

THE USE OF SMART CONTRACTS IN PUBLIC ADMINISTRATION (USING THE EXAMPLE OF THE REPUBLIC OF ARMENIA)

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Key words: smart contracts, blockchain, public procurement, digital governance, institutional readiness, cost efficiency

Introduction

Technological advancement transforms not only the operational logic of the private sector but also the models applied within public administration systems. In numerous countries worldwide, digital solutions have become key pillars in modernizing governance systems. Within this context, the application of blockchain-based smart contracts emerges as a significant innovative tool, enhancing transparency, accountability, and cost-efficiency in public sector processes [Tapscott & Tapscott, 2016].

Smart contracts are programmed agreements executed automatically on blockchain networks, performing contractual terms without intermediary involvement. These contracts ensure immutability, transparency, reduced contractual risks, and lower transaction costs. Such characteristics become particularly crucial in areas of public administration characterized by high levels of bureaucracy, corruption risks, and inadequate oversight mechanisms [Christidis & Devetsikiotis, 2016].

In Armenia, recent years have marked noticeable progress in the digitalization of public administration. Specifically, ARMEPS – the Armenian Public Electronic Procurement System has been introduced, along with the e-government platform (e-gov.am) and digital identification solutions such as imID. However, various studies, reports highlight persistent issues in Armenia's public administration system, notably concerning efficiency, accountability, and corruption [Transparency International, 2023; OECD, 2023].

Estonia is frequently cited as a global leader in digital governance. In Estonia, approximately 99% of governmental services – including elections, healthcare, business registration, among others – are provided online [OECD, 2022]. Georgia, too, has demonstrated substantial progress in recent years, particularly in digitizing public procurement and administrative processes [UN E-Government Survey, 2022].

Armenia, being a developing country neighboring states with similar advancements, possesses practical opportunities to enhance public governance effectiveness through the implementation of smart contracts. Given the substantial volume of governmental procurements – exceeding 480 billion AMD in 2022 [ARMEPS, 2023] – even minor percentage savings could translate into considerable financial benefits.

The objectives of this paper are:

- To evaluate the feasibility and potential impact of implementing smart contracts within the Armenian public administration system.
- To analyze best international practices and compare them with Armenia's institutional, technological, and regulatory contexts.
- To propose a phased strategic approach for the adoption and systematic implementation of smart contracts.

The scientific value of this research lies in integrating theoretical frameworks, particularly institutional economics and the theory of innovation diffusion, with a practical analysis based on operational data from Armenia's digital governance systems.

Methodology

The primary goal of this research is to assess the applicability and effectiveness of implementing smart contracts within the context of public administration in Armenia. The study adopts a multilayered methodological approach, combining theoretical analysis and data-driven practical assessment. Qualitative and quantitative methods have been applied to provide a comprehensive view of the potential implementation of this innovative technology in the public governance sector.

The research has been conducted along three primary methodological directions. First, we performed document analysis, examining national strategies, policy documents, and legislative acts related to public administration digitalization. The analysis of these documents facilitated an understanding of the legal and institutional prerequisites as well as limitations that could influence the adoption of smart contracts [OECD, 2023].

Second, we employed a comparative analytical method, benchmarking the digital governance systems and practical experiences of Armenia with those of Estonia and Georgia. Estonia was selected as a benchmark country due to its extensive adoption of blockchain technologies, whereas Georgia was chosen as a regionally comparable state – similar to Armenia in terms of size, institutional structure, and level of development [UN, 2022].

Third, a quantitative evaluation was conducted to model potential cost savings in public procurement resulting from the implementation of smart contracts. This evaluation is based on an internationally recognized expert approach suggesting that blockchain technology in public contracts can achieve average savings between 1.5% and 3%, primarily driven by reductions in transaction costs and automation of monitoring processes [WEF, 2020]. These scenarios were applied to Armenia's public procurement volumes in 2020 - 2022, thus allowing for the development of a preliminary financial efficiency model.

Theoretically, this article relies on several fundamental frameworks. Within the scope of institutional economics theory, smart contracts are considered an institutional innovation capable of transforming the structure of governance processes [North, 1990]. Concurrently, Transaction Cost Economics theory [Williamson, 1979] provides insight into how

smart contracts can substantially decrease transaction costs, especially those associated with monitoring, intermediation, and renegotiations. Lastly, Innovation Diffusion Theory [Rogers, 2003] elucidates the mechanisms through which innovative technologies permeate institutions, highlighting the stages involved in their public or institutional acceptance. This methodological foundation enables not only the theoretical justification of the potential for smart contract implementation but also a practical assessment of its feasibility within the Armenian public administration system.

