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# Digital Technologies and Artificial Intelligence in Public Administration: Methods for Evaluating Economic Efficiency

## M.Y. Isohujaeva[*1]

1. International Relations, Economics, and Business" Department, Diplomat University
* Correspondence: dimkasabirov123456789@gmail.com

**Abstract:** Public administration decisions in the field of e-commerce are economically assessed through procedures using digital tools and artificial intelligence (AI). The proposed decision-making framework provides public administrators with tools to measure operational risks so that they can balance costs with revenues, as well as conduct additional cost analysis. Public administration uses advanced tools and artificial intelligence to enhance strategic decision-making capabilities in order to achieve innovative and cost-effective results from the implementation of methods. The proposed method analyzes the predicted problems and benefits using a structured risk assessment system that provides transparent results. Such a methodology allows for a comprehensive assessment of both administrative costs and revenues associated with various options. This research developed mathematical models alongside operational guidelines which demonstrate the actual implementation advantages of digital systems alongside artificial intelligence in governmental operations. Quantitative instruments enable the development of economic evaluation methodologies which demonstrate automation and e-commerce technologies as critical transformative elements in present-day public administrative systems.

**Keywords:** Digital Technologies, Artificial Intelligence, Public Administration

## 1. Introduction

All public administration institutions operating globally are facing modern requirements that require optimization of efficiency and improvement of service delivery quality while reducing costs. Combining modern digital technologies with artificial intelligence systems allows achieving previously unimaginable goals [1], [2]. The current implementation of the technology involves a two-stage process between economic evaluation and risk management, while requiring attention to the constraints of project implementation financing [3], [4], [5]. The research field of digital transformation of governance is becoming more extensive every day, but practical solutions for evaluating the economic efficiency of AI-based solutions are still lacking, especially in the sectors of e-commerce and automation of public services [6].

The aim of the study is to develop and test a method for evaluating economic outcomes in decision-making in the field of public administration. The method includes planned risk assessments and cost-benefit assessments to create an analytical framework that allows officials to assess the value and potential of implementing digital and AI projects.

The results of this study provide important tools to contribute to evidence-based decision support in public administration. The methodological framework simplifies complex governance mechanisms through an evaluation model, helping public officials implement innovative governance technologies on a larger scale. This study presents a

new evaluation method that links cost analysis with economic benefit management and risk management to assess the impact of deep digital transformation on public governance systems.

## 2. Materials and Methods

The research platform provides a framework for assessing the economic benefits of government decisions to implement digital technologies using artificial intelligence [7]. The methodology is useful for evaluating digital solutions because it allows for a structured assessment of the value of a technology solution, the costs of implementing it, and the risks associated with it [8]. The methodology provides quantitative, results-based economic information that shows the operational impact of new management systems being implemented in government operations [9], [10].

Increased efficiency in service delivery and savings in operating costs along with revenue growth define the points at which economic growth occurs. Public services achieve faster transactions through automated checks and more efficient development of tax infrastructure where security benefits arise [11], [12], [13]. Detailed analysis of government outcomes provides full transparency on the increased value that results from the implementation of digital technologies and artificial intelligence in government platforms [14].

Risk assessments are essential methodological components that serve as the basis for decision-making by public administrators [15]. Organizational decisions cover risk areas, which require a comprehensive assessment to identify possible risks and assess them [16]. Risk assessment is performed by examining system failures and privacy breaches in structural flaws of the AI algorithm, coupled with the loss of user trust in system authorities. The assessment methodology enables decision makers to understand potential problems and their associated outcomes through probability analysis coupled with impact assessment. During this process, organizations gain access to strategic risk management tools, enabling them to develop specific plans to effectively manage and mitigate potential threats.

The methodology performs a benefit-risk analysis to determine the total additional costs arising from the implementation of digital technologies and the integration of artificial intelligence-based solutions. The financial framework consists of three components: funding for new hardware and software, employee training, as well as license fees and support costs, and a reserve fund for emergency situations. A realistic assessment of the financial resources required to successfully implement innovative technologies is achieved through a clear cost estimation process within this framework. In addition, the analysis framework demonstrates specific procedures for measuring the benefits of a project against the associated risks and costs, which helps to confirm cost-effectiveness. The evaluation system provides decision makers with clear guidance on choosing possible implementation plans for proposed initiatives and helps to allocate funds to projects that provide the greatest value. The analytical method develops options by comparing the budgetary boundaries of a project with stakeholder requirements and risk severity indicators. Existing thresholds allow the risk categorization process to differentiate between low, medium and high risk levels. The audit system based on cross-sectoral risk assessment shows that basic checks are sufficient for low-risk actions, while high-risk decisions require significant changes or completely new project checks. The method includes capabilities that provide flexibility in response, as well as advanced planning capabilities. The system helps decision makers in public administration make choices with the help of digital support from artificial intelligence that optimizes process flows. Thanks to this methodology, decision makers receive comprehensive assessments of economic effects in combination with performance indicators in management systems and scores reflecting citizen satisfaction and resource sustainability analysis.

