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Review Paper

Engineering Implementation Mechanisms in the System of Public Administration

Oleksandr Nepomnyashchyy[1*], Yurii Prav[2], Oksana Medvedchuk[3], Iryna Lahunova[4] and Iryna Kharaim[5]

[1]Department of Computer Technologies of Airport Construction and Reconstruction, National Aviation University, Kyiv, Ukraine
[2]Department of Information Security, Faculty of Cybersecurity, Computer and Software Engineering, National Aviation University, Kyiv, Ukraine
[3]Department of Public Administration and Information Management, University of New Technologies, Kyiv, Ukraine
[4]Department, Interstate Consultants Engineers Guild, Kyiv, Ukraine
[5]Department of Public Administration, Interregional Academy of Personnel Management, Kyiv, Ukraine

*Corresponding author: tvkurus1@ukr.net (**ORCID ID:** 0000-0002-5766-3150)

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ABSTRACT

The article is devoted to determining the mechanism for implementing engineering in the public administration system using the example of Ukraine. The study aims to consider the current state of the public administration engineering system and identify critical areas for its improvement. The research uses methods of statistical analysis, a critical analysis of scientific literature, and foreign experience in the introduction of engineering in modern public administration systems, the systematization of information on the implementation of progressive systems in public administration. The inductive and deductive methods determined the components of the mechanism of engineering introduction and built the concept of its implementation in public administration. The study's results include an analysis of the foreign experience in public administration system engineering, determining its need for Ukraine, and the possibility of implementation in the current state of Ukraine. Studying foreign experience in engineering administrative processes allows for drawing appropriate conclusions about the potential opportunities for developing this direction in Ukraine. Engineering is not only necessary, it can be implemented, but it is essential to use reasonable methodologies and modern tools and set adequate tasks solved by public administration at all levels. The main components of the engineering system are determined by the document flow digitalization, the formation of a unified communication and information system, and the formation of the possibility of providing public services through online applications. The article shows an example of the application of DIIA used in public administration in Ukraine. The practical significance of the study lies in the possibility of applying its results to the improvement of the electronic system of public administration.

HIGHLIGHTS

- The article is devoted to determining the mechanism for implementing engineering in the public administration system using the example of Ukraine.
- The study aims to consider the current state of the public administration engineering system and identify critical areas for its improvement.
- The practical significance of the study lies in the possibility of applying its results to the improvement of the electronic system of public administration.

Keywords: Engineering, public administration, mechanisms of public administration, project management, Diia, e-government

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There are many problems in the sphere of public administration in Ukraine, which the population and businesses face regularly. Unfortunately, most of these problems look hopeless today and cannot be solved in the current public administration system. People stand in long queues for civil servants, carry lots of documentation, and civil servants with no answers to business questions – all these are the realities in the business sphere of public administration services for citizens of Ukraine.

Complex procedures, outdated tools, and vague goals entrenched today in public administration are unacceptable in private business. Market requirements require quality and fast services with high service because if the company cannot create such services, it goes out of the market and exits. And only on the governmental level of reforms, changes, and modernization of new programs and applications make only the visibility of functional transformations. Still, ordinary citizens and businesses perceive all these improvements as another obstacle at the state level.

It is necessary to admit that the Ukrainian public administration system is arranged insufficiently effectively. It creates queues and dissatisfaction among the population and impedes economic growth. Modern consumers of state services demand fast procedures and decisions, less bureaucracy, and better quality of service in state authorities. All these questions can be solved immediately – with personnel training, technical equipment, and increased administrative apparatus expenses. Another more progressive option is to adapt to the progress of technology and permanently remove all elements of inefficient operation from public authorities. It is a radical, quick, and low-cost solution for the state. At the same time, "new technologies" and "innovations" should not be a one-time action to introduce a new program on outdated computers in civil servants' offices but a systematic approach. This engineering solution requires rigorous design, flexibility, technical support, and significant expenditure of significant resources to bring all processes of public administration to a single perfect system.

Mechanisms of the introduction of engineering into the system of public administration are complicated. Still, the successful foreign practice, which shows the possibility of practical implementation, and the urgent need for integrative processes in the conditions of post-war state reconstruction should become an important goal and motivation for forming such a state-building system. Moreover, the country's high intellectual potential allows the idea's implemented quickly, qualitatively, and inexpensively.

