The Impact of the COVID-19 Pandemic on the Expansion of Electronic Document Management in the Field of Information Security

Irina S. Zyazyulya[1][a], Airat A. Kayumov[1][b] and Lidiia E. Urmanova[2][c]
[1]*Department of Information Security Systems, Kazan National Research Technical University named after A. N. Tupolev – KAI, Kazan, Russia*
[2]*Department of Foreign Languages, Russian and Russian as a Foreign Language, Kazan National Research Technical University named after A. N. Tupolev – KAI, Kazan, Russia*
irina.zyazyulya.work@gmail.com, lightman660@gmail.com, leurmanova@kai.ru

Keywords: COVID-19 Pandemic, Remote Work, Telehealth Services, Electronic Document Management, Technology in Healthcare, Vaccine Development, Cybersecurity, Digital Transformation, Artificial Intelligence, Global Health Crisis.

Abstract: This article explores the profound impact of the COVID-19 pandemic on the expansion of electronic document management, the integration of modern technologies, and the evolution of cybersecurity. It delves into how the pandemic catalyzed a rapid shift to remote work, prompting a technological and cultural revolution in work practices and management. The challenges and opportunities arising from this shift, such as effective communication, productivity maintenance, and the potential for a more diverse workforce, are examined. The article also highlights the significant role of technology in healthcare during the pandemic. It discusses the expansion of telehealth services and how they have transformed healthcare delivery, making it more digital and accessible. Furthermore, the critical contribution of technology in the rapid development and distribution of COVID-19 vaccines is analyzed, emphasizing the efficiency brought by advanced computing and logistics technologies. Throughout, the article underscores the essential role of artificial intelligence and cybersecurity in adapting to these new challenges and opportunities. The lessons learned and the standards set during the pandemic are poised to continue influencing the future of work, healthcare, and technology, marking a new era in the digital revolution. This article provides valuable insights into how the COVID-19 pandemic has reshaped the technological landscape and set a precedent for future advancements.

1 INTRODUCTION

The COVID-19 pandemic has profoundly impacted economies and public life worldwide. The rapid spread of COVID-19 and the ensuing quarantines dramatically transformed the business landscape and, consequently, the job market within days. This crisis led to the suspension of public relations activities for both large and small enterprises, a reduction in working hours, and widespread staff layoffs. In this context, the effective organization of electronic document management (EDM) at enterprises has emerged as an urgent necessity.

Russian businesses, surviving despite the economic and internal political challenges of recent decades, have proven the necessity of establishing proper planning, accounting, and control of all available resources. This necessity is recognized under the realization that corporate activities must be transparent and efficient.

The need for changes in passport work procedures affects at least that part of corporate document flow that has not yet been fully digitized. Particularly, there are issues with the approval of paper-based documents by two or three individuals working remotely, as well as the exchange of documents between different parties. With the limitation of

[a] https://orcid.org/0009-0005-0938-2791
[b] https://orcid.org/0009-0009-4860-8502
[c] https://orcid.org/0009-0002-0089-3710

physical contacts, it becomes problematic to create a paper document, sign it, send it to a creditor, receive it by mail or courier, send it back signed by both parties, and then forward it to accounting.

A legally significant electronic document management system could resolve these challenges. However, for its effective implementation, it should be adopted by all creditors and utilized in internal corporate documents, including those signed by committees.

2 DEVELOPMENT OF ELECTRONIC DOCUMENT MANAGEMENT IN RUSSIA

For businesses in Russia, a priority has emerged: the electronic signing of HR documents. Leading organizations have proactively begun implementing solutions, not waiting for changes in labor legislation. They rely on the existing Federal Law No. 63-FZ "On Electronic Signature" and judicial practices to guide these implementations.

A package of amendments to the Labor Code has been submitted for consideration in the State Duma. This clearly indicates that at the state level, there is a movement towards simplifying the transition of employers and employees to digital interaction.

Artificial Intelligence (AI) plays a critical role in handling correspondence, automatically identifying responsible parties, filling out document cards, verifying details, and more. We are developing a system that facilitates these processes with intelligent tools. This ensures seamless integration and high readiness for immediate use "out of the box".

AI is now a tangible tool for businesses, impacting the efficiency of company processes. For most companies, it has become a necessity. AI liberates employees from repetitive tasks, creating digital assistants that handle labor-intensive operations. This allows human workers to focus on more engaging and important tasks. Although users retain responsibility for validating data processed by AI services, the digital assistant simplifies and enhances this process, marking another step forward in the development for any company.