Literature review

The interconnectedness of smart contracts, blockchain technology, and public administration digitalization is gaining increasing attention both in academic research and practical fields. Over the past decade, this topic has become a focal point for interdisciplinary research, spanning economics, law, management theory, and informatics.

A foundational work on blockchain technology and smart contracts is "Blockchain Revolution" by Don Tapscott and Alex Tapscott, which presents smart contracts as automated trust mechanisms capable of fundamentally reshaping operations within governmental and financial institutions [Tapscott & Tapscott, 2016].

The precise technological nature and operational capabilities of smart contracts have been analyzed extensively by Christidis and Devetsikiotis (2016). Their research emphasizes that smart contracts facilitate the automation of complex transactions, including government-initiated payments, licensing procedures, and contractual obligation monitoring, eliminating the necessity of centralized intervention. From an institutional perspective, Douglass North's contributions to the theory of institutional economics are particularly relevant. North argues that institutional changes serve as key catalysts for economic development, and emerging technologies can act as triggers for such transformations if they align appropriately with local institutional frameworks [North, 1990].

Within the framework of Williamson's Transaction Cost Economics (TCE), the use of smart contracts is viewed as a mechanism for reducing transaction costs. According to Williamson (1979), when contracts become automated and require minimal ongoing supervision or intermediary involvement, organizations can significantly reduce transactional inefficiencies and associated costs.

Everett Rogers's Diffusion of Innovations Theory provides further analytical leverage, offering insights into why certain innovations are successfully adopted by governmental systems while others are rejected. Utilizing this theoretical approach, the potential for the successful adoption of smart contracts in Armenia can be evaluated based on institutional readiness, technological accessibility, and public perception [Rogers, 2003].

In an international context, examples of smart contract implementations can be observed in Estonia, Singapore, Switzerland, among other countries. The OECD's 2023 report em-

phasizes developments in digital governance, highlighting blockchain's potential role in enhancing efficiency within public service delivery processes [OECD, 2023]. Likewise, the World Economic Forum's report "State of the Connected World" underscores the importance of developing digital trust institutions and recognizes smart contracts as a fundamental component of these emerging institutional frameworks [WEF, 2020].

Thus, both theoretical and practical sources substantiate that the implementation of smart contracts within public administration constitutes a rapidly growing research domain, demanding in-depth investigation tailored to local contexts and institutional realities.

Scientific novelty

Innovations in economics and management represent not merely indicators of technological advancement but also powerful catalysts for institutional transformation. The application of smart contracts within public administration exemplifies such institutional innovation, necessitating thorough analysis from theoretical, comparative, and practical perspectives. The scientific novelty simultaneously contributes on several levels:

1. *Theoretical Foundations.* In Armenia, smart contracts have yet to find practical implementation within any sector of public governance. Furthermore, comprehensive scientific works in Armenian analyzing their implementation potential – drawing upon theories such as institutional economics, transaction cost economics, and innovation diffusion – are currently absent. This paper constitutes the first scholarly attempt to integrate theoretical and practical approaches specifically tailored to Armenia's public governance context.

2. *Practical-Level Novelty.* This article proposes a phased strategic framework for the implementation of smart contracts, encompassing:

- Preparation and development of a supportive legislative environment,
- Implementation of pilot projects specifically within the public procurement sector,
- Establishment of structural and institutional capacities,
- Development of public and professional awareness mechanisms.

This practical approach outlines specific actionable steps, bridging theoretical conceptualizations with real-world application. Moreover, this paper for the first time models potential cost-saving scenarios (ranging from 1.5% to 3%) attributable to the introduction of smart contracts within Armenia's public procurement system, grounded in data provided by the World Economic Forum – WEF (2020).

Analysis

The opportunities for implementing smart contracts within Armenia's public administration system are analyzed through the lenses of institutional reality, current practices, international comparative experiences, and quantitative data. This section addresses key sectors where the deployment of blockchain-based smart contracts could yield substantial

impact, providing a preliminary assessment from both economic efficiency and institutional improvement perspectives.