The purpose of the study is to consider the current state of the system of engineering in public administration and identify critical areas for its improvement.

Literature Review

Interest in engineering technologies in public administration emerged as early as the 1980s during the world's information systems development. Firstly, as a management technology, engineering in the private sector became a revolutionary enterprise transformation method and radical business process restructuring based on automation. At the same time, in practice in the field of public administration, reengineering is used more often than engineering because public administration systems in all countries have already been formed and therefore require not construction, but improvement, i. e., reengineering. Hammer M. (1990) is considered the author of the reengineering theory. He defined the essence of engineering as the fundamental and radical design of a company's business processes to achieve tangible improvements in such indicators as cost, service, quality, and rates.

The application of system solutions in public administration occurs according to different models. In particular, the U.S. and other developed countries use the Zachman model. This author introduced the concept of enterprise architecture in business organization. Zachman J. (1987), in his article "A Framework for Information Systems", first referred to his concept as the architecture structure of information systems and later as the structure of enterprise architecture. From this article came the idea of government "architecture" and its derivation of government "engineering" as the process of creating architecture.

More than forty years have passed since the emergence of the theory of engineering in public administration. During this time, the theoretical ideas of scientists and practitioners have been fully or

partially implemented in the public administration systems of different countries. At the same time, it should be noted that the full implementation of e-government systems in all areas of general regulation is rarely observed (Mihaiu *et al.* 2010). Comprehensive, systemic solutions focused on customer satisfaction have been implemented in Korea, the United States, and European countries (Kaminska and Kaminskyi, 2008). For example, in the USA, the public administration apparatus represents a social and economic complex, where the government acts as a single organization providing services to the population. The move to e-government has not only modernized the management process in the U.S. but has also reduced the costs that government budgets face (Herrnson *et al.* 2008). Many other countries are adopting engineering to solve pressing problems in public administration, such as – long lead times. For example, Estonia, Canada, and Britain have recently undergone public administration reforms (Kaminska and Kaminskyi, 2008).

It is worth emphasizing that such systems are not implemented in the most developed countries but in countries where digital technologies are actively developing, such as Korea. Beschel *et al.* (2010) note that Korea's system has been at the forefront of digital government engineering since 2010. Weerakkody *et al.* (2011) show in their study the successful experience of Britain and Denmark in the application of e-government, which also covers a fairly wide range of public services.

In general, the literature analysis shows that digitalization is the main component of public administration engineering implementation. In this case, the first stage of implementing such mechanisms is total electronic document management. After that, all the work of public authorities should be performed without paper documents, using digital signatures and other identification tools.

Public administration engineering in developed countries performs the essential tasks:

- Enables communication between the public administration apparatus and the population;
- Allows all documentary processes to be conducted digitally;
- Provides a flow of information on the use of state or regional funds;
- Provides an opportunity to formalize a public service for the population and businesses.

Iceland is a prime example of an effective communication process (Suteu, 2015). The island state became an example of a unique experience in the electronic participation of citizens in the discussion and development of the country's draft Constitution, which is public crowd-sourcing. Every week, members of the Constitutional Assembly posted new provisions of the Constitution on the Internet portal and collected and processed citizens' suggestions. The most popular social networks, like Facebook, Twitter, YouTube, etc., were actively used. All assembly meetings were also broadcast online and were open to the Internet. Crowd-sourcing the Icelandic Constitution was made possible solely by the presence of 95 % active Internet users. The essential communication element between the population and the state is the election. For example, in the U.S. elections, electronic voting machines simplify the process for the state and the citizens. Due to this innovation in the electoral system, voter turnout increases, which is virtual in nature (Herrnson *et al.* 2008).

A successful example of effective interaction between different public services is the Estonian e-government system (Kattel and Mergel, 2019). As the study points out, there is no single data repository in the country; all information is distributed among different institutions. State institutions can exchange data using the X-road system, but all movements are tracked. Every action of a person or official requesting information leaves a digital trail.

