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METHODOLOGY FOR ECONOMIC ASSESSMENT OF AI IMPLEMENTATION IN PUBLIC ADMINISTRATION

Rapid digital transformations in public administration have made evident the need for extensive methodologies for the evaluation of economic impacts of artificial intelligence (AI) technologies. The goal of this research is to develop a comprehensive framework that would integrate traditional cost-benefit analysis and qualitative indicators for the assessment of tangible fiscal benefits as well as intangible socio-administrative impacts, especially focused on adapting this methodology to the context of Kazakhstan. It thus fills a significant gap in the literature where most conventional evaluation methods overlook factors such as citizen satisfaction, service quality, and policy effectiveness. The research, bringing together thus well-established economic theories with recent advancements in digital transformation, proposes some new conceptual indicators such as Adjusted Net Present Value (ANPV), Adjusted Benefit-Cost Ratio (ABCR), and Adjusted Return on Investment (AROI), as well as additional measures including the Digital Readiness Index (DRI) and the Government Policy Implementation Factor (GPIF). The proposed methodology is based on systematic literature review and document analysis of international case studies and policy reports, which serve as secondary data sources to inform the conceptual model. Introduction of qualitative measures along with financial metrics significantly strengthen the evaluation of AI implementations as learned from cases analyzed from Denmark. On the other hand, the current practices in Kazakhstan entirely

rely on traditional methods for that and underestimates the far-reaching benefits of digital transformation. The findings confirmed the assumption that the integrated approach does yield a more robust context-sensitive evaluation. It offers an applicable model to the field which may guide informed policy decisions and effective AI investment optimization in public administration.

Keywords: Artificial Intelligence, digital transformation, digital government, ANPV, ABCR, GPIF.

Introduction

AI technologies are increasingly taking root in public administration. The global drive toward efficiency, transparency, and service delivery has largely been responsible for this development. The choice of the subject is warranted by the very fast digital transformation witnessed by the governments of the world; among others, successful use cases in Denmark were a testament-the case in point being the integrated cost-benefit analysis frameworks leading to significant operational performance enhancement; meanwhile, in Kazakhstan, new practices are being introduced. That said, there still exists a glaring gap in the literature on comprehensive methodologies for determining both the tangible fiscal benefits and the intangible qualitative improvements associated with AI deployment. This is an urgent issue, as traditional economic evaluation approaches are unable to capture intangible benefits, such as increased citizen satisfaction and higher levels of administrative transparency. The pertinence of this study is further magnified by the fact that there seem to be widespread societal interests in improving the performance of the public sector, combined with an urgent need for well-structured, multidimensional frameworks for evaluation that will adequately assist in informing policy choices and steering future digital investments.

The study object is the economic evaluation of AI in the public administration setting, while the subject is the development of an integrated approach that combines quantitative financial indicators with qualitative service quality and digital readiness indicators. The principal aim of the research is to prove that an evaluative framework equipped with modified financial indicators such as Adjusted Net Present Value (ANPV), Adjusted Benefit–Cost Ratio (ABCR), Adjusted Return on Investment (AROI), including a few other measures like Digital Readiness Index (DRI) and Government Policy Implementation Factor (GPIF), allows for AI to be seen in a broader perspective of value. The secondary goal of this research is through the existing methodologies, critical gaps in present practices will be identified, and the adjustment of an economic assessment model in public administration within Kazakhstan will be formulated. The study, in the

methodological sense, will comprise quantitative approaches such as financial modelling and econometric analysis complemented with qualitative data collection through surveys and expert interviews. The interdisciplinary approach applies principles from economics, public administration, and digital transformation studies to posit the hypothesis that an integrated framework that captures both tangible benefits and intangible benefits will provide deep actionable insights above and beyond what traditional methods yield. The relevance of the theory and practice of this work evidently strengthens the further potential of offering policymakers a replicable and locally relevant model for AI investment appraisal, which could in turn allow further effective decisions and greater performance in the public sector from a digitalization perspective.

Materials and methods

This paper uses a qualitative research design that is founded on systematic literature review and document analysis to examine the economic assessment of such artificial intelligence (AI) technologies in public administration, and to adjust these methods in accordance with the context of Kazakhstan. The main research question is: «How could traditional cost–benefit analysis frameworks be modified and complemented «with qualitative indicators a comprehensive evaluation of AI investments in public administration, and how could such framework be adapted for Kazakhstan's unique policy and institutional environment?» The main hypothesis entails that by amalgamating usual monetary measures with qualitative assessments-such capturing citizen satisfaction, service quality, and policy effectiveness-it presents a more nuanced and contextualized evaluation of the AI's effects than even traditional approaches could.