Public Procurement as a High Transaction Cost Field: The public procurement system represents one of the largest and most vulnerable mechanisms for distributing public resources, consuming up to 20-25% of governmental budgets in developing countries [OECD, 2016]. In Armenia, this figure reached approximately 480 billion AMD in 2022, according to ARMEPS data. Nevertheless, the scale of procurement alone does not directly reflect system efficiency. Key factors undermining efficiency, as viewed through Transaction Cost Economics, include:

- Complexity of the supply chain,
- Lengthy bureaucratic processes,
- Limited accessibility to competitive tenders for certain suppliers,
- Corruption risks during contract renegotiation phases.

These issues can be comprehensively analyzed using Williamson's Transaction Cost Economics (TCE) model, which suggests that organizations typically select transaction methods minimizing total associated costs, which include:

- *Ex-ante costs* – expenses related to searching for suppliers and preparing proposals,
- *Ex-post costs* – expenses related to contract enforcement, monitoring, and potential legal disputes.

In Armenia's procurement system, ex-post costs are particularly high, driven by suppliers' contract breaches, delayed payment cycles, and overburdened judicial processes.

Blockchain-based smart contracts can effectively eliminate or significantly reduce these problematic stages by automating the validation and execution of contractual obligations. Leveraging Oracle technology, data integration from external platforms – such as e-invoicing or warehouse management systems – enables automatic initiation of payments upon verifying the fulfillment of contractual conditions.

Quantitative Evaluation: Modeling Potential Savings. Drawing upon assessments provided by the World Economic Forum (2020), blockchain and smart contract adoption can reduce transaction costs by approximately 1.5%-3% in public procurement processes, based on documented cases from Italy, Chile, and Georgia.

Table 1. Potential savings from the introduction of smart contracts in Armenian public procurement

Year	Total Procurement (billion AMD)	1.5% Savings	3% Savings
2020	340	5.1	10.2
2021	420	6.3	12.6
2022	480	7.2	14.4

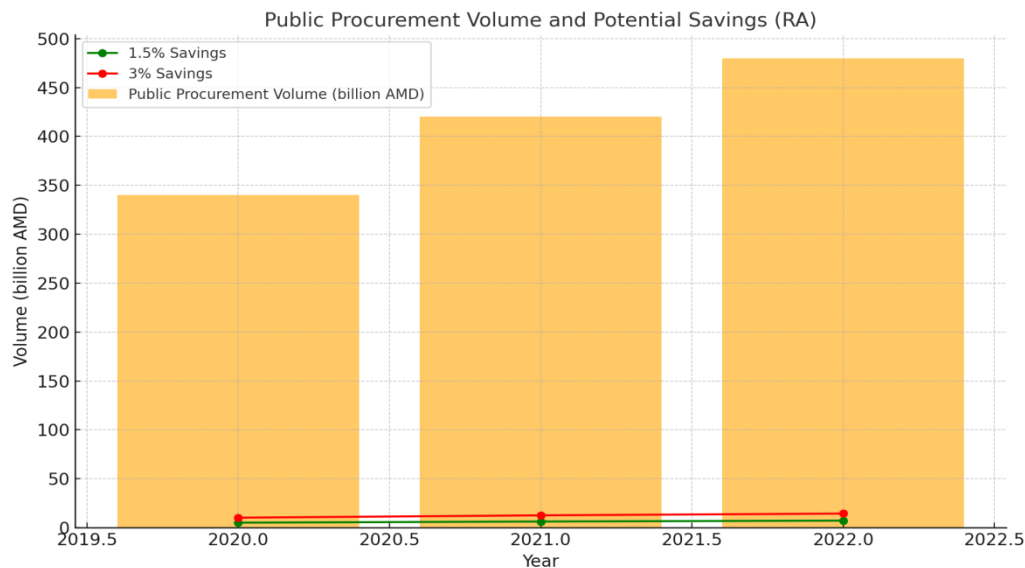


Figure 1. Government procurement volumes, smart contract savings scenarios (bln AMD)

The provided figure illustrates the growth trajectory of public procurement from 2020 to 2022 alongside two savings scenarios, highlighting the potential financial impacts upon the introduction of smart contracts.

Table 2. Sector-specific Features from the Perspective of Smart Contract Applicability

Procurement Sector	Annual Spending (billion AMD)	Typical Issues	Smart Contract Applicability
construction	~150	Deadline breaches, contract amendments	Automatic inventory verification and time monitoring
pharmaceuticals/healthcare	~50	Delivery delays, price discrepancies	Product origin tracking, automatic expiration checks
general public procurement	~60	Limited competition, preferred suppliers	Equal supplier access through open data

Illustrative Scenario: Smart Contract Application in Construction. Scenario: The government contracts a contractor for renovating a school building.