### 3. Results

Public administration uses digital technologies together with artificial intelligence (AI) to create simplified administrative operations with greater operational efficiency and lower cost of implementation. The implementation of the system requires periodic economic assessment combined with risk factor analysis. Correctly made decisions allow saving the budget and at the same time providing high-quality services to citizens. This article presents a simple method for calculating the economic efficiency of public administration.

The methodology for calculating the economic efficiency of management decisions in public administration related to e-commerce using digital technologies and artificial intelligence can be presented as follows:

$$E_{gov} = \frac{\sum_{i=1}^{n}(TR_i - R_i) - C_{d,i}}{\sum_{i=1}^{n} T\,C_i}$$

Here:

$E_{gov}$ — Economic efficiency in public administration;

$TR_i$ — Economic benefit of the iii-th managerial decision (e.g., revenue, cost reduction, or efficiency improvement);

$R_i$ — Risk assessment R_i evaluates the iii-th management decision by identifying both its likelihood for creating harm and its potential severity.

$C_{d,i}$ — The implementation of digital technologies and AI together with their associated infrastructure support and user training and licensing costs constitutes C_(d,i).

$TC_i$ — The total implementation costs for the iii-th decision include fixed costs and variable costs which we will represent by TC_i.

The method delivers a structured assessment of economic efficiency which recognizes how advanced technologies work to optimize governance operations.

Economic efficiency assessment method (TR_i):

Calculation of income or savings resulting from the implementation of the decision:

For example, reduction in transaction processing time, automated checks or improvement of tax administration.

Risk identification (R_i):

Identification of risks (financial, technical, social) of each decision:

Errors in the IS algorithms.

Violation of data confidentiality.

Decrease in public trust due to system errors.

Calculation of the value of each risk:

$$R_i = P_i \times D_i$$

Here $P_i$ — is the probability of the risk occurring, $D_i$ — is the financial loss.

Accounting for additional costs ($C_{d,i}$):

Including the costs of:

Purchase of equipment and software and their maintenance.

Training of employees to work with the IS.

Licenses and technical support.

Reserve funds to eliminate the consequences of errors.

Total Cost Calculation ($TC_i$):

Calculate the fixed and variable costs of each decision. \

Plug the values into the formula ($E_{gov}$):

Plug the values into the formula.. If $E_{gov} > 1$, the decision is considered economically efficient.

For example:

The government plans to implement two decisions using AI:

Decision 1 (automated tax audit):

Economic efficiency ($TR_1$) = 1,000,000.

Probability of error ($P_1$) = 0.1, зарар ($D_1$) = 100,000 → $R_1$ = 0.1 × 100,000 = 10,000.

Additional costs ($C_{d,1}$) = 50,000.

Total costs ($TC_1$) = 600,000.

Decision 2 (digitalization of government services):

Economic efficiency ($TR_2$) = 500,000.

Cyberattack risk ($P_2$) = 0.05, зарар ($D_2$) = 200,000 → $R_2$ = 0.05 × 200,000 = 10,000.

Additional costs ($C_{d,2}$) = 30,000.

Total costs ($TC_2$) = 400,000.

Calculation:

$$E_{gov} = \frac{(1,000,000 - 10,000 - 50,000) + (500,000 - 10,000 - 30,000)}{600,000 + 400,000}$$

$$E_{gov} = \frac{940,000 + 460,000}{1,000,000} = 1.4$$

Conclusion:

The obtained value $E_{gov} = 1.4$ indicates the economic efficiency of management using digital technologies and AI. However, additional measures (for example, data encryption, personnel training) should be taken to reduce risks.

The advantages of the method are as follows:

a. Takes into account the risks and costs inherent in digital technologies.
b. Simplifies the comparative assessment of decisions.
c. Suitable for long-term planning in public administration.

When determining the threshold values for risks in making management decisions using digital technologies and artificial intelligence (AI), the project specifics, budget and expectations of stakeholders should be taken into account. The approach to calculating threshold values is presented below.