The research materials form an extensive range of secondary data on published literature from academics, official policy documents, and case studies from Denmark to digital transformation reports. All of these materials are analyzed qualitatively and in theoretical terms to derive insights into both strengths and weaknesses of current methodologies. In this process, the study systematically reviewed at least 15 works by foreign authors in English to assure a robust foundation spanning classical economic evaluation methods and novel approaches for digital governance.

The study was segmented into different stages. The first stage comprised the identification and critical review of the foundational and recent literature regarding the economic assessment of AI in public administration, which yielded an understanding of conventional methods like cost-benefit analysis, econometric models, and multi-criteria decision analysis (MCDA). During this stage, case studies from Denmark about public agencies successfully merging traditional indicators-net present value (NPV), benefit-cost ratio (BCR), and return on

investment (ROI)-were analyzed with qualitative performance evidences. At this stage, literature and official reports served as the primary source for the understanding of core indicators such as processing time reduction, labor cost savings, improvements in service quality, and citizen satisfaction.

Now, the research was conceptualized model building based on those insights. The cognizance of the fact that traditional models leave intangible benefits out requires that this study put up a comprehensive framework with its adapted financial indicators. In particular, it introduced the Adjusted Net Present Value (ANPV), Adjusted Benefit-Cost Ratio (ABCR), and Adjusted Return on Investment (AROI)-and associated new measures like the Digital Readiness Index (DRI) and Government Policy Implementation Factor (GPIF). Thus, for example, ANPV is defined conceptually as:

$$ANPV = \sum(t = 0)^{T}((B_t + P + I_t) - C_t)/(1 + r)^t \quad (1)$$

where B_t= tangible benefits, I_t= intangible benefits, C_t= costs, r= locally adjusted discount rate, and P= weighting factor. Similar alterations are included in ABCR and AROI so that both quantifiable fiscal impacts and qualitative returns are accounted.

What is left is the last stage of the study, which entails merging into these conceptual models what was gleaned from the literature review and document analysis for establishing the state of practice in Kazakhstan. This analysis shows that while the Digital Kazakhstan initiative speaks about the digital transformation commitment of Kazakhstan, the economic assessment processes are still largely traditional cost-benefit measures that undervalue intangible benefits. This study, therefore, relies largely on a very extensive body of secondary data or documented case studies-as it involved no primary data collection, such as interviews or surveys-as sufficient evidence to develop the proposed integrated evaluation framework.

The methodological approach adopted in the research is systematic literature review, document analysis, and conceptual model development. In sum, this enables such close study of both established kinds of evaluation in contexts like Denmark and specific challenges being faced in Kazakhstan leading into an integrated, context-sensitive framework for economic assessment of AI in public administration.

Results and discussion

The economic evaluation of artificial intelligence in public administration has an enormous body of literature with both primary and original innovative works. Foundational works in economic evaluation have identified Boardman, Greenberg, Vining, and Weimer as offering very comprehensive frameworks

for cost-benefit analysis and quantifying the fiscal change or the effect through public sector investments [1]. This is developed by Agrawal, Gans, and Goldfarb, who opened the interplay with AI considerations [2]. They primarily argue that prediction technologies minimize uncertainty and therefore amend the models used in economics. This early literature also intersects empirical research into digital transformation, since Dunleavy et al. argued that now, with digital-era governance, we live in an era in which the public management paradigm needs to be shifted to very different evaluation techniques [3].

The most recent studies have addressed the effects of digital transformation on the public sector. Mergel and Mergel Edelmann and Haug showed how initiatives for digital government transformation give birth to a new kind of public administration marked by efficiency gains and qualitative improvements in citizen-centric transparency and participation [4;5]. This is further supported by empirical studies and policy guidelines from the OECD, which have known much development in understanding how the global government strategies of the public sector systematically are evaluated in terms of AI. The analysis put forth by Hilbert also enriches the understanding of application and economic impact through AI in the public sector by quantifying the profits or benefits from such integration of technology in government operation [6;7;8].