Transition to smart contract execution:

- Delivery deadlines for construction materials are predefined; an Oracle verifies the delivery via a QR-coded receipt.
- Upon confirmed arrival of materials at the designated site, a payment mechanism (20% initial payment) is automatically triggered.

- If the supervisory body uploads relevant photographic evidence upon completion of each phase, subsequent payments are automatically executed.

Thus, both contract compliance and the payment system are integrated within a single coded contract, significantly reducing manual oversight and associated risks.

Given its significant scale and institutional sensitivity, Armenia's public procurement sector provides an optimal platform for the pilot implementation of smart contracts. The objective prevalence of high transaction costs, widespread contract non-compliance, and inefficient oversight substantiate the economic and technological justification for implementing smart contracts as a tool for enhancing public expenditure efficiency.

Comparative Analysis: The Experiences of Estonia and Georgia. In assessing Armenia's potential for implementing smart contracts, an international comparative analysis is critical. For this purpose, two countries – Estonia and Georgia – have been selected. Both nations stand out due to their active digitalization initiatives, although they exhibit varying degrees of institutional maturity and technological infrastructure.

The comparative analysis framework incorporates the *Diffusion of Innovations theory* [Rogers, 2003] and the *Institutional Readiness Assessment (IRA)* model [World Bank, 2020]. These frameworks allow for evaluating not only the prerequisites for successful innovation adoption but also societal and institutional preparedness.

Estonia: A Model of Advanced Digital Governance. Estonia's experience with blockchain applications is globally recognized as exemplary. Since 2001, the country has operated the X-Road system, ensuring secure and fully automated data exchanges between government agencies [E-Estonia, 2023]. Smart contracts have been actively employed since 2012 across various domains, including property registration, notarial services, healthcare data management, and electronic voting. Estonia consistently ranks at the forefront of global digital governance indexes (OECD Digital Government Index – ranked 1st), with over 99% of public services provided digitally [OECD, 2022]. The core factors contributing to Estonia's success include:

- Institutional Integration: *All government entities interconnected via a unified data network.*
- Clear Legal Framework: *Comprehensive legislative provisions regulating digital tools and technologies.*
- High Digital Literacy: *Digital literacy among the population is notably high [91%, OECD, 2022].*

Georgia: Active Digitalization with Selective Blockchain Applications. In recent years, Georgia has significantly enhanced its digital governance capacities. However, unlike Estonia, Georgia demonstrates a comparatively limited institutional and regulatory environment. The country has implemented blockchain solutions selectively – for instance,

employing Bitfury’s platform for property registration since 2016 [TI Georgia, 2021]. More recently, digitalization of public procurement via the e-Procurement platform has noticeably reduced the time and costs associated with public tenders.

Key characteristics of Georgia’s public governance system include:

- *Partial Digitalization*: Blockchain implementation is sector-specific and lacks a centralized system.
- *Moderate Digital Literacy*: The digital literacy rate stands at 68% [UN E-Government Survey, 2022].
- *Limited Institutional and Regulatory Compatibility*: Institutional readiness scores at 64%, indicating lower-than-average preparedness [World Bank, 2022].

Benchmarking Institutional Readiness: A Comparative Assessment

To deepen the analysis, an *Institutional Readiness Score (IRS)* was calculated, incorporating the following key components:

- Technological Infrastructure;
- Legal Environment;
- Human Resource Capacities;
- Political Support;
- Digital Literacy of Citizens.

Table 3. Comparative Institutional Readiness Scores (IRS, %)

Components	Estonia	Georgia	Armenia
Technological Infrastructure	95%	75%	55%
Legal Environment	92%	67%	45%
Human Capital	90%	60%	55%
Political Support	94%	70%	60%
Digital Literacy	91%	68%	65%
Average IRS Score	92.4%	68%	56%

Key Findings from Comparative Analysis:

The comparative analysis indicates:

1. Armenia's global positioning in digital governance remains below average (IRS = 56%), suggesting the critical need to enhance the legal and technological infrastructure to facilitate smart contract adoption.
 2. Estonia’s experience demonstrates that successful digital governance fundamentally depends on clear political support, unified technological platforms (such as X-Road), and robust legislative regulations.
 3. Georgia’s experience presents a more realistic and easily adaptable model for Armenia, due to comparable social, economic, and political conditions.
- Armenia can thus benefit from the lessons provided by Georgia and Estonia by adopting a phased implementation strategy, which should primarily focus on:

- Developing a robust legislative framework,
- Integrating technological infrastructure (unified government data platforms),
- Enhancing professional training and capacity-building efforts.

