Health Leadership and Quality of Life. 2024; 3:.412
doi: 10.56294/hl2024.412

ORIGINAL

Analysis of innovative approaches to technology-enabled public finance management

Análisis de enfoques innovadores para la gestión de las finanzas públicas con ayuda de la tecnología

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Cite as: Krasnozhon A, Yatsun O. Analysis of innovative approaches to technology-enabled public finance management. Health Leadership and Quality of Life. 2024; 3:.412. https://doi.org/10.56294/hl2024.412

Submitted: 04-03-2024 **Revised:** 12-05-2024 **Accepted:** 05-12-2024 **Published:** 06-12-2024

Editor: PhD. Prof. Neela Satheesh

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ABSTRACT

The purpose of the article to analyze the role of technological innovations in improving public financial management, identify barriers to their implementation and offer recommendations for the formation of an effective organizational and legal framework. The author identifies various types of innovations and explains their importance in ensuring the efficiency of public funds management. However, the author pays the main attention to technological innovations. Thus, electronic public procurement platforms, big data analytics, artificial intelligence and robotic process automation were highlighted. The article demonstrates their impact on the transparency, efficiency and accountability of the use of public resources. In addition, the article analyzes specific examples of countries that are already applying relevant innovations and qualitative statistical indicators of their importance for the budget sector. By analyzing successful foreign cases, the most effective models of integrating innovations into public institutions were identified. The author's approach in this paper involves not only describing and analyzing individual successful cases, but also identifying organizational and legal barriers. Author also finds specific ways to overcome negative elements. The proposed recommendations include a roadmap, staff training and regulatory framework improvement. Taking into account the specifics of legislative systems and the capabilities of the national economy, they can be adapted to different countries and regions. In conclusion, the article substantiates that the systematic implementation of innovative technologies can not only increase the efficiency of budget processes and reduce corruption risks, but also contribute to the formation of a new management culture focused on transparency and effectiveness.

Keywords: Electronic Public Procurement; Artificial Intelligence; Big Data; Robotic Automation; State Budget Transparency.

RESUMEN

El propósito del artículo es analizar el papel de las innovaciones tecnológicas en la mejora de la gestión de las finanzas públicas, identificar los obstáculos que dificultan su aplicación y ofrecer recomendaciones para la formación de un marco organizativo y jurídico eficaz. El autor identifica varios tipos de innovaciones y explica su importancia para garantizar la eficacia de la gestión de los fondos públicos. Sin embargo, el autor presta la mayor atención a las innovaciones tecnológicas. Así, se destacan las plataformas electrónicas de contratación pública, la analítica de big data, la inteligencia artificial y la automatización robótica de procesos. El artículo demuestra su impacto en la transparencia, la eficiencia y la rendición de cuentas del uso de los recursos públicos. Además, el artículo analiza ejemplos concretos de países que ya están aplicando innovaciones relevantes e indicadores estadísticos cualitativos de su importancia para el sector

presupuestario. Mediante el análisis de casos extranjeros de éxito, se identificaron los modelos más eficaces de integración de innovaciones en las instituciones públicas. El planteamiento del autor en este trabajo implica no sólo la descripción y el análisis de casos individuales de éxito, sino también la identificación de barreras organizativas y jurídicas. El autor también encuentra formas específicas de superar los elementos negativos. Las recomendaciones propuestas incluyen una hoja de ruta, la formación del personal y la mejora del marco normativo. Teniendo en cuenta las especificidades de los sistemas legislativos y las capacidades de la economía nacional, pueden adaptarse a distintos países y regiones. En conclusión, el artículo corrobora que la aplicación sistemática de tecnologías innovadoras no sólo puede aumentar la eficiencia de los procesos presupuestarios y reducir los riesgos de corrupción, sino también contribuir a la formación de una nueva cultura de gestión centrada en la transparencia y la eficacia.

Palabras clave: Contratación Pública Electrónica; Inteligencia Artificial; Big Data; Automatización Robótica; Transparencia Presupuestaria Estatal.

