IT infrastructure, making it more flexible and environmentally friendly. Examples of successful case studies include a reduction of over 50% in paper usage at Sberbank over several years, savings of 3,5 billion roubles and the preservation of 100 hectares of forest at VTB over two years, and T-Bank's plans to build data centres with record-low PUE figures - all confirm that «green» IT proves its worth from both an environmental and an economic perspective.

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ҚАЗІРГІ ЗАМАНҒЫ БАНК ІСІНЕ «ЖАСЫЛ» АҚПАРАТТЫҚ ТЕХНОЛОГИЯЛАРДЫ ЕНГІЗУ

Ниязбекова Ш. Ө.
Ресей Федерациясы Үкіметі жанындағы Қаржы университеті жоғары білім берудің федералдық мемлекеттік бюджеттік білім беру мекемесі, Мәскеу, Ресей
e-mail: shakizada.niyazbekova@gmail.com

Аңдатпа. Бұл зерттеу қаржы саласындағы цифрлық даму мен экологиялық тұрақтылықтың синергетикалық дамуын жеделдететін катализатор ретінде «жасыл» ақпараттық технологияларды қазіргі заманғы банктік операцияларға енгізудің негізгі аспектілерін қарастырады. Мақала «жасыл» ақпараттық технологиялардың тұжырымдамалық негіздерін ақпараттық және есептеу жүйелерін жобалау, өндіру, пайдалану және жою тәсілдерінің жиынтығы ретінде ашып көрсетеді, сонымен бірге қоршаған ортаға теріс әсерін азайтады. Зерттеудің ғылыми жаңалығы – банктік сектордың ESG трансформациясы контекстінде «жасыл» ақпараттық технологиялардың рөлін жан-жақты талдауда, мұнда экологиялық критерийлер қаржы институттарының ақпараттық-технологиялық инфрақұрылымына және бизнес-процестеріне енгізіледі. Автор дәстүрлі цифрландырудан тұрақты технологиялық трансформацияға парадигмалық ауысымды сенімді түрде көрсетеді, онда цифрлық шешімдерді енгізу энергия тиімділігін арттыру және көміртегі ізі азайту шараларымен бірге жүреді.

Бұл жұмыстың методологиялық құндылығы «жасыл» IT шешімдерін енгізудің негізгі бағыттарын жүйелеуінде: қағазсыз технологиялар, бұлттық инфрақұрылымдар, энергия үнемдейтін деректер орталықтары, цифрлық құжат айналымы жүйелері және қашықтан қызмет көрсету технологиялары. Зерттеу сандық және экологиялық инновациялардың бір-бірін нығайтып, эко-экономикалық тиімділіктің синергетикалық әсерін тудыратын механизмдерді анықтайды. Зерттеудің практикалық маңызы жетекші ресейлік банктердің табысты іс-тәжірибелерін егжей-тегжейлі талдау арқылы расталады. Зерттеу әсердің екіжақты сипатын айқындайды және банктік сектордағы «жасыл» IT: цифрлық технологиялар материалдық және энергия шығынын азайтып, банктерді экологиялық тұрғыдан тиімді етеді, ал экологиялық мақсаттарға басымдық беру озық цифрлық

шешімдерді енгізуді ынталандырады. Автор ESG қағидалары мен халықаралық тұрақты даму бастамаларына сәйкес келетін анағұрлым тұрақты және тиімді банктік модельді дамытуды ұсынады. Бұл жұмыс жаһандық экологиялық сын-қатерлер контекстінде банктік сектордың трансформациясын түсінуге елеулі үлес қосады, өлшенетін экологиялық және экономикалық нәтижелері бар технологиялық инновациялар арқылы тұрақты даму тұжырымдамасының практикалық іске асырылуын көрсетеді.

Түйін сөздер: «жасыл» ақпараттық технологиялар; коммерциялық банктердің тұрақты дамуы; банктік секторды жасылдандыру; банктік сектор.

ВНЕДРЕНИЕ «ЗЕЛЕНЫХ» ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ В СОВРЕМЕННУЮ БАНКОВСКУЮ СФЕРУ

Ниязбекова Ш. У.
Федеральное государственное бюджетное образовательное учреждение высшего образования «Финансовый университет при Правительстве Российской Федерации», г. Москва, Россия
e-mail: shakizada.niyazbekova@gmail.com

Аннотация. Исследование освещает фундаментальные аспекты интеграции «зеленых» информационных технологий в современную банковскую деятельность как катализатора синергетического развития процессов цифровизации и экологизации финансового сектора. Работа раскрывает концептуальные основы Green IT как совокупности подходов к проектированию, производству, использованию и утилизации информационно-вычислительных систем с минимизацией негативного воздействия на окружающую среду. Научная новизна исследования заключается в комплексном анализе роли «зеленых» информационных технологий в контексте ESG-трансформации банковского сектора, где экологические критерии интегрируются в ИТ-инфраструктуру и бизнес-процессы финансовых учреждений. Автор убедительно демонстрирует парадигмальный сдвиг от традиционной цифровизации к устойчивой технологической трансформации, при которой внедрение цифровых решений сопровождается мероприятиями по энергоэффективности и снижению углеродного следа. Методологическая ценность работы определяется систематизацией ключевых направлений внедрения «зеленых» ИТ-решений: безбумажные технологии, облачные инфраструктуры, энергосберегающие центры обработки данных, системы управления цифровыми документами, технологии дистанционного обслуживания. Исследование выявляет механизмы взаимного усиления цифровых и экологических инноваций, формирующих синергетический эффект эколого-экономической эффективности. Практическая значимость исследования подтверждается детальным анализом успешных кейсов ведущих российских банков. Исследование выявляет двусторонний характер влияния «зеленых» ИТ на банковскую сферу: цифровые технологии способствуют сокращению потребления материалов и энергии, повышая экологичность банков, а ориентация на экологические цели стимулирует внедрение передовых цифровых решений. Автор обосновывает формирование более устойчивой и эффективной банковской модели, отвечающей принципам ESG и международным инициативам устойчивого развития. Работа вносит существенный вклад в понимание трансформации банковского сектора в условиях глобальных экологических вызовов, демонстрируя практическую реализацию концепции устойчивого развития через технологические инновации с измеримыми экологическими и экономическими результатами.

Ключевые слова: «зелёные» информационные технологии; устойчивое развитие коммерческих банков; экологизация банковской сферы; банковский сектор.