Methodological Conclusion. The comparative assessment methodology employed in this study (Institutional Readiness Score - IRS) enables not only an evaluation of countries' current states but also the formulation of strategic recommendations for implementing blockchain technologies and smart contracts. By adopting a phased and pilot-oriented approach, Armenia can significantly advance in digital public governance by leveraging insights drawn from the analyzed experiences of Estonia and Georgia.

Legal and Institutional Readiness: In-depth Analysis in the Armenian Context. The success of smart contract implementation cannot be limited solely to technological factors. Therefore, it is essential to assess the institutional and legal environments that can either facilitate or hinder the introduction of such innovation. This analysis utilizes two primary methodological frameworks:

1. *Institutional Diagnostic Toolkit* (Harvard Kennedy School)
2. *Institutional Readiness Assessment (IRA)* (World Bank, 2020)

These tools facilitate a systematic evaluation of institutional readiness, identify legal constraints and gaps, and outline the required reforms.

Legal Environment Analysis: The existing legal framework governing digital services in Armenia, despite recent incremental improvements, remains incomplete, particularly regarding clear definitions and regulations of smart contracts and blockchain technologies. This gap presents a significant obstacle for legal recognition, mandatory application, and dispute resolution related to technological innovations. *Specifically:*

- The Civil Code of Armenia does not explicitly define the legal status of digital contracts or smart contracts.
- Legal norms regulating issues related to breaches and responsibilities arising from the use of smart contracts are absent.
- Regulation regarding data protection and confidentiality remains insufficiently developed and limited, potentially undermining public trust in adopting these new technologies.

Institutional Readiness Assessment (IRA): International experience demonstrates that successful application of blockchain technologies and smart contracts demands high institutional capacity in integrated data exchange among governmental bodies and robust human resource competencies.

To evaluate the institutional readiness of Armenia, the following key Institutional Readiness Indicators (IRA) have been assessed:

Table 4. Institutional Readiness Assessment for Armenia

IRA Indicator	Score (%)	Obstacles
Structural Integration	50%	Fragmented governmental systems
Technical and Human Resource Capacities	55%	Lack of qualified specialists
Political Support	60%	Absence of clearly defined strategic steps
Public and Private Sector Engagement	45%	Low level of public trust
Overall IRA Average Score	52.5%	Below-average institutional preparedness

Structural Integration: Data exchange systems among Armenian public institutions remain partially implemented, mostly within specific isolated sectors (e.g., ARMEPS, e-gov.am, imID). Unlike Estonia's unified X-Road system, Armenia currently lacks a fully integrated and cohesive technological environment for public administration.

Technical and Human Resource Capacities: Digital and technological skills among Armenian public sector employees are evaluated as below average (Digital Readiness Score: 55%). There is a noticeable shortage of specialists, especially in blockchain-based technological solutions design, software management, legal regulation of digital contracts.

Political Support and Institutional Leadership: Although strategic governmental documents emphasize the importance of digital governance reform (e.g., the "Armenia 2040" strategy), specific political initiatives, strategic plans, and budgetary support dedicated explicitly to blockchain technology implementations remain absent.

Public and Private Sector Engagemen: Engagement from the public and private sectors in processes involving these technologies is still limited. While digital literacy among the population is estimated at around 65%, public confidence in governmental digital tools remains low (OECD, 2023).

Conclusions

The introduction of smart contracts in public administration – particularly within public procurement, social services, and budgetary control processes – can significantly enhance efficiency, reduce transaction costs, and mitigate corruption risks. Although the Republic of Armenia has already embarked on digitalization, it has not yet reached a level sufficient for the large-scale deployment of smart contracts.

The comparative analysis demonstrates that the experiences of Estonia and Georgia can serve as benchmarks for political, technological, and institutional reforms. The examined data indicate that technology alone does not ensure success; it must be supported by an appropriate enabling environment at legal, organizational, and educational levels.