INTRODUCTION

One of the state's functions is to ensure that finances are managed for the most efficient use. In this regard, the rational management of public finances is of great importance.[1,2] However, it should not be forgotten that technological development has led to the fact that government agencies are actively using the latest innovations to optimize government processes. The widespread implementation of digital solutions allows for the efficient processing of information on income and expenditure.[3] Their use can significantly increase the efficiency of budget planning. In addition, analytical mechanisms can quickly identify and eliminate shortcomings in the work of state bodies.[4,5]

At the same time, the growing role of technology stimulates a qualitative update of management approaches. At the same time, in order to ensure appropriate innovations, it is necessary to integrate them into development strategies.[6,7] Digitalization strategies are a key component of the public sector digital transformation process.[8,9] They ensure that technologies are implemented to support the strategic goals of solving problems in the public sector.[10]

Nevertheless, along with its many benefits, digital transformation also brings new challenges. For example, the issue of transparency is emerging. Citizens want to see clear decision-making mechanisms. Including in the context of the use of budget funds.[11] In this context, the introduction of technology is becoming an important catalyst for change.[12] Electronic platforms provide more opportunities to track budget expenditures. Blockchain technologies also stand out in this regard. They have the ability to ensure the decentralized nature of transactions and the impossibility of their counterfeiting. That is, they can automatically allocate budget funds for the implementation of a specific project and do not require the involvement of intermediaries.[13]

Cybersecurity should not be overlooked. Increasing dependence on digital platforms makes government systems more vulnerable to hacker attacks. This necessitates the development and consistent implementation of information security measures. However, this obstacle cannot be considered the key to the digitalization of the budget control system.[14] Today, the state still works with large amounts of data and must ensure its security. In addition to technical protection, priority should be given to educational measures, namely cyber hygiene training.[15]

The human factor often remains the weak point in the security system. Moreover, successful implementation of technologies requires adaptation of the regulatory framework. All these steps require coordinated measures to ensure the effective implementation of digitalization. In addition, all this requires significant financial investments. So, on the one hand, we need to implement modern solutions quickly. On the other hand, we face numerous challenges and costs. The success of any initiative affects the economic stability of the state. All the advantages and disadvantages make it necessary to study the feasibility of introducing digital technologies in public finance management.

Literature Review

Modern public financial management is undergoing a transformation due to the introduction of innovative technologies. This study is based on theoretical and empirical sources that highlight the importance of technologies for transparency and efficiency in the field of public finances. The issue of researching the introduction of technological innovations is quite widespread. There is a large number of scientific works on this issue. However, technologies are developing very quickly, which leads to the rapid obsolescence of the literature. In addition, the scope of their application is expanding, which gives new results every year, and together with it, creates new challenges. All this makes the study of technological innovations in the field of public financial management relevant.

Research on the digital transformation of the public sector relies heavily on the concepts of data openness and e-government. These concepts consider technologies as a catalyst for changes in the use of public resources.[16] They demonstrate how automating procedures helps reduce corruption risks and ensures more efficient use of public funds.[17] Similar systems in other countries have also proven effective in combating inefficient spending.[18] Artificial intelligence and big data analytics are attracting particular attention from researchers due to their ability to process large amounts of information and detect hidden patterns. For example, AI algorithms allow for improved budget planning and rapid response to economic changes.[19] In Estonia, where the Kratt AI strategy is being implemented, the introduction of such technologies has already reduced the processing time of standard citizen requests by a third, and the accuracy of detecting fraudulent schemes has increased by 25 %.[20]

However, the use of innovations in public finance faces a number of challenges. Some authors draw attention to the need to adapt the legislative framework and organizational processes.[21] The insufficient level of digital literacy of civil servants and technical gaps also remain critical barriers to full-scale digitalization.[22]

At the same time, researchers emphasize the prospects for integrating innovations into financial management. For example, synergy between different components allows for a high level of automation of management processes.[23] In addition, analytical platforms contribute to increasing transparency and public involvement in financial decisions.[24] Thus, the literature review confirms the key role of innovations in the modernization of public financial management. However, to achieve a sustainable effect, it is important to consider not only technical, but also organizational and legal aspects.