The systematic reviews from Kettunen and Kallio have now addressed digitalization phenomenon into public sector, revealing both the potential benefits and limits while applying AI technologies [9]. Manyika et al. go for a more wholesome view by placing AI in the realm of disruptive technologies and highlighting how they hold transformational promises across the board, including public administration [10]. In public management reform, comparative practices such as Pollitt and Bouckaert underscore how evaluating methods must evolve to continue serving the changing needs in governance [11]. Wirtz, Weyerer, and Geyer particularly address applications for AI in the public sector as well as the challenges such applications face [12].

Moreover, Westerman, Bonnet, and McAfee and Brynjolfsson and McAfee provide necessary groundwork for an understanding of the broader landscape of digital transformation where technological advancements have introduced tremendous changes in both economies and organizations [13;14]. Despite the substantial number of studies, an important research gap remains in the combination of quantitative with qualitative measures that can capture such unquantifiable benefits as citizen satisfaction, enhanced service delivery, and much greater realized transparency. Emerging contexts like Kazakhstan have little information along that line, as initiatives such as Digital Kazakhstan involve

a strong thrust toward modernization of public administration, but evaluation frameworks still remain inconsistent or unsatisfactory.

This, therefore, is one of the research gaps which the current study aims to fill by offering such a methodology that is integrated into the traditional economic evaluation methods to count both tangible and intangible benefits. The Adjusted Net Present Value (ANPV), Adjusted Benefit-Cost Ratio (ABCR), and Adjusted Return on Investment (AROI), and new approaches in the shape of, for example, a Digital Readiness Index (DRI) and Government Policy Implementation Factor (GPIF) could go a long way or improve on the emerging framework for assessing AI investments in public administration. The overall objective would be to bridge the gap between established economic evaluation techniques and the emerging need for comprehensive assessments in digital governance so that they yield new insights and practical tools for policymakers in advanced and emerging economies alike.

In Europe, pilot projects have attempted to apply cost–benefit analysis to quantify the net economic impact of AI investments on public service delivery, yielding measurable improvements in operational efficiency as recorded by Boardman et al. In some instances, the quantitative assessments have been complemented by econometric models that isolate the impact of AI from other factors out there, such a perspective put forth by Agrawal et al., who stated that AI's ability to reduce prediction costs creates a distinguishing factor in the traditional evaluation framework.

To illustrate, the study of Denmark on digital governance integrated econometric techniques and scenario analysis to predict long-term advantages and potential risks based on the qualitative input from public administrators, achieving a balanced view covering both fiscal and non-fiscal outcomes. In the same stride, the public administrations in Finland have been applying multi-criteria decision analysis for socio-economic impact assessment by weighting factors like transparency and citizen satisfaction as also supported by findings from Mergel et al.

Collectively these case studies have shown that hybrid methods-an approach combining conventional quantitative tools with qualitative assessment-offer a finer view and deeper understanding of the effects of AI on public administration.

Kazakhstan's early pilot projects under the Digital Kazakhstan initiative have just begun to incorporate some methodologies, but current practice tends to be fairly conventional, adhering to measurable cost-benefit techniques that fail to assess intangible benefits such as enhanced transparency and citizen trust. This fragmented methodology as per official documentation published on the Digital Kazakhstan website brings to light a significant gap in the Kazakh economic assessment process such that the evaluative practices in Kazakhstan would be

greatly served by an integrated model that combines quantitative rigor with qualitative richness.

Overall, the situations highlight the need for a flexible, all-encompassing methodology that allows some adjustment for context, especially in the case of countries such as Kazakhstan, where a transition to a digital government raises unique challenges and opportunities.

The results of this study indicate that several cases have successfully applied methodologies for the economic assessment of artificial intelligence (AI) implementation in public administration practice. For example, pilot projects in European public agencies have employed cost–benefit analysis and econometric models to estimate the direct fiscal impacts of AI systems while also integrating qualitative assessments through multi-criteria decision analysis. These cases demonstrate that traditional quantitative methods, although robust in calculating net present values and forecasting cost savings, often fall short in capturing intangible benefits such as improved transparency, citizen satisfaction, and overall public trust. An illustrative comparison of methods is presented in the following table 1:

Table 1 – Comparison of methodology for economic assessment of the implementation of artificial intelligence technologies in public administration practice