The basic formula for assessing risks:

$$R = P \times D$$

Here:

$R$ — is the risk (in monetary terms);

$P$ — is the probability of the risk occurring (in the range from 0 to 1);

$D$ — is the amount of loss if the risk occurs.

Approach to determining threshold values:

Classification of risks by criticality:

Low risk: $R \leq R_{\text{low}}$ — losses that do not affect the overall result.

Medium risk: $R_{\text{low}} < R \leq R_{\text{moderate}}$ — a manageable risk that requires additional measures.

High risk: $R > R_{\text{moderate}}$ — a risk that cannot be tolerated without significant changes in strategy.

Probability threshold values (P):

For low risk: $P \leq 0.1$ (the event is unlikely).

For medium risk: $0.1 < P \leq 0.3$.

For high risk: $P > 0.3$ (the event is likely or very likely).

Damage threshold values (D):

Determined based on the project budget and the level of financial stability.

For example:

Low level: $D \leq 5\%$ of the budget.

Medium level: $5\% < D \leq 15\%$.

High level: $D > 15\%$.

Calculation of the threshold value of risk:

$$R_{\text{threshold}} = P_{\text{threshold}} \times D_{\text{threshold}}$$

For each risk level:

Low risk: $R_{\text{low}} = 0.1 \times 0.05 \times B = 0.005 \times B$, here $B$ — is the project budget

Medium risk: $R_{\text{moderate}} = 0.3 \times 0.15 \times B = 0.045 \times B$.

High risk: $R > 0.045 \times B$.


Calculation example:

Let's say the project budget is \$1,000,000.

Low risk:     $R_{\text{low}} = 0.005 \times 1{,}000{,}000 = 5{,}000$

Medium risk:    $R_{\text{moderate}} = 0.045 \times 1{,}000{,}000 = 45{,}000$

High risk: Any value of $R > 45{,}000$ is considered high

Recommendations:

a. Low risk: No additional measures are required in these cases.
b. Medium risk: Take measures to minimize the risk, for example, insure, allocate budget reserves, test solutions.
c. High risk: It is necessary to reconsider the strategy and, if necessary, abandon the decision.

The advantages of the method include: the introduction of threshold values in accordance with the budget and project context; realistic risk analysis, taking into account the probability and harm; the clarity of calculations and results facilitates decision-making.

The article proposes a method for assessing the economic efficiency of decisions in public administration through the introduction of digital technologies and artificial intelligence. During the calculations, the economic benefits, risks and additional costs of decisions were analyzed in depth. The main conclusions are presented below:

1. The importance of assessing economic efficiency

The introduction of digital technologies and artificial intelligence provides great opportunities for making public administration more efficient. In this case, the economic efficiency of each decision is closely related to generating income, reducing costs and increasing efficiency.

2. The need to identify and assess risks

It is important to identify risks in the process of introducing innovative technologies. Citizens lose trust when artificial intelligence algorithms misfunction or data security fails or technical problems arise. Research must define both the probability and monetary effects of each security hazard.

3. Impact of additional costs

The costs associated with the implementation of digital technologies, including equipment, software, staff training, and infrastructure support, directly affect the effectiveness of the decision.

4. Efficiency assessment model

The proposed calculation formula allows you to determine the economic efficiency of decisions. If a decision is economically beneficial, it is advisable to implement it.

5. Strategic importance of innovations

The effective use of digital technologies and artificial intelligence in public administration creates great opportunities for providing quality services to citizens, saving budget funds, and improving the management system.

## 4. Discussion

The described methodology plays an important role in increasing the efficiency of public administration using digital technologies and artificial intelligence. This approach serves as a reliable tool for effective decision-making for government agencies.

## 5. Conclusion

The research develops an organized framework to assess managerial decision efficiency in public management utilizing digital technology with artificial intelligence capabilities (AI). The study demonstrates how technology-based approaches enable complex administrative simplification alongside enhanced operational efficiency with lower costs and higher citizen-oriented services. The proposed framework establishes a decision-making system which allows administrators to use results from systematic risk evaluation with cost data and economic value analysis. Risk thresholds together with comprehensive cost analysis integrated in public administration methods reveal economically sound and creative approaches. The studied results demonstrate a government's capacity to implement digital transformation both through improved resource management systems and increased governance integrity while increasing public trust levels. Further examination of the proposed methodology requires additional research to advance its refinement through inquiry into contemporary AI implications and ethical concerns and framework confirmation across different governance scenarios and practical applications. Additional research into these components will enhance the universal effectiveness of the methodology which supports digital transformation in public administration throughout the world.

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