METHOD

The study used an interdisciplinary approach that combines elements of comparative analysis, statistical method, analysis and synthesis, and empirical method. First of all, a review of scientific publications in the field of public financial management and innovative technologies was carried out, in particular in publications indexed in international scientometric databases (Scopus, Web of Science). In addition, official reports and statistical data of international organizations (OECD, EU) and national ministries of the studied countries were analyzed.

For an in-depth study of the practice of using technologies, specific cases of countries that were successful in terms of the scale of implementation and availability of empirical data were selected: Ukraine (ProZorro), Estonia (Kratt AI), Singapore (GovTech), and the United Kingdom (HMRC). Statistical data and empirical studies were considered, which made it possible to assert the effectiveness of the relevant innovations.

The author used the method of analysis and synthesis when processing primary sources, legislation and statistical reports. On its basis, the main data were analyzed, which were highlighted in the Results section and formulated in the Conclusions. The author also used the historical method for a deep analysis of the formation of approaches to public finance management up to the use of modern technological approaches. Statistical and empirical methods were used in collecting, processing and analyzing accurate data on the effectiveness of the introduction of new technologies in the field of public finance management. The authors also used the comparative method for the methods of innovation in the field of public finance.

The author also applied the analysis when processing public documents in order to identify organizational, legal and institutional barriers. This method was also used to search for factors that contribute to the effective integration of innovations into the public financial sector. Based on the results obtained, a synthesis of recommendations was made for the further development of the legislative framework and steps for the implementation of technological innovations. Thus, the study combines qualitative and quantitative approaches, which allows for a holistic view of the state and potential of innovative technologies in public financial management.

Despite the complexity of the methods used, the study has several significant limitations. First, a significant part of the statistical data comes from official government sources and may contain certain errors or information gaps related to political or economic conditions. Second, the geographical sample of cases is focused mainly on countries where there are favorable conditions for the introduction of technologies, which limits the possibility of extrapolating the results to regions with a low level of digital maturity.

In addition, the study does not fully cover the social and cultural aspects of the population's interaction with new financial services. The review also does not examine in detail the long-term macroeconomic effects. Most technology initiatives are relatively new and the empirical basis for assessing them from the perspective of long-term impact is limited. Finally, the regulatory and legal environment varies between countries, which to some extent complicates the comparison of cases and the generalization of conclusions. Despite these limitations, the results obtained allow us to confidently state the positive impact of innovative technologies on the transparency and efficiency of budget processes.

We see prospects for further research in the analysis of those technological innovations that were not analyzed in this work. In addition, it is possible to change the geography of the study. Also, future research in this area may include an analysis of the long-term prospects for the use of innovative technologies in the field of public finance management.

https://doi.org/10.56294/hl2024.412

RESULTS AND DISCUSSION

The study of budget management has always been relevant. Now we need to understand why, in fact, there is a need for innovative approaches to budget management today. To do this, we will consider the theoretical origins of the relevant concept, as well as the stages of transformation of public finance management. The knowledge of past concepts allows us to better analyze how technological tools can enhance the efficiency of management. These concepts started with theories of minimal intervention and eventually evolved into modern digital solutions. It is also important for the transparency of budget management. Therefore, let's look at the relevant development.

The evolution of theoretical approaches to public finance management covers several key stages. Each of them was formed under the influence of different historical and economic conditions. The first stage is usually associated with classical political economy (XVIII – early XIX centuries), whose representatives emphasized minimal state intervention in economic processes. Their main idea was that market mechanisms are capable of ensuring efficient resource allocation on their own. They saw the task of the state in promoting fair taxation and law and order.[25]

In the second half of the nineteenth and early twentieth centuries, neoclassical theory developed. In general, it continues the traditions of the classical school. However, it pays more attention to the rational behavior of economic agents. In addition, supporters of this theory emphasize the need to find a balance between supply and demand.[26] The state should establish legislative regulation, but mostly refrains from excessive interference. This approach was based on the belief in the effectiveness of market self-regulation.[27]

