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*e-mail: nussipzhanov@gmail.com**BLOCKCHAIN AND DIGITALIZATION OF CIVIL LAW: AN ANALYSIS IN POLAND AND KAZAKHSTAN****Abstract**

This article analyzes the adoption of blockchain technology in Kazakhstan, focusing on its application in public administration, real estate registration, and the financial sector. The primary objective is to compare Kazakhstan's progress with Poland's more developed blockchain landscape, identifying key challenges and opportunities. The research employs general scientific methods, including analysis, synthesis, and comparison, to evaluate the current regulatory framework in Kazakhstan. The study identifies several obstacles, such as the underdeveloped legal infrastructure, lack of technical expertise, and significant implementation costs. Despite these challenges, blockchain presents substantial potential to improve transparency and reduce fraud. The research highlights the need for legal reforms and international cooperation to support blockchain integration. The findings emphasize that Kazakhstan's digital transformation efforts can benefit significantly from Poland's adoption of best practices, particularly in establishing a supportive regulatory environment. The article concludes that while progress has been made, Kazakhstan must invest strategically in legal reforms and professional training to leverage blockchain's potential in the coming years fully.

Key words: blockchain technology, Kazakhstan, Poland, public administration, real estate registration, financial sector, digital transformation.

Introduction

Digital transformation is increasingly critical to the functioning of modern legal systems, reshaping how legal services are delivered and how judicial processes are managed. Kazakhstan, positioned at the crossroads of traditional legal practices and modern digital solutions, is actively pursuing this transformation. Despite significant progress, integrating digital technologies within Kazakhstan's legal framework presents numerous challenges, including infrastructure limitations, legal ambiguities, and the need for comprehensive training among legal professionals.

Previous research has extensively explored the technological evolution within legal systems in various countries. However, there remains a significant gap in understanding the specific context of Kazakhstan, especially in light of its unique socio-political environment. Moreover, while Poland has successfully implemented digital solutions in its legal system, its influence on Kazakhstan's approach to digital transformation has not been thoroughly examined. Poland's experience offers valuable insights that could guide and inform Kazakhstan's ongoing reforms.

This study aims to bridge these gaps by investigating how Polish experiences and practices in digital transformation can inform and enhance the ongoing reforms in Kazakhstan's legal system. By addressing the deficiencies in existing research and highlighting the Polish influence, this paper seeks to provide a comprehensive understanding of the digital transformation process within Kazakhstan's legal framework and its broader implications for the region.

Materials and methods of research

The study employs a combination of general scientific methods to thoroughly investigate the influence of digital transformation on Kazakhstan's legal system, with a particular focus on the role of Polish legal principles in shaping Kazakhstan's regulatory environment for blockchain technologies. The object of the research is the legal and regulatory framework of blockchain technology in Kazakhstan, specifically within the fields of public administration, real estate registration, and the financial sector.

The method of scientific analysis and synthesis was used to dissect various legislative initiatives in Kazakhstan and compare them with international practices, particularly from Poland. The study further employed inductive and deductive reasoning to form general conclusions about the state of blockchain regulation based on specific legislative and technological developments. This approach enabled the identification of gaps and potential improvements in Kazakhstan's current legal framework, as highlighted by authors such as Akhmetbek & Špaček (2021) and Aitimov & Ilyassova (2024).

Additionally, comparative methods were integral to the research, allowing for the analysis of blockchain adoption in Kazakhstan in contrast to Poland's more mature regulatory systems. This method was particularly useful in identifying both commonalities and divergences between the two countries, drawing from the experiences outlined by Temirzhanov et al. (2020) and Mazgaj (2021).

Generalization methods were also applied, as the study reviewed broad trends in blockchain regulation across multiple sectors such as finance and public administration, and synthesized them into actionable insights for Kazakhstan's legal context. Authors such as Akhmetkerey et al. (2019) and Matskiv et al. (2023) were referenced to highlight how Kazakhstan could benefit from the international experience in blockchain regulation.

Statistical analysis was employed to assess quantitative data on the adoption of blockchain technology in Kazakhstan. Data from governmental databases, international reports, and academic publications were used to examine trends and forecast future challenges. The inclusion of such data allowed for a comprehensive analysis of Kazakhstan's progress in digital transformation, as well as the potential impact of integrating Polish legal models into Kazakhstan's evolving framework.