Method	Advantages	Disadvantages
Cost–Benefit Analysis	Provides a quantitative measure of net economic impact and is well-established; facilitates decision-making by quantifying costs and benefits (Boardman et al., 2018)	Often fails to incorporate intangible benefits; highly sensitive to assumptions regarding discount rates and future projections
Econometric Models	Offers empirical rigor by controlling for confounding factors and estimating causal effects; useful in policy evaluation (Agrawal et al., 2018)	Requires large datasets and careful model specification; may not fully capture non-monetary outcomes
Multi-Criteria Decision Analysis (MCDA)	Integrates both quantitative and qualitative dimensions; adaptable to various contexts and stakeholder perspectives (Mergel, 2016)	Involves subjectivity in assigning weights to criteria; can become complex when aggregating diverse measures
Sensitivity and Scenario Analysis	Captures uncertainties by modeling a range of possible outcomes; useful in risk assessment and strategic planning (Dunleavy et al., 2006)	Computationally intensive and heavily dependent on scenario assumptions; may lead to wide variations in results

Case Studies	Provides detailed, context-specific insights and qualitative data that highlight unique implementation challenges (Mergel et al., 2019)	Limited generalizability and potential selection bias; does not offer easily scalable quantitative metrics
Note – complied by the author		

A careful analysis of these methods reveals that while cost–benefit analysis and econometric models are valuable for their quantitative rigor, they are often insufficient in isolation due to their inability to capture the full spectrum of benefits derived from AI, particularly those that are intangible or qualitative. Multi-criteria decision analysis, despite its subjectivity, offers a more holistic evaluation by integrating diverse stakeholder perspectives and non-monetary factors. Sensitivity and scenario analysis are critical in managing uncertainties inherent in digital transformation projects, and case studies contribute rich contextual insights that are essential for understanding local dynamics.

Danish public administrations have set up a cost-benefit analysis net to assess the economic impacts of artificial intelligence technologies on the delivery of services and the operational efficiency of various agencies. In their totality, Danish agencies have adopted most commonly recognized financial indicators supplemented by qualitative assessments to ascertain both direct fiscal benefits and indirect advantages such as improved citizen satisfaction and reduced administrative errors. This approach enables decision-makers to understand monetary savings not only through AI implementations but also see broader societal benefits contributing to enhanced public service performance.

Key economic assessment indicators in the Danish cases are net present value (NPV), benefit–cost ratio (BCR), and return on investment (ROI). Net present value is calculated by using the formula

$$NPV = \sum(t = 0)^{T}(B_t - C_t)/(1 + r)^t \quad (2)$$

in which Bt signifies benefits in period t, Ct costs incurred in that period, r the discount rate and T the total time horizon considered. Benefit-cost ratio operates similarly, i.e., dividing the sum of discounted benefits with the sum of discounted costs as,

$$BCR = \frac{[\sum(t=0)^{T} B_t/(1+r)^t]}{[\sum(t=0)^{T} C_t/(1+r)^t]} \quad (3)$$

Further adding to the discussion is ROI, which is computed as,

$$ROI = \frac{Total\ Benefits - Total\ Costs}{Total\ Costs} \quad (4)$$

Moreover, these financial parameters are accompanied by operational and qualitative indicators according to which the Danish agencies further scrutinized the overall effects of implementing AI in their operations. A typical example is reduction in processing time which measures the average time taken to process tasks pre-and post-AI implementation. Labor cost savings derive from a comparison of changes in personnel expenditure. While service quality improvements are often measured using survey based performance scores, citizen satisfaction indexes are created via feedback surveys on public perceptions about service delivery. Here under follows a summary table (table 2) of such indicators with applicable formulas or methods and a very short description on the purpose of each.

Table 2 – Summary of methodology for economic assessment of the implementation of artificial intelligence technologies in public administration practice of Denmark