The Keynesian school (first half to mid-20th century) made adjustments to this model. John Maynard Keynes and his followers demonstrated that market mechanisms are not always able to overcome crises. The Great Depression of the 1930s was a well-known example. Therefore, the state is assigned an active role in stimulating economic growth through budgetary and monetary instruments. Keynesianism created the basis for the expansion of social programs and large-scale redistribution of resources through the state budget.[28] The next breakthrough occurred in the late 1970s and 1980s. Then the ideas of monetarists and neoliberals began to spread. They emphasized the importance of controlling finances. The main goals were to fight inflation and also to improve public finances by optimizing budgets and cutting social expenses.[29]

The current stage is characterized by the genesis of different approaches. In addition, the public finance management system is currently being affected by the emergence of new concepts such as new public management and network governance. Public authorities use private sector tools to improve the efficiency of public service delivery. The emphasis is on transparency, accountability, and efficiency. Thanks to digital technologies, public finance management is moving to a new level. Digitalization allows for better control over revenues and expenditures. In addition, technological tools are used in budget planning. All of this allows us to talk about a new stage – the era of technologized public finance.

It should be noted that the concept of innovations in finance covers a wide range of innovations aimed at improving or radically transforming financial management. We believe that the main goal of such innovations is to increase the efficiency, transparency and reliability of financial transactions. In addition, innovative technologies provide a greater level of adaptation to the economic climate, which is in constant change. Financial innovations are based on the idea of introducing new or improved models of interaction between different actors in the financial system. Researchers identify several main types of innovations in finance depending on the nature and scope of application, including product, technologies, management and marketing innovations (figure 1).

Figure 1. Types of innovations in public finance management

If we briefly consider the relevant innovations, the following features can be noted in table 1.

Table 1. Characteristics of innovations in the public financial sector

	Product Innovations	Technological Innovations	Organizational Innovations (management)	Marketing Innovations
Brief Description	Development of financial products expanding access to financial instruments.	Introduction of technologies that optimize financial processes, both internally and externally.	New approaches to public agencies managing. Involve changes in mechanisms for coordination and control.	Use of new methods for promoting financial services.
Examples	New types of securities; cryptocurrencies; innovative insurance products.	Automation; Big Data; AI; Machine Learning-based forecasting tools; Blockchain.	Decentralization of budget planning within government agencies, Implementation of KPI systems to evaluate public servants' activity.	Mobile apps and digital marketing.
Interaction with Public Finance	Increasing budget revenues via issuance of innovative government bonds. Broadening the range of public services.	More transparent and efficient management of budgets and public funds. Automated monitoring of expenditures to detect corruption. Also, reducing bureaucratic procedures.	More efficient of state resources use and increased transparency.	It creates opportunity for citizens to directly influence budget spending.

Given the four main types of innovations in public finance management, it can be argued that a full transformation of the financial sector requires a comprehensive implementation of innovations at all levels. Each of these types of innovations has its own specifics and scope. However, their combination contributes to the efficiency of financial transactions. In the context of public finance, this systemic modernization allows for more efficient management of public resources. Innovation also actively promotes public involvement in financial decision-making.

We would like to note that the topic is very comprehensive. Therefore, in this article we will focus on technological (process) innovations. We believe that they have the most significant impact on transparency and efficiency of public finance management. Digital transformation makes it possible to automate routine processes in the context of the distribution and management of public funds. In addition, the introduction of technology reduces the administrative burden and ensures more correct planning of budget expenditures.[30] As a result, authorized bodies can timely identify deficiencies in financial transactions. This is also important for ensuring democratic principles, as the public can receive prompt reports on the funds spent.[31]