Recommendations

Based on the analysis, the following strategic measures are recommended to enhance the effective introduction of smart contracts:

1. Development of a Legislative and Regulatory Framework

- Clearly define the legal status of smart contracts within Armenia's Civil Code.
- Establish regulatory guidelines for the use of smart contracts in public institutions.
- Introduce legally binding standards for digital contracts.

2. Development of Technological Infrastructure

- Establish a state-level blockchain platform dedicated to smart contract implementation.
- Adopt clear cybersecurity standards to ensure secure data flows.
- Integrate smart contracts within existing e-governance systems, including e-gov.am and imID.

3. Capacity Building for Human Resources

- Conduct specialized training programs for civil servants, IT specialists, and legal professionals.
- Incorporate courses on smart contracts into university curricula.
- Support the private sector in utilizing smart contract design tools.

4. Implementation of Pilot Programs

- Launch pilot projects within critical areas such as public procurement, social programs, or healthcare.
- Evaluate outcomes from the perspective of cost savings, process acceleration, and transparency.
- Utilize pilot outcomes to inform policy formulation and refinement.

5. Public Awareness and Participation

- Conduct public information campaigns to explain the purpose and value of smart contracts.
- Encourage civil society participation in technological transformation processes.

Smart contracts represent a pivotal component of future public administration. Their introduction into Armenia's governance system is not merely a technological innovation but also a powerful catalyst for governance reform. However, the successful deployment of this technology is contingent upon a comprehensive approach that integrates political will, robust legal foundations, professional expertise, and public trust. Armenia possesses all the necessary prerequisites to adopt smart contracts through an experimental and phased approach, beginning with the most vulnerable and beneficial areas.

References

1. ARMEPS. (2023). *Electronic Public Procurement System of Armenia*.
2. Christidis, K., & Devetsikiotis, M. (2016). Blockchains and Smart Contracts for the Internet of Things. *IEEE Access*, 4, 2292–2303. <https://doi.org/10.1109/ACCESS.2016.2566339>
3. E-Estonia. (2023). *The Digital Society*. Retrieved from <https://e-estonia.com>
4. GIZ Armenia. (2022). *Public Sector Digital Readiness Assessment Report*. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).
5. Government of Armenia. (2021). *Armenia 2040 Strategic Development Document*. Retrieved from <https://www.gov.am>
6. North, D. C. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge University Press.
7. OECD. (2022). *Digital Government Index: 2022 Results*. Retrieved from <https://www.oecd.org/gov/digital-government>
8. OECD. (2023). *Digital Government Policy Framework*. Retrieved from <https://www.oecd.org/gov/digital-government>
9. Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). Free Press.
10. Tapscott, D., & Tapscott, A. (2016). *Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World*. Penguin Publishing Group.
11. TI Georgia. (2021). *Transparency and Efficiency of Public Procurement in Georgia*. Transparency International Georgia.
12. Transparency International. (2023). *Corruption Perceptions Index*. Retrieved from <https://www.transparency.org/en/cpi>
13. UNDP Armenia. (2023). *Digital Transformation Progress Report*. United Nations Development Programme, Armenia.
14. United Nations. (2022). *E-Government Survey 2022: The Future of Digital Government*. Department of Economic and Social Affairs. <https://publicadministration.un.org/egovkb>
15. Williamson, O. E. (1979). Transaction-cost economics: The governance of contractual relations. *Journal of Law and Economics*, 22(2), 233–261. <https://doi.org/10.1086/466942>
16. World Bank. (2021). *Armenia: Improving Efficiency in Public Procurement*. Retrieved from <https://www.worldbank.org>
17. World Economic Forum. (2020). *State of the Connected World*. Retrieved from <https://www.weforum.org/reports>

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The use of smart contracts in public administration (using the example of the Republic of Armenia)

Key words: smart contracts, blockchain, public procurement, digital governance, institutional readiness, cost efficiency

This article analyzes the feasibility of implementing smart contracts in the public administration system of the Republic of Armenia. Drawing upon theories of institutional economics, transaction cost economics, and innovation diffusion, the study conducts both theoretical and practical analyses. Based on international experience, the most impactful areas for implementation – public procurement, social services, and budgetary oversight – are identified. A quantitative model estimates potential cost savings ranging from 1.5% to 3% if smart contracts are adopted. Strategic policy recommendations are proposed, targeting legal, technological, and institutional reforms. The findings suggest that phased implementation is both realistic and technologically sound.