3 THE IMPACT OF THE COVID-19 PANDEMIC ON ELECTRONIC DOCUMENT MANAGEMENT IN EUROPE

The COVID-19 pandemic in 2020 caused significant changes in the daily lives of Europeans, including a transition to remote work and learning. This shift has also spurred the wider adoption of electronic document management (EDM) to maintain the operations of businesses and organizations. In this context, many European countries have taken steps to support and accelerate the implementation of EDM.

- Italy: facing serious challenges due to the pandemic, Italy declared plans to create a national platform for electronic document exchange.
- United Kingdom: the UK took measures to expedite the shift to EDM, including offering tax incentives to companies that implement EDM systems.
- Germany: the German government announced plans to invest €500 million in the development and dissemination of EDM in the country. This initiative aims to support businesses, reduce paper documentation, and lower the risk of virus transmission.

Despite these efforts, challenges remain. For instance, transitioning to EDM often requires significant investment in technology and staff training. Additionally, some companies and organizations may struggle to adapt to new working conditions.

Nevertheless, the COVID-19 pandemic has underscored the importance of electronic document management and its ability to sustain the operations of businesses and organizations under restrictions and in remote working conditions.

4 THE IMPACT OF THE COVID-19 PANDEMIC ON MODERN TECHNOLOGIES AND CYBERSECURITY

The COVID-19 pandemic has had an unprecedented impact on various aspects of human life, including the modern technological landscape (see Fig.). For instance, the successful deployment of cloud, super, and cognitive computing applications, along with sensor networks, drones, personal gadgets, smartphones, and digital biological and sanitary

avatars, in combating the epidemic in China, showcased the effectiveness of the fourth industrial revolution's information technologies and robotics.

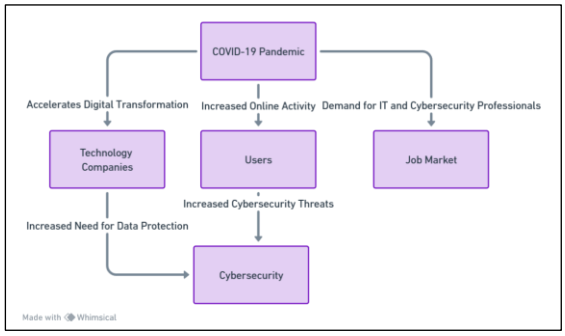

Figure 1: Impact of the COVID-19 pandemic on technology and cybersecurity.

The heightened focus on coronavirus in the information and cyberspace has inevitably brought to light critical cybersecurity issues affecting information systems at all levels, from personal to international. This scenario underscores the vulnerabilities in our increasingly interconnected digital world.

There has been a notable increase in cyberattacks on healthcare institutions and medical research facilities. A widely reported incident involved a ransomware attack on a Czech clinic in mid-March. Interestingly, some hacker groups adhere to an informal code of conduct, avoiding attacks on clinics and hospitals with limited budgets. However, this doesn't eliminate the risks faced by these vital institutions.

Another significant threat, exacerbated by quarantine measures, is the leakage of personal data of individuals undergoing treatment, quarantine, or self-isolation. Telemedicine systems, increasingly popular in the West for home treatments, have emerged as a relatively new target for cyberattacks aimed at compromising personal data.

Additionally, the pandemic has seen cyberattacks targeting online commercial enterprises. These attacks exploit the increased reliance on digital platforms for trade and commerce during lockdowns and social distancing measures.

5 DIGITAL TRANSFORMATION AND WORK CULTURE SHIFT

The COVID-19 pandemic acted as a catalyst, significantly speeding up the digital transformation of workplaces around the world. Companies of all sizes and sectors were compelled to adopt remote work models almost overnight. This sudden shift demanded quick adaptation to digital technologies, primarily focusing on virtual collaboration tools and cloud-based solutions.

The transition to remote work was underpinned by a surge in the usage of virtual collaboration tools. Video conferencing applications, project management software, and cloud-based communication platforms became indispensable. These tools bridged the physical gap between team members, ensuring that work processes continued with minimal disruption. The adoption of cloud technology facilitated access to necessary data and resources from any location, enhancing flexibility and mobility.

Beyond technology, the shift to remote work brought about a profound change in work culture and employee management practices. Companies had to rethink their approach to managing remote teams, focusing on outcomes rather than traditional office hours. This required a greater emphasis on trust and accountability, along with an understanding of the unique challenges of remote work, including maintaining work-life balance and preventing burnout.