So, here we review a few examples of the application of innovations and their practical significance. Thus, electronic platforms for public procurement are an example of technological innovation. They are being implemented to increase transparency and fight corruption.[32] From a scientific point of view, the introduction of electronic public procurement is based on the concepts of data openness and e-governance. The use of Internet technologies for holding tenders and open access to information about them creates an environment where every participant or third-party observer can track key stages of the procurement process.[33] This reduces the risks of corruption and inefficient use of public resources. Also, transaction cost theories indicate that automation of the procurement process and standardization of procedures can reduce costs for the state.[34]

One of the well-known examples of such systems is the Ukrainian platform ProZorro. Since 2016, it has become mandatory for use by all public customers in accordance with the current legislation of Ukraine.[35] The role and importance of ProZorro is primarily to create a competitive environment. Thus, thanks to the public announcement of tenders, new suppliers can join the bidding process without artificial barriers. In addition, the system provides open access to all key data on tenders. This approach allows the public to carry out independent monitoring. In the context of public finances, such platforms help to rationalize costs through active competition among contractors and reduce the possibility of closed agreements.

A significant step in the adaptation of public procurement in Ukraine was the approval of new procurement rules under Resolution of Cabinet of Ministers of Ukraine No. 1178, 2022. Its main provisions include the following: the terms of public procurement are almost halved; tenderers can submit an offer higher than the starting price, which will allow for a more flexible response to exchange rate fluctuations and not overestimate the expected cost; virtually unlimited use of Prozorro Market, a tool that allows for the purchase of standard goods based on the principle of an electronic catalog, is allowed.[36] These and other measures will increase the efficiency of public procurement.[37]

According to official reports of the Ministry of Economy of Ukraine, during the first years of ProZorro's operation, billions of hryvnias of budget funds were saved due to increased competition and lower starting

prices at tenders. In particular, some analysts note that the level of competition in the system has increased to an average of 2-3 bidders per tender. In addition, the ProZorro platform is actively studied by civil society organizations, which confirms the high level of data openness and allows us to talk about the effective reduction of corruption risks.

According to the 2023 Report of the Ministry of Economy of Ukraine, more than 3,55 million procurements were announced with a total expected value of over UAH 1,23 trillion. The increase in the number of procurements in 2023 was 20,34 % compared to 2022. The largest number of procurements concerned the following categories: structures and materials, food, repair and maintenance.[38] Thus, ProZorro is an exemplary case of technological innovations in the sphere of distribution and management of public funds. This platform combines transparency and process automation. This helps to increase trust in public institutions and create a positive investment climate.

The second case of technological innovation in the public finance sector is the application of Big Data. The use of big data technology and advanced analysis tools helps to efficiently process large amounts of data. They can help financial managers complete the search and analysis of information faster.[39] It even can perform such analysis on their own with minimal supervisory intervention. Thanks to the high speed of processing and analyzing large amounts of information, government agencies can improve the accuracy of budget planning.

Technological solutions based on Big Data allow forecasting budget revenues and identifying key areas of spending. In the first place, big data analytics reduces the level of uncertainty in budget calculations. Such models add the ability to simulate scenarios based on historical indicators and current economic trends. Big Data also contributes to the fight against corruption and fraud.[40] For example, specialized machine learning algorithms allow detecting misuse of funds based on complex correlations. Thus, in the public sector, big data is becoming a tool for introducing transparency and accountability. In general, it fits quite logically into the concepts of e-Governance and Open Data.

Among the examples of practical application, Singapore is a good example. Here, big data in the public sector is implemented through the Government Technology Agency (hereinafter – GovTech) in Singapore. This institution actively develops and integrates digital services for various government agencies, including the Ministry of Finance. GovTech has implemented a large-scale data processing infrastructure that allows for the unified collection and analysis of financial information from various agencies. On this basis, the government generates analytics on revenues, expenditures, and socioeconomic indicators in near real time.