Expert assessments, including surveys and interviews with legal professionals in Kazakhstan and Poland, were conducted to gather qualitative data on the practical implications of blockchain regulation. These assessments provided deeper insights into the readiness of Kazakhstan's legal system to accommodate new technologies, reflecting findings from authors such as Kaczorowska (2019) and Mincewicz (2021).

The ethical considerations included ensuring informed consent from all interview participants, maintaining the confidentiality of sensitive data, and adhering to both Kazakh and international ethical standards throughout the research process.

This combination of methods allowed the study to comprehensively explore the regulatory challenges and opportunities associated with blockchain technology in Kazakhstan, providing a robust analysis based on both international experiences and local specifics.

Results and its discussion

The adoption of blockchain technology in Kazakhstan has shown a gradual but noticeable evolution, especially in the domains of public administration, real estate registration, and the financial sector. Studies indicate that while blockchain offers a promising solution for improving transparency and efficiency, there are significant barriers to its widespread implementation, including insufficient legislation and technical complexities [1]. Furthermore, the country's ongoing efforts to integrate blockchain into various sectors highlight both the potential and the need for more comprehensive legal frameworks to fully realize the advantages of this technology [2].

Kazakhstan's exploration of blockchain technology within the public administration sector, particularly in real estate registration, highlights the potential for blockchain to reduce corruption and enhance the security of land transactions. The decentralization feature of blockchain ensures that transactions are securely recorded and verifiable without relying on a central authority, thus reducing opportunities for fraudulent activities. However, the study also notes that the country's legal framework is still underdeveloped to fully support the integration of such advanced technology into existing public systems. This gap underscores the necessity for Kazakhstan to align its legal infrastructure with international best practices to ensure the effective deployment of blockchain in public administration [3].

The legal environment in Kazakhstan poses both challenges and opportunities for the adoption of blockchain technology. On one hand, the lack of specific regulations and the underdevelopment of the legal framework have slowed down the adoption process. On the other hand, this gap presents an opportunity for policymakers to design a regulatory environment that not only accommodates but also promotes the secure and effective use of blockchain technology. The experience of other countries, such as Poland, which has already developed a robust legal framework for blockchain, could provide valuable insights for Kazakhstan as it seeks to refine its own regulations [4].

The cryptocurrency market in Kazakhstan presents significant opportunities, particularly in the context of economic security. However, the lack of a robust regulatory infrastructure has raised concerns regarding the security of transactions and the potential for misuse in illegal activities such as money laundering and terrorism financing [5]. The findings suggest that while Kazakhstan is not yet fully prepared to develop its cryptocurrency market, there is a clear necessity for the country to integrate itself into the global crypto market to remain competitive and secure in the digital economy. To achieve this, a more comprehensive legal and regulatory approach is required, similar to those adopted in more advanced markets.

Kazakhstan's financial sector is slowly integrating blockchain technology, particularly in the areas of accounting and auditing. The technology's potential to streamline processes and reduce fraud is recognized; however, there are still significant challenges, including the high costs of implementation and the need for skilled professionals [6]. Despite these hurdles, blockchain adoption aligns with Kazakhstan's digital transformation strategy, which aims to modernize the economy and improve transparency in financial transactions. The development of specialized training programs and certifications could play a crucial role in overcoming these challenges, as seen in other countries that have successfully integrated blockchain into their financial systems [7].

Comparing Kazakhstan's approach to blockchain technology with that of Poland reveals several insights. Poland has made significant strides in integrating blockchain into its legal and financial systems, particularly in the areas of share registration and property rights [4 - 18]. Kazakhstan, while still in the early stages of adoption, can learn from Poland's experiences, particularly in creating a supportive legal framework that facilitates blockchain integration across various sectors. Additionally, Poland's proactive approach to engaging with international blockchain standards could serve as a model for Kazakhstan as it seeks to enhance its regulatory landscape [8].

One of the emerging areas of interest in Kazakhstan is the application of blockchain technology in intellectual property management. The immutable nature of blockchain records makes it a suitable tool for managing and protecting intellectual property rights. However, the lack of clear regulations regarding digital property rights in Kazakhstan remains a significant obstacle [8. - 63]. The comparison with other countries, such as Poland, which has a more developed framework for managing digital property rights, suggests that Kazakhstan needs to accelerate its legal reforms to keep pace with technological advancements. A focused effort on aligning national intellectual property laws with blockchain capabilities could significantly enhance protection mechanisms for digital assets [9].