At regional levels, such systems are standard in every developed or developing country. For example, local (or regional) management systems are used in Italy, particularly in the Port of Genoa. The automated system helps to build an optimized management system that has radically changed the level of public administration (Battilani, 1996).

Through e-government systems, issues are addressed not only in the context of a particular location but also in the context of specific tasks. For example, in Britain, Denmark, and Canada, it was essential to

solve the problem of the long time taken to receive documents. As a consequence, the system of quick issuance of documents, just in time, was introduced. The practical implementation results showed the effectiveness of such measures and, in a fairly short period, achieved high results, which through the use of digital technology will reduce the time of a particular administrative service (Shpinyova, 2021), which is especially important for businesses that need approval documents. In the United States, for example, the use of such systems for business registration saves not only time but also money. So, if getting a license or its renewal costs 7 dollars through a cash register, through the application, the business pays 2 dollars (Chaltseva, 2017).

The interest of public authorities in Ukraine in engineering technology arose in connection with the project of administrative reform and the intention of the leadership to create e-government in stages in 2010. This led to the emergence of interest in the topic on the part of scientists. In particular, Todorova T. (2016) showed in her article the issue of how important the industrial engineering approach is for public administration, where the state is perceived as the only organization that works for one result - general satisfaction. The importance of electronic forms of public administration was described by authors Kaliushko and Demkova (2004), Korotych (2006), Lipentsev and Polyak (2008), Chaltseva and Lavrishcheva (2017), Shpinyova (2021) and others. E-government is part of the formation of government branding, which is accompanied by a high level of public trust (Petrenko *et al.* 2022). Researchers from other countries have conducted similar studies in the context of other developing countries. For example, Saxena K. (1996) showed in her research the importance of engineering in public administration in South Africa.

But despite a sufficiently large number of studies in the field of engineering or construction of the electronic state, the question of the practical implementation of this mechanism remains open. Given the current situation in Ukraine, when the country is rapidly integrating into the European Union, such practical solutions should be real, executable, and inexpensive.

Methods and Methodology

The analysis of scientific literature on improving public administration and state management unified electronic systems formation forms the theoretical basis of the current study. Critical literature analysis allowed identifying foreign experience in implementing such a concept. Systematization of information allowed determining different approaches to engineering. A comparison of historical facts and the Ukrainian situation allows for determining how foreign public administration mechanisms can be implemented in Ukraine and what methods and techniques are necessary to implement such a project.

Ukraine's legal and regulatory framework was investigated to determine the current state of public administration in Ukraine and to evaluate its architecture. These are the fundamental laws that make the use of e-government systems real. In addition, to study the potential of public administration and its comparison with other countries is used the UN rating for e-government development. The organization uses the e-government development index, which has the abbreviated name of EGDI. According to the UN methodology, the critical elements of e-government are the availability of technical capabilities to form such a state, the willingness of people to work in such an environment, and online public services.

The application of inductive and deductive methods made it possible to find the problems of the current architecture of public administration and show the directions of its engineering.

Research Results

Before considering the mechanism of public administration engineering, let us define the mechanism in terms of management. Korotych (2006) and Lipentsev and Polyak (2008) denote that the management mechanism is a category that includes:

- Purpose of management, social potential;
- Elements of management and interconnections;
- Solution methods;
- Material and financial resources.

Based on this structure of the management mechanism, it is possible to determine the components of the engineering implementation mechanism in the public administration system.

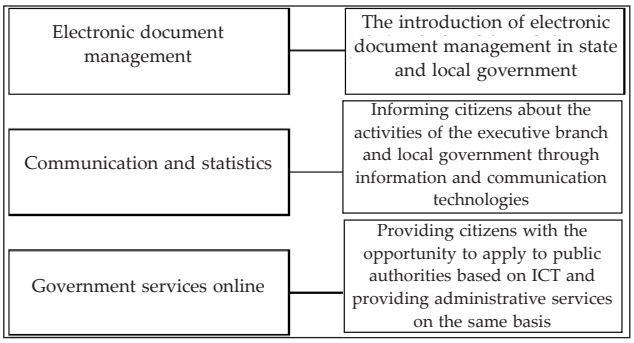
The purpose of the management system engineering

The introduction of the engineering mechanism into the public administration system is an essential prerequisite for developing an effective digital economy and digital market in Ukraine and its further integration into the EU Digital Single Market Strategy for Europe. This goal lies within the framework of the implementation of the Association Agreement between Ukraine and the European Union, where Ukraine should ensure the comprehensive development of e-government following European requirements. The main goal of state management system engineering is to increase the level of business activity in the state and the population's satisfaction.