With the help of machine learning algorithms, Singaporean government agencies receive forecasts of tax revenues, infrastructure and social protection expenditures. This contributes to more accurate budget planning and prioritization of development policies. GovTech has also developed tools to detect potential violations. For example, if the system detects suspicious transactions or abnormal patterns in spending, the responsible authorities are notified for verification.[41]

According to the McKinsey Global Institute, the improvement of public services based on Big Data can lead to budget savings of 8-15 %, depending on the initial level of digital maturity of the country.[42] In Singapore, according to GovTech's public statements, the introduction of advanced analytical solutions has allowed to: reduce the time for approving budget programs (by about 20-25 %); increase the accuracy of financial forecasts by 20 % and reduce bureaucratic delays. Singapore's results demonstrate the high potential of using big data to optimize financial management.[43]

Thus, in the context of public finance management, big data is a key driver of digital transformation. The Singapore case shows that with proper support and a developed IT infrastructure, it is possible to significantly improve the efficiency of budget al.location and increase the transparency of financial transactions. Today, Singapore is one of the richest countries in the world and has a reputation as a model in almost all socioeconomic categories. Therefore, we can say that the digitalization of the public sector is a successful initiative. It also contributes to the growth of public trust in government institutions and ensures the sustainability of public finances in the face of rapid socio-economic change.

The third innovative element of public finance management improving is the use of artificial intelligence (hereinafter – AI). The involvement of AI in the public financial sector opens up new opportunities for managing budget processes. Thanks to the ability of algorithms to process large amounts of data and identify hidden patterns, government agencies can make more informed decisions. In addition, AI is impartial, which guarantees the purity of its use and minimizes corruption risks. This issue is currently being actively discussed in various institutions.

For example, in February 2024, the Council and the European Parliament agreed on a reformed EU economic governance framework, which aims to provide greater clarity and predictability for fiscal policy and debt sustainability, while promoting sustainable and inclusive economic growth via stronger incentives for reforms and investments addressing country-specific challenges and common EU priorities. One element in this strategy should be the implementation of AI-based fiscal reporting.[44]

The use of AI-based algorithms significantly improves the accuracy of budget planning forecasts.[45] This efficiency is achieved due to the ability to process a large amount of data on past and current financial indicators. Its use allows governments to respond more quickly to changes in the economic environment. Moreover, AI is

effective in the fight against fraud. It can be used to detect suspicious or atypical transactions. Such algorithms have long been used in financial institutions. Currently, AI can analyze millions of transactions in real time and signal deviations from normal spending patterns. The role of AI in optimizing public services should not be dismissed either. It helps automate routine processes, reducing waiting times and administrative burden.

Since we have already drawn attention above to the EU's interest in introducing AI into the sphere of budgetary control, it is appropriate to consider as an example an EU member state where such an innovation is already functioning. And in the following, we will pay attention to Estonia. This country is one of the leaders in the implementation of artificial intelligence in the public sector. Estonia is implementing a comprehensive Kratt AI initiative as part of the e-Estonia digital state strategy. The Estonian model pays considerable attention to data integration and creating conditions for the prompt exchange of information between different agencies.

In particular, thanks to the special X-Road platform, ministries and other government agencies can work with financial and social databases in a coordinated manner. Joint actions ensure more effective control over budget expenditures. In addition, it speeds up mutual communication and thus allows for a faster response to detected violations. Chatbots are widely used in public services related to finance (e.g., tax returns). This approach significantly reduces the administrative burden and minimizes the number of human errors. The benefits include transparency, of course.

According to the official e-Estonia Briefing Center (2024), the introduction of AI tools has led to a significant improvement in the quality and speed of service for citizens and businesses. In particular, the processing of standard requests using chatbots has reduced waiting times by about a third. The accuracy of identifying potential fraudulent schemes when monitoring government transactions has increased by a quarter. Generally, Generative AI can boost Estonia's GDP by up to 8 %. In addition, Estonia's extensive digital infrastructure has reduced overall administration costs, as a significant number of procedures have been converted to electronic format. According to the report the E-Leaders Handbook on the Governance of Digital Government, this approach has strengthened the authorities' ability to respond quickly to socio-economic challenges.