Indicator	Formula/Method	Description
Net Present Value (NPV)	$NPV = \sum(t=0)^{T}(B_t - C_t)/(1+r)^t$	Measures the difference between discounted benefits and costs over time.
Benefit–Cost Ratio (BCR)	$BCR = \frac{[\sum(t=0)^{T} B_t/(1+r)^t]}{[\sum(t=0)^{T} C_t/(1+r)^t]}$	Compares the present value of benefits to the present value of costs.
Return on Investment (ROI)	$ROI = \frac{Total\ Benefits - Total\ Costs}{Total\ Costs}$	Quantifies the overall return relative to total expenditure.
Processing Time Reduction (%)	$\text{Reduction (\%)} = \left(\frac{(\text{Time before} - \text{Time after})}{Time\ before}\right) \times 100$	Indicates the percentage decrease in processing time due to AI.
Labor Cost Savings (%)	$\text{Savings (\%)} = \left(\frac{(\text{Labor Cost before} - \text{Labor Cost after})}{\text{Labor Cost before}}\right) \times 100$	Measures the percentage reduction in labor costs after AI integration.
Service Quality Improvement Measured via survey scores and key performance indicators Assesses improvements in service delivery and overall quality.		
Citizen Satisfaction Index	Aggregated score from citizen surveys	Reflects citizen perceptions and satisfaction with public services.
Note – complied by the author		

An interesting case from Denmark showed that an AI-based digital processing system could cut processing time by 30 percent. This would help to save a quite substantial sum of money on labor costs and improve the quality of service. The system has helped to save operational costs and improved satisfaction among citizens while reducing errors in administrative processes. The above-mentioned results clearly illustrate that quantitative financial measures can be integrated with performance assessments in qualitative terms to offer a complete picture of the value of AI to public administration.

The success of this method in DOECDk, coupled with insights from Agrawal et al. and policy guidelines from the OECD, provides solid evidence on the economic feasibility of investments in AI. This model can be replicated; thus, it becomes an important benchmark for countries thinking of similar investments in technology.

Innovatively tweaking the traditional financial equations along with a link to quality indicators applicable in the local context is what will make the economic assessment of AI implementation in public administration relevant to Kazakhstan. Since all the cost-benefit analysis dimensions have indicators like net present value (NPV), benefit-cost ratio (BCR), and return on investment (ROI), these measures have to be recalibrated in line with economic context, including the local currency (KZT), higher-risk profiles as well as the policy environmental richness of Kazakhstan. Below existing definitions for NPV, BCR, and ROI are conceptually valid, but the discount rate (r) is to be adjusted to incorporate the local cost of capital as well as economic volatility. Qualitative benefits are usually not captured in the existing monetary measures, such as improvements in civic satisfaction, transparency, or quality of service. The above mentioned caveat can also be addressed through developing an enhanced model which has an extra component factor of intangible benefits. For example, the Adjusted Net Present Value may be defined as:

$$ANPV = \sum(t = 0)^{T}((B_t + P + I_t) - C_t)/(1 + r)^t \quad (1)$$

where B_t is tangible benefits, C_t costs at time t, I_t quantified intangible benefits (like increases in citizen satisfaction or improved service quality), and P comprises a weighting factor in terms of how those intangible benefits are affected by government policy effectiveness concerning them. Similarly, a formula of an Adjusted Return on Investment might read as:

$$\text{AROI} = \frac{(\text{Total Benefits} + \text{P} \times \text{Total Intangible Benefits} - \text{Total Costs})}{\text{Total Costs}} \quad (5)$$

To adapt these methodologies, Kazakhstan will need comprehensive financial data from budgets and operational records related to public administration, as well as qualitative data from structured surveys and interviews with citizens and public officials. Further, broader indicators should be suitable to capture the general effects of the specific digital transformation. For example, the Digital Readiness Index (DRI), created from digital infrastructure and service quality benchmarking, will be considered a good proxy indicator for an enabling environment for AI. Another good measure is Government Policy Implementation Factor (GPIF), developing through expert evaluations and policy performance metrics to measure how well the government promotes digital initiatives.

The forthcoming table can summarize indicators, formulas, and descriptions in the adapted economic assessment model in Kazakhstan:

Table 3 – Summary of economic assessment model for adaptation in Kazakhstan

Indicator	Formula/Method	Description
Adjusted Net Present Value (ANPV)	$ANPV = \sum(t = 0)^{T}((B_t + P + I_t) - C_t)/(1 + r)^t$	Measures the difference between the combined tangible benefits and weighted intangible benefits against costs over time, using a locally adjusted discount rate.
Adjusted Benefit–Cost Ratio (ABCR)	$\text{ABCR} = \left[\sum(t = 0)^{T} \frac{(B_t + P \times I_t)}{(1 + r)^t}\right] \div \left[\sum(t = 0)^{T} \frac{C_t}{(1 + r)^t}\right]$	Compares the present value of adjusted benefits (including intangible factors) to the present value of costs.
Adjusted Return on Investment (AROI)	$\text{AROI} = \frac{(\text{Total Benefits} + P \times \text{Total Intangible Benefits} - \text{Total Costs})}{\text{Total Costs}}$	Quantifies overall returns while integrating both tangible and intangible benefits.
Digital Readiness Index (DRI)	Measured via standardized surveys and benchmarking methods	Assesses the quality and capacity of digital infrastructure and services in Kazakhstan.
Government Policy Implementation Factor (GPIF)	Derived from policy performance metrics and expert evaluations	Reflects the effectiveness of government policies in promoting digital transformation.
Note – complied by the author		