The rapid adoption of remote work is likely to have lasting implications. Many organizations are contemplating a hybrid work model, combining remote and in-office work, to provide flexibility and meet diverse employee needs. This shift also opens up opportunities for hiring talent from a broader geographic pool, potentially leading to more diverse and inclusive workplaces.

The transition to remote work, driven by the pandemic, has brought forth a mix of significant challenges and novel opportunities for businesses and their workforces. Ensuring effective communication among remote teams emerged as a primary hurdle, as the absence of face-to-face interactions necessitated reliance on digital communication platforms. Another major challenge was maintaining productivity, with the overlapping of personal and professional life in home environments. Additionally, setting up a robust and secure technical infrastructure for employees, including reliable internet and appropriate hardware, became crucial.

However, this shift also opened up new possibilities. One notable opportunity is the enhanced work-life balance for many employees. The elimination of commutes and increased control over working environments allowed for more effective time and responsibility management. Flexibility became a key theme, not just in terms of location but

also working hours, leading to greater employee satisfaction. Companies started re-evaluating the rigid 9-to-5 structure, accommodating different time zones and personal preferences.

Another significant aspect is the potential for creating a more diverse and geographically dispersed workforce. Remote work has enabled companies to access a global talent pool, bringing in diverse perspectives and fostering innovation. This change has also led businesses to reconsider their need for large, physical office spaces, potentially resulting in cost savings and a shift towards a hybrid model that combines remote and in-office work. This reimagining of workspaces is poised to suit a variety of employee needs and preferences, potentially leading to long-term changes in how work environments are structured and operated.

6 THE ROLE OF TECHNOLOGY IN HEALTHCARE ADVANCEMENTS

The COVID-19 pandemic has been a significant catalyst in the expansion of telehealth services. As the world grappled with the challenges of providing healthcare during a health crisis, healthcare providers swiftly augmented their telehealth capabilities. This rapid scaling was essential to offer safe and remote consultations, minimizing the risk of virus transmission during in-person visits.

The shift towards telehealth is not just a temporary measure but is expected to have lasting effects on the healthcare delivery system. Traditionally, healthcare has been predominantly an in-person service, but the pandemic has shifted this paradigm to a more digital-focused approach. Telehealth services have proven to be an effective alternative for a range of healthcare needs, from routine check-ups to mental health services and even some emergency consultations.

This transition to telehealth has necessitated a greater reliance on digital platforms. These platforms are not only used for video consultations but also for patient monitoring, electronic health records, and digital prescriptions. The use of technology has enhanced the accessibility and efficiency of healthcare services, allowing patients to receive care from the comfort of their homes.

The integration of telehealth into the healthcare system is likely to continue post-pandemic. Its benefits, such as increased accessibility, time efficiency, and reduced healthcare costs, make it a viable complement to traditional healthcare methods. However, this shift also raises questions about the digital divide, as not all patients have equal access to the necessary technology and internet connectivity. Ensuring equitable access to telehealth will be an important consideration as this technology becomes an integral part of healthcare delivery.

The unprecedented speed in developing COVID-19 vaccines can be largely attributed to the advancements in technology. Advanced computing and sophisticated data analysis techniques were at the forefront of this rapid development. These technological tools allowed scientists and researchers to swiftly sequence the virus's genome and understand its structure, leading to the accelerated creation of effective vaccines. This process, which traditionally takes years, was remarkably condensed into months due to these technological innovations.

Once the vaccines were developed, the next significant challenge was their distribution on a global scale. Here, logistics and supply chain technologies played a vital role. These technologies enabled the efficient management of the complex logistics involved in vaccine distribution, from manufacturing to delivery at vaccination centers. They ensured that vaccines were transported under the required conditions, managed inventory levels, and coordinated the distribution to various parts of the world, often overcoming significant logistical challenges.

The use of digital systems has been pivotal in managing the vast and intricate task of vaccinating millions of people. Digital platforms were utilized for tracking vaccination progress, scheduling appointments, and managing the supply of vaccines. These systems provided real-time data on vaccination rates, inventory levels, and helped identify areas with low vaccination rates needing focused efforts. They also enabled individuals to book and manage their vaccination appointments conveniently, increasing the efficiency and accessibility of the vaccination process.

The integration of technology in vaccine development and distribution played a crucial role in the global response to the COVID-19 pandemic. It not only facilitated the rapid development and distribution of the vaccines but also ensured that the vaccination process was organized, efficient, and accessible to people across the globe. This comprehensive use of technology in public health response has set a precedent for future healthcare challenges and has highlighted the potential of technology in revolutionizing healthcare and medical responses.