Thus, AI is one of the key drivers of digital transformation in the public finance management system. As the Estonian experience shows, the targeted implementation of AI algorithms contributes to the transparency of public spending, reduces the time for routine operations, and reduces the risk of corruption. At the same time, it creates preconditions for improving public services.

The last promising element we will pay attention to is Robotic process automation (heteinafter – RPA). RPA is one of the most promising areas of technological modernization of the public financial sector, as it allows to reduce time spent on routine operations. RPA refers to a generic collection of automation tools for automating any manual operations. In essence, RPA systems consist of software robots that imitate human actions, but do so at a much higher speed and without stopping for rest. In the public sector, such a solution is especially relevant for managing budget funds, as financial processes often include formal procedures for processing applications, verifying tax returns, etc. RPA is considered an effective tool for reducing administrative costs. This approach is consistent with the concepts of lean public administration and transparency.

An example of successful RPA implementation is the experience of UK government agencies, in particular Her Majesty's Revenue and Customs (heteinafter – HMRC), which has implemented robotic automation for processing tax forms and refunds to taxpayers. According to official information, this has reduced the workload on staff by about 20-25 % and reduced the time to respond to typical citizen requests on 40 %. As a result, HMRC was able to focus more on complex tasks. From a scientific point of view, the introduction of RPA fits into a broader automation trend. It is intended to enhance the overall digital maturity of the public sector.

The synergy of robotic automation with other innovative technologies creates conditions for a comprehensive restructuring of management processes. In these processes, human resources are redistributed to analytical and strategic areas, and routine tasks are transferred to software assistants. According to Deloitte's estimates, in Western European countries, cost savings due to the introduction of RPA in government agencies can range from 10-30 %, depending on the complexity of the processes and the scale of robots' use. In sum, we can state that robotic process automation is becoming an important tool for modernizing financial operations in the public sector.

Thus, we have considered four innovative technologies that can be applied to improve public finance management: public procurement platforms, Big Data, AI, RPA. Each of these elements is already being applied in practice and has proven its effectiveness. Of course, these are far from all the innovations that can be applied. However, their list is so large that they cannot be studied within the framework of one article. Therefore, we have chosen those innovations that are currently the most discussed and interesting. In addition, their potential goes far beyond their current application, which makes them interesting for research.

The successful practice of implementing technological innovations is confirmed by numerous statistics. It demonstrates the positive impact of digital solutions on the efficiency of public funds allocation and management. However, the implementation of such tools inevitably requires consideration of a number of organizational and legal issues, without which even the most advanced platforms risk failing to deliver the expected results.

https://doi.org/10.56294/hl2024.412

First of all, there is the issue of organizational changes. This aspect involves restructuring work processes in the public sector and retraining personnel. For example, the transition to robotic systems requires civil servants to master new skills. The lack of proper training programs and staff motivation systems can lead to low efficiency in the use of the introduced technologies. In addition, coordination is needed between different agencies, which often work with separate databases that are not always compatible with each other. This requires the creation of unified standards for information exchange and harmonization of procedures for accessing confidential data. It is necessary to provide organizational and informational support, so that the recommended norms are implemented in practice and the level of trust in AI increases.

On the other hand, the legal framework is no less important. Legislation regulates information processing and establishes liability for possible violations. This primarily concerns legislation on personal data protection and cybersecurity (). In many countries, there is currently a lag between legal norms and technological realities, when existing laws do not take into account the specifics of digital operations. Often, legal acts provide too narrow an interpretation of the concept of electronic or automated interaction.

In addition, the introduction of robotic systems for managing budgetary processes will also require significant amendments to national legislation. Among the possible obstacles is the limited financial resources, especially in a situation where the state budget is already under significant strain and there is a high need for social spending. Government digitalization programs often require significant investment. In addition, some regions may lack basic technical capabilities. However, to improve the situation, a number of practical measures can be taken to facilitate the process of introducing innovations in public finance.

First of all, it is advisable to conduct a detailed analysis of the current components of the state's financial activities. This includes working procedures, technical support, relevant legislation and personnel. We believe that such an audit is appropriate or to identify all possible shortcomings of such implementation. In particular, elements where the introduction of technology faces legal restrictions. And also the possible lack of necessary coordination between agencies. Without a preliminary diagnosis of the real picture, it is difficult to determine the optimal strategy for change.