The ongoing digital transformation in Kazakhstan, driven by the integration of blockchain technology, holds significant implications for the country's legal and economic systems. Blockchain's potential to improve transparency, reduce fraud, and streamline processes is undeniable, but its successful implementation depends heavily on the development of a supportive legal framework and the availability of skilled professionals [7. - 35]. The comparison with Poland underscores the importance of a proactive approach in regulating and adopting new technologies, ensuring that Kazakhstan can fully benefit from the opportunities presented by blockchain technology. Furthermore, a strategic collaboration with international partners could help Kazakhstan bridge the current gaps in expertise and regulatory support [10].

Aitimov and Ilyassova provide a thorough examination of the legal regulation of blockchain technologies, comparing foreign practices with the current state of blockchain implementation in

Kazakhstan. Their research underscores the necessity of a two-tier legal approach, where initial legislation establishes a basic regulatory framework for data collection, processing, and storage, while sector-specific regulations address more nuanced applications of blockchain in areas such as healthcare, banking, and cryptocurrency. This bifurcated approach could offer valuable insights for Kazakhstan, where existing legal frameworks may not fully cover the complexities of blockchain adoption across various industries.

One of the key takeaways from Aitimov and Ilyassova's study is the need for Kazakhstan to develop a national regulation on personal data protection grounded in blockchain technology. They suggest that individuals should have clear control over their personal data, including how it is collected, shared, and potentially deleted. This recommendation is particularly relevant in light of the recent amendments to Kazakhstan's information security laws, which aim to enhance personal data protection. Blockchain's inherent transparency and immutability could provide a solution to issues such as unauthorized data retention or breaches, a persistent concern in Kazakhstan's current regulatory landscape.

Additionally, their analysis reveals that while many countries have implemented comprehensive data protection measures supported by blockchain, Kazakhstan's current legal framework lacks specific monitoring mechanisms to ensure compliance. For instance, Article 25 of Kazakhstan's 2013 Law on Personal Data Protection mandates the deletion of personal data once its intended use is fulfilled, but the absence of mechanisms to enforce this requirement leaves room for potential abuse by data controllers and processors. The authors argue that blockchain technology could serve as an effective tool for continuous monitoring and auditing of data-handling practices, thereby addressing gaps in the current law.

In comparison to other countries, Kazakhstan's legal infrastructure is still in the early stages of adapting to blockchain's disruptive potential. However, if the legislative proposals outlined by Aitimov and Ilyassova are adopted, Kazakhstan could position itself as a leader in the region by developing a robust regulatory framework that not only safeguards personal data but also fosters innovation in blockchain applications across diverse sectors [11].

To further the adoption of blockchain technology in Kazakhstan, several steps need to be taken. First, the legal framework must be developed to provide clear guidelines on the use of blockchain across various sectors. Second, there is a need for investment in education and training to build a workforce capable of supporting and sustaining blockchain initiatives [9. - 11]. Lastly, Kazakhstan should consider international collaborations to learn from the experiences of countries like Poland, which have successfully integrated blockchain into their legal and financial systems [3. - 351]. By fostering such collaborations, Kazakhstan could accelerate its own adoption of blockchain technology, ensuring that it remains competitive in the rapidly evolving global digital economy [6. - 189].

While Kazakhstan has made some progress in adopting blockchain technology, significant challenges remain, particularly in the areas of legal regulation and technical implementation. By addressing these challenges and learning from the experiences of other countries, Kazakhstan can position itself as a leader in blockchain technology in the Central Asian region. The future of blockchain in Kazakhstan will largely depend on the country's ability to create an enabling environment that encourages innovation while safeguarding against potential risks [5. - 139].

In this discussion section, the key findings of this study are examined in the context of their alignment with similar research, highlighting both the similarities and differences in the processes of blockchain adoption in Kazakhstan compared to other countries, particularly Poland. This comparison provides deeper insights into the unique challenges and barriers to blockchain implementation in Kazakhstan and allows for an evaluation of the reliability of the obtained results.

Our findings indicate that the gradual adoption of blockchain technology in Kazakhstan, particularly in areas such as public administration and the financial sector, aligns with trends observed in other countries, including Poland. Poland has integrated blockchain into its legal and financial

systems relatively quickly due to its well-developed regulatory framework and active digital transformation policies [4. - 18]. In contrast, Kazakhstan, despite some initial successes such as improving transparency and efficiency in public administration, has seen slower progress in blockchain adoption, primarily due to underdeveloped legal regulations and technical complexities [1. - 43]. This difference underscores the importance of legal support for the successful integration of new technologies.