7 CONCLUSIONS

The COVID-19 pandemic has undeniably served as a catalyst for monumental changes across various sectors, particularly highlighting the pivotal role of technology in adapting to new challenges. The rapid shift to remote work necessitated a dual technological and cultural revolution, pushing businesses to embrace digital platforms and rethink traditional work models. This transition, while challenging, opened doors to enhanced work-life balance, flexible working hours, and opportunities for a more diverse workforce.

In healthcare, the pandemic accelerated the adoption of telehealth services, transforming the way healthcare is delivered and making it more accessible. Technology's role in the swift development and distribution of COVID-19 vaccines was nothing short of revolutionary, showcasing the potential of advanced computing, data analysis, and logistical technologies in managing global health crises.

These developments, born out of necessity during the pandemic, have set new standards and expectations in both the corporate and healthcare sectors. The integration of technology in daily operations and crisis management has not only provided immediate solutions but also paved the way for future innovations.

As we move forward, the lessons learned during the pandemic will continue to influence and shape the future of work and healthcare. The importance of digital readiness, the value of flexibility and adaptability, and the potential of technology to bridge gaps and create solutions have been firmly established. The post-pandemic world will likely continue to see the growth of remote work, digital healthcare solutions, and an increased reliance on technology in various aspects of life and business, marking a new era in the digital revolution.

REFERENCES

Posnaya, E.; Alesina, N., Shevtsov, A., 2023. Current Problems in Functioning of Russian Federation Banking Institutions during the Pandemic Period and Ways of their Solution. In *Proceedings of the 2nd International Scientific and Practical Conference "COVID-19: Implementation of the Sustainable Development Goals" – RTCOV*, pages 227-231.

Osadchii, V.V.; Zolkin, A.; Levoshich, N.; Tokova, S., Ryabkova, G., 2023. Impact of COVID-19 on the Welfare of Russian Enterprises. In *Proceedings of the 2nd International Scientific and Practical Conference "COVID-19: Implementation of the Sustainable Development Goals" – RTCOV*, pages 285-291.

Viktorov, I., Gibadullin, R., 2023. The principles of building a machine-learning-based service for converting sequential code into parallel code. *E3S Web of Conferences*, **431**, 05012.

Grigoriev, A., 2023. Socio-economic Instability and Attempts to Exit the "Coronavirus" Labyrinth: Russian and Foreign Experience. In *Proceedings of the 2nd International Scientific and Practical Conference "COVID-19: Implementation of the Sustainable Development Goals" – RTCOV*, pages 280-284.

Kolomeitseva, N., Glotova, I., 2023. How Has the Pandemic Changed the Agroindustrial Complex. In *Proceedings of the 2nd International Scientific and Practical Conference "COVID-19: Implementation of the Sustainable Development Goals" – RTCOV*, pages 299-304.

Yoqubjonov, J., Gibadullin, R., Nuriev, M., 2023. Advanced robotic process automation for enterprise efficiency. *E3S Web of Conferences*, **431**, 07011.

Antsiferova, O., Petrova, L., 2023. Information and Communication Technologies as a Trigger for the Development of Companies in the Agro-Industrial Complex. In *Proceedings of the 2nd International Scientific and Practical Conference "COVID-19: Implementation of the Sustainable Development Goals" – RTCOV*, pages 43-48.

Dmitrieva, E., 2023. New Socio-economic Picture of the World: Consequences and Challenges of Coronavirus.. In *Proceedings of the 2nd International Scientific and Practical Conference "COVID-19: Implementation of the Sustainable Development Goals" – RTCOV*, pages 373-379.

Shakirzyanov, M., Gibadullin, R., Nuriyev, M., 2023. Prerequisites for the development of the system of automatic comparison of video and audio tracks by the speaker's articulation. *E3S Web of Conferences*, **419**, 02029.

Gibadullin, R. F., Vershinin, I. S., Volkova, M. M., 2020. Software development for placing tiles in two-dimensional space. In *2020 International Multi-Conference on Industrial Engineering and Modern Technologies (FarEastCon)*, pages 1-7. IEEE.

Gibadullin, R. F., Perukhin, M. Y., Mullayanov, B. I., 2020. Optimization of water supply by the method with model predictive. In *2020 International Multi-Conference on Industrial Engineering and Modern Technologies (FarEastCon)*, pages 1-6. IEEE.