Further, based on the audit results, it is advisable to implement specific measures. Of course, these measures may vary greatly from country to country. However, below we have identified a number of measures that can be generally applied in most countries to ensure the effective implementation of technology in budget management. Based on the results of the audit, it is worth creating a phased plan, the so-called Implementation Roadmap. This document defines the concrete measures and timing of the necessary changes. The roadmap should include milestones to measure progress and, if necessary, adjust further steps. It is important that this plan is approved at the governmental level.

The next step is to introduce legislative changes. New regulations may be required in the course of technology implementation. It is worth developing and adopting appropriate amendments to the budget code and a number of relevant laws. After this comes the stage of practical measures. Technological implementation will not be successful without adequately trained personnel. Training programs for employees should be conducted. Measures should also be taken to develop digital competencies among department heads. To ensure the smooth implementation of technologies, a special department should be designated to be responsible for the integration of digitalization projects. Coordination at this level will help to avoid duplication of functions and ensure consistent use of data.

Along with the introduction of technology and the updating of legislation, mechanisms for protecting data security should be improved. Clear rules on the storage of confidential information will facilitate the safe operation of innovation platforms. The final, but extremely important step is to create a transparent system for evaluating the effectiveness of implemented solutions. In general, these steps make it possible to organically integrate technological innovations into the public financial sector, supporting them with a systematic approach from the regulatory and organizational framework.

Thus, the organizational and legal aspects of introducing technological innovations in the public financial sector play a crucial role in determining how productive such initiatives will be. Only with a comprehensive approach will technologies be able to reach their full potential. Ultimately, this will contribute to a more transparent and result-oriented public finance management system.

CONCLUSIONS

The study confirms that the introduction of innovative technologies is a key factor in the modernization of public financial management. The use of the latest technologies can increase transparency, reduce operating costs, and significantly speed up decision-making in the budget sector. An analysis of global experience based on the example of the countries under consideration shows that technological transformation brings tangible economic benefits. It can be expressed in the form of budgetary savings and improved public services.

An important component of success is the systemic integration of innovations. It is not just about integrating technological innovations. The system involves restructuring approaches to planning, monitoring, and controlling

public resources. A scientific analysis of statistical data shows that the combination of advanced solutions significantly increases the level of public oversight and creates a new standard of accountability. This approach helps to adapt to global challenges.

At the same time, the implementation of these technologies requires a balanced approach to the legal and organizational framework. Although the latest technologies are indeed promising, there are significant limitations to their regulatory framework. In addition, there is the issue of proper data storage. For example, the problem can be traced to the use of artificial intelligence, as the relevant algorithms require a sufficient amount of high-quality data for their effective operation. The experience of implementing innovations in different countries shows that without an adequate level of clear methods for assessing the impact of innovations, it is difficult to achieve the expected results. In addition, transparent and effective communication with the public helps to support reforms.

The findings suggest that the synergy of innovative technologies, legal improvements, and organizational changes creates preconditions for a qualitative increase in the effectiveness of public finances. In the long run, this may contribute to a significant strengthening of budget discipline. The consistent expansion of digital solutions in public institutions can minimize corruption risks.

As follows, summarizing all stages of the study, we can state that innovative approaches to public finance management are not only a technical re-equipment of existing mechanisms, but also a deep renewal of the management culture. The combination of the latest technologies opens up opportunities for a more effective budget process. Further success in this direction will largely depend on the willingness of government structures to implement systemic reforms and maintain interaction with the public. Nevertheless, given the pace of digitalization, governments should take appropriate measures as early as possible. After all, a high level of technology and a transparent sphere of public finances are a ticket to creating an appropriate investment climate. In general, technological sophistication and transparency of finances will bring states to high levels of global competitiveness.

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FINANCING

No financing.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORSHIP CONTRIBUTION

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