The tool to achieve the goal is creating a single program or application of public administration which integrates all state services.

Elements of governance and interrelationships

Considering the studied foreign experience, we can find the main elements of the digital public administration system (Fig. 1).



Note: *systematized by authors based on Kaliushko and Demkova (2004).*

Fig. 1: Main elements of the digital public administration system

According to the adopted laws "On electronic documents and electronic document flow" (2003), electronic documents have a similar force to paper versions. According to the law, an electronic digital signature is a tool to create a legal basis for electronic document flow, enter into agreements, regulate relations between state entities, etc. The system of electronic signatures is currently in operation, but there is no uniform mechanism for its use within the state administration apparatus. Applicable legislation in Ukraine allows the formation of a digital product that will enable the public to function with the authorities, public services, and businesses.

Communications and statistics are essential solutions to the issue of government decision transparency and corruption. In our opinion, the application of e-government will help realize citizens' rights to access available public information, increasing their confidence in the government. It should also help to organize the feedback between the government and society and make the dialogue between public administration. In turn, state institutions, when adopting draft laws, should allow citizens to get acquainted with the document, express their own opinion, and only then approve it, making the decision-making procedure more transparent, and practicing the principles of democracy and subsidiarity. Unfortunately, today in Ukraine, it is still possible to influence the governance process with the help of online resources only to a limited extent. One of the available services in e-government in the Ukrainian space is electronic petitions. For example, on the official website of the President of Ukraine, citizens can lobby their petition for the government's consideration by collecting 26,000 votes.

Online government services are one of the promising directions of Ukraine's development. The state has created the portal Diia (diia.gov.ua), where all online state services are collected. A separate group of services on the portal are business services, divided into the following subgroups: licenses and permits; land, construction, real estate; medicine and pharmaceuticals; elevators and certificates; transport; business creation. Services for citizens are placed in the following categories: family; health; pensions, benefits, and entitlements; licenses and permits; security and law enforcement; transportation, land, real estate, construction, certificates, environment, and entrepreneurship.

But despite the rather large amount of work worked out with the application Diia, which many residents of Ukraine use, the issue of engineering the public administration system remains unresolved. It is because the first stage - digitizing all documentation- has not been passed. Therefore all other programs and applications for public services still require

Table 1: Level of e-administration in some countries

Rank	Country	EGDI Level	EGDI Rating	EGDI 2020	Online Service Index	Telecomm. Infrastructure Index	Human Capital Index
24	Poland	Very High EGDI	V3	0,8531	0,8588	0,8005	0,9001
69	Ukraine	High EGDI	HV	0,7119	0,6824	0,5942	0,8591
7	UK	Very High EGDI	VH	0,9358	0,9588	0,9195	0,9292
9	USA	Very High EGDI	VH	0,9297	0,9471	0,9182	0,9239

Source: *UN E-Government knowledge base.*

certification, a live signature, and submission to the relevant organization.

In the last few years, the system of public administration succumbed to many changes, but if we evaluate the work done in comparison with other countries, Ukraine in 2020 ranked 69th in the world for the level of electronic administration with a digital power index score of 0.71 out of 1 (for example, in the U.S. the score is 0.93)

In Ukraine, the process of providing electronic services to the population is only at the initial stage compared to the developed countries in this regard (in particular, in Ukraine, the index of online government services is 0.68, while in Poland, the index is 0.85). Increased access of citizens and businesses to government information – primarily in education, health care, and social security, employment, taxation, licensing and doing business, public procurement, government order, and international trade operations will allow the creation of an effective system of public administration in Ukraine in the future (Chaltseva, 2017).