Kazakhstan can greatly improve its evaluation system that deals with applications for AI through the combination of quantitative financial data with qualitative survey and policy impact data. The replacement of traditional formulas with the inclusion of items like intangible benefits and policy efficacy ensures a complete assessment of fiscal and socio-administrative impacts. This has the advantage of providing a framework for nuanced evaluation, which ultimately applies to the unique economic, technological, and policy conditions in Kazakhstan,

thus ensuring relevant decision-making and effective public administration's digital transformation.

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Conclusions

Integrative methodology has been developed to carry out economic assessment of AI technologies regarding the public administration and toward particular alterations in the tradition evaluation framework to fit into the Kazakhstan context. Such primary research question-how has traditional cost–benefit analysis been altered so that qualitative indicators such as citizen satisfaction, service quality, and policy effectiveness can also be incorporated into it-has resulted in the use of a systematic literature review and document analysis methodology. This study also presents a framework that included new measures such as Adjusted Net Present Value (ANPV), Adjusted Benefit–Cost Ratio (ABCR), Adjusted Return on Investment (AROI), Digital Readiness Index (DRI), and Government Policy Implementation Factor (GPIF).

According to the results of the study, although traditional analytical modes such as net present value, benefit–cost ratio, and return on investment encompass well near-direct fiscal effects, those intangible benefits appear to be completely omitted. In Denmark, real-life examples show that, while quantitative financial measures are usually included in any qualitative performance assessment, such mixed evaluations exhibit comprehensive evaluations on assessment of value generation by AIs within public administration. Therefore, the planning measures in Kazakhstan-the Digital Kazakhstan initiative-are predominantly based on traditional cost–benefit measures, thus ignoring improvements-as improved transparency, citizen satisfaction, and quality improvements in service delivery. This proposed integrated model addresses this gap by theoretically incorporating a weighting factor for intangible benefits as well as adjusting major financial parameters to accommodate the economics local environment.

The conclusions drawn from this study confirm the truth of the initial hypothesis: an integrated evaluation framework that combines traditional economic metrics with qualitative assessments proves to be a very fine and constructive context-sensitive measure of AI's impact directly in public administration. This work contributes by synthesizing existing research and extending it to advance a model that rightly captures the complexities of digital transformation, particularly in new economies such as Kazakhstan. Therefore, the integrated model deepens

our understanding of the economic implications of AI with a systematic pattern that could also be reproduced by policymakers who want to optimize uses for investment in AI.

Prospective perspectives for implementation are very favorable. Future empirical studies that incorporate primary data, such as field surveys or pilot program analyses, could serve to validate and fine-tune the proposed model even further. In addition, the application of the methodology opens opportunities for applications that develop in digital government systems, allowing for improved and more comprehensive assessments of technological investments, thereby improving policy decisions and aligning with the goals of transformation now underway in digitization. Overall, the study indicates new directions for research and practice, as the judicious mix of quantitative and qualitative methods is a prerequisite for better scientific knowledge and practical evaluation of AI in public administration.

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МЕМЛЕКЕТТІК БАСҚАРУҒА ЖАСАНДЫ ИНТЕЛЛЕКТ ЕНГІЗУДІ ЭКОНОМИКАЛЫҚ БАҒАЛАУДЫҢ ӘДІСТЕМЕСІ