The indicator on telecommunication infrastructure is also relatively low. Although the Internet is available in almost every home, its quality and the quality of technical equipment are pretty low. So Ukrainians often face the fact that the local authorities can't use their computers or printers, the server hangs up, there is no Internet, etc.

In turn, if we talk about human capital, in other words, the readiness of the population to use online services, the indicator is also not high enough for the implementation of such a project.

Methods for the implementation of the mechanism of engineering of public work are quite debatable. But one thing is sure, any development of complex projects should begin with digitalizing documents and archives. Only in this way is it possible to make the system effective. If we talk about financing the creation of the project, such investments are not significant for the state budget. Given the country's intellectual potential, creating an intelligent product at the state level may become a free or economic project.

DISCUSSION

As the experience of public administration system engineering in Western and Eastern countries shows, digital technologies help the state to reduce dependence on the human factor, which in the long run completely renews the bureaucratic apparatus and reduces the number of civil servants.

Ukrainian society still lacks proper "information awareness" (index 0.86 out of 1). Therefore, a part of the population that does not know how or cannot use digital technologies will always need traditional tax services, executive authorities, social security agencies, etc.

The implementation of digitalization technologies requires quite serious funding, and the feasibility of such investments is due to the possibility of reducing the number of public employees. Thus, given the lack of readiness of the population to digital methods of public administration, the introduction of new technologies always pulls an additional financial burden on the budget rather than savings. Therefore, for such technologies to be cost-effective, it is necessary to:

- Improve the digital skills of the population;
- Improve the quality of the Internet and Internet technologies;
- To allocate more funds for the technical equipment of public services.

According to official data, Ukraine rightfully belongs to first place in Europe in the number of IT specialists – more than 100 thousand specialist

programmers. Their services are used by companies and organizations in most leading countries of the world, and this demand is steadily growing, but not within Ukrainian borders (Vaulina, 2016). The availability and quality of Ukrainian specialists have long distinguished the country in the IT market. IT is recognized as the industry with an urgent need for progressive state development in the post-war reconstruction period. At the same time, today, the state is focused on receiving cash flows from the export of information services, while it could have used this resource to solve problems in the domestic market. The development of an e-government system requires a large number of developers, and they are present in the market. To solve the issue of product development and support, it is necessary to create their own IT hubs, which can make quality products for the state (Shevchenko, 2020). Also, experts and volunteers do a massive segment of the e-government development work, which may be pretty acceptable (Chaltseva and Lavrishcheva, 2017). The development of such public administration systems could be free or economical as further promotion of large IT hubs that can work in the international market to implement similar projects. Thus, to solve the issue of financing or organization of projects, it is necessary to:

- To organize a competition between Ukrainian companies for the best organization of business processes that can be implemented in public administration;
- To assemble a team of product developers and specialists from different public services, which, in active cooperation, will be able to solve all the issues related to the automation of administrative processes;
- Create a support team that responds quickly to service issues and constantly develops the product.

CONCLUSION

Analysis of the current state of the engineering system in public administration has shown that Ukraine stands at the stage of development. At the same time, the potential for creating an effective method of state regulation is high. Furthermore, given the active development of the country's IT industry, the Ukrainian intellectual capital should be focused not only on the export of services but also on the creation of a perfect, unified and effective public administration system.

Today, there are progressive projects in state regulation that could solve the fundamental problems of the population. One such project is Diia, which provides a range of public services for businesses and people. But unfortunately, to date, the tasks of digitalization of public services are partially fulfilled, which does not allow us to feel the positive effect of implementing such a project.

An adequate system of state regulation should begin with digitalizing document flow. At the same time, digitalization should occur not through using a particular program by individual authorities but through creating a unified base, allowing interaction between different government services.

In addition, the state needs to solve the issue of the readiness of the population to use such services, for which it is necessary to increase the level of digital literacy among the population.

Only after passing these stages the engineering of the public service can be implemented technically. Therefore, the main objective of the project is to improve the sphere of public services by creating a single program or application which can solve the following tasks: to conduct two-way communication between the population and the authorities, to receive information and statistics, and to receive the whole range of public services.

As a result, such a public administration system will become transparent, fast, economical, and efficient. The study's practical significance is the possibility of applying its results to improving the electronic public administration system.

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