Мемлекеттік басқарудағы жедел цифрлық трансформациялар жасанды интеллект (ЖИ) технологияларының экономикалық әсерін бағалау үшін кешенді әдістемелердің қажеттілігін айқын көрсетті. Бұл зерттеудің мақсаты – дәстүрлі шығын-пайда талдауын және сапалы көрсеткіштерді біріктіретін, нақты қаржылық тиімділікті және бейтарап әлеуметтік-әкімшілік әсерлерді бағалау үшін кешенді әдістемелік негізді әзірлеу, әсіресе Қазақстан контекстіне бейімдеу. Осы зерттеу әдебиеттегі маңызды алшақтықты толтырады, өйткені көптеген дәстүрлі бағалау әдістері азаматтардың қанағаттануы, қызмет сапасы және саясаттың тиімділігі сияқты факторларды елемейді. Экономиканың дами келе жатқан теорияларын цифрлық трансформацияның соңғы жетістіктерімен үйлестіре отырып, зерттеу жаңа тұжырымдамалық көрсеткіштерді ұсынады, мысалы, түзетілген таза ағымдық құн (ANPV), түзетілген пайда-шығын қатынасы (ABCR) және түзетілген инвестициялардың қайтарымы (AROI), сондай-ақ қосымша шаралар ретінде Цифрлық дайындық индексі (DRI) және Үкіметтік саясатты жүзеге асыру факторы (GPIF). Ұсынылған әдістеме халықаралық кейс-стадиялар мен саяси есептерден алынған екінші дәрежелі деректер негізінде жүргізілген жүйелі әдеби шолу және құжаттарды талдауға сүйенеді, ол концептуалдық модельді қалыптастыру үшін пайдаланылады. Қаржылық көрсеткіштермен бірге сапалы өлшемдерді енгізу Даниядан алынған мысалдар арқылы ЖИ енгізулерін бағалауды айтарлықтай күшейтеді. Екінші жағынан, Қазақстандағы қазіргі тәжірибе толығымен дәстүрлі әдістерге негізделгендіктен, цифрлық трансформацияның кең ауқымды пайдасы төмен бағаланады. Зерттеу нәтижелері интеграцияланған тәсілдің контекстке сезімтал әрі сенімді бағалауды қамтамасыз

ететінін растайды. Алынған модель мемлекеттік басқаруда ЖИ инвестицияларын тиімді оңтайландыру мен негізделген саясаттық шешімдерді қабылдауға бағытталған практикалық құрал ретінде қолданылуы мүмкін.

Кілтті сөздер: Жасанды интеллект, цифрлық трансформация, цифрлық үкімет, ANPV, ABCR, GPIF.

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МЕТОДОЛОГИЯ ЭКОНОМИЧЕСКОЙ ОЦЕНКИ ВНЕДРЕНИЯ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА В ГОСУДАРСТВЕННОЕ УПРАВЛЕНИЕ

Быстрые цифровые преобразования в государственной администрации выявили необходимость в разработке комплексных методологий для оценки экономических последствий внедрения технологий искусственного интеллекта (ИИ). Цель данного исследования – разработать всеобъемлющую методологическую основу, которая интегрировала бы традиционный анализ «затраты-выгоды» и качественные показатели для оценки как материальных фискальных выгод, так и нематериальных социально-административных эффектов, с особым акцентом на адаптацию данной методологии к контексту Казахстана. Это исследование заполняет значительный пробел в литературе, где большинство традиционных методов оценки игнорируют такие факторы, как удовлетворённость граждан, качество обслуживания и эффективность проводимой политики. Объединяя устоявшиеся экономические теории с последними достижениями в области цифровой трансформации, работа предлагает новые концептуальные показатели, такие как скорректированная чистая приведённая стоимость (ANPV), скорректированное соотношение выгода-стоимость (ABCR) и скорректированная норма окупаемости инвестиций (AROI), а также дополнительные

меры, включая индекс цифровой готовности (DRI) и фактор реализации государственной политики (GPIF). Предлагаемая методология основана на систематическом обзоре литературы и анализе документов международных кейс-стадий и политических отчётов, которые служат вторичными источниками данных для формирования концептуальной модели. Введение качественных мер наряду с финансовыми метриками существенно усиливает оценку реализации ИИ, как показали анализы примеров из Дании. С другой стороны, текущая практика в Казахстане полностью опирается на традиционные методы, что приводит к недооценке далеко идущих преимуществ цифровой трансформации. Результаты исследования подтвердили предположение о том, что интегрированный подход действительно обеспечивает более надёжную, контекстно-чувствительную оценку. Полученная модель может стать полезным инструментом для принятия обоснованных политических решений и оптимизации инвестиций в ИИ в государственной администрации.

Ключевые слова: Искусственный интеллект, цифровая трансформация, цифровое правительство, ANPV, ABCR, GPIF

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