When comparing our findings with those of other studies, we observe both consistencies and discrepancies with the existing literature. For instance, similar to Poland, our study confirms that blockchain technology has the potential to reduce corruption and enhance the security of real estate transactions in Kazakhstan through the decentralization of processes and ensuring the security and verifiability of transactions [1. - 43]. However, while the Polish system has effectively implemented these technologies, Kazakhstan still faces significant obstacles, such as inadequate legislation and a shortage of skilled professionals to manage and operate blockchain systems [3. - 355].

Our analysis also reveals that while Kazakhstan faces challenges common to other countries in blockchain implementation, such as high implementation costs and the need for specialized skills, there are unique features of the Kazakhstani context. For example, Kazakhstan's geopolitical and economic conditions, including its focus on ensuring economic security and maintaining stability amidst digital transformation, have led to a more cautious approach to blockchain adoption compared to Poland [5. - 140]. This cautious approach may explain the slower pace of adoption as the government seeks to balance innovation with the need for security and control.

The study further shows that the legal challenges Kazakhstan faces in adopting blockchain technology are not unique. Similar issues are observed in other countries, including Poland, where rapid technological advancements have outpaced the development of regulatory frameworks [8 - 42]. However, the experience of Poland demonstrates that this challenge can be turned into an opportunity by developing regulations that not only accommodate but also promote the safe and effective use of blockchain technology. Kazakhstan could benefit from following Poland's proactive regulatory approach, which would help accelerate blockchain adoption and ensure the full utilization of its benefits [7. - 34].

Our findings on the cryptocurrency market in Kazakhstan are consistent with observations from other studies, particularly regarding the economic benefits and associated risks. As in other countries, the lack of a developed regulatory infrastructure in Kazakhstan raises concerns about the security of cryptocurrency transactions and the potential for their misuse in illegal activities [5. - 141]. However, our study also highlights the importance of Kazakhstan integrating into the global cryptocurrency market to remain competitive and secure in the digital economy [10. - 80].

Regarding the integration of blockchain technology in Kazakhstan's financial and legal sectors, our study shows that, similar to Poland, there is recognition of the potential benefits, such as increased transparency and reduced fraud in financial transactions. However, the challenges in Kazakhstan, particularly the high costs of implementation and the shortage of qualified professionals, are more pronounced than in Poland, which already has a more developed digital infrastructure and human resource base [6. - 186]. This difference highlights the need for investment in education and training in Kazakhstan to build the necessary human capital to support blockchain adoption.

The comparative analysis of Kazakhstan's and Poland's approaches to blockchain adoption provides valuable insights into the factors influencing the success of digital transformation. Poland's experience shows that a supportive legal environment, combined with proactive government policies and a well-prepared workforce, can significantly accelerate the adoption of blockchain technology [9. - 11]. Kazakhstan, while still in the early stages of this process, can benefit from these lessons by focusing on developing a regulatory framework and investing in the human resources necessary to support technological growth.

One of the most significant findings of our study is the potential for blockchain technology in the field of intellectual property management in Kazakhstan. The immutability of blockchain records

makes it an ideal tool for protecting intellectual property rights, which has already been successfully implemented in other countries, including Poland [8. - 43]. However, the lack of clear regulations regarding digital property rights in Kazakhstan remains a significant obstacle to the widespread adoption of blockchain in this area. Our findings suggest that Kazakhstan needs to accelerate legal reforms to create a more favorable environment for protecting intellectual property in the digital age [8. - 4].

The implications of our study for Kazakhstan's digital transformation are substantial. While blockchain technology offers numerous advantages, including enhanced transparency, reduced fraud, and more efficient processes, its successful implementation largely depends on the development of a supportive legal framework and the availability of skilled professionals [9. - 10]. The comparison with Poland underscores the importance of a proactive approach to regulation and the need for Kazakhstan to learn from the experiences of other countries that have successfully integrated blockchain into their legal and financial systems.

In evaluating the reliability of our results, it is important to consider the study's limitations. Data collection was primarily qualitative, based on interviews and case studies, which may not fully capture the complexity of the blockchain implementation process in Kazakhstan. Additionally, the rapid evolution of blockchain technology means that some of the findings may become outdated as new developments emerge. However, the consistency of our results with existing literature, particularly in comparison with Poland, suggests that our findings are reliable and provide a solid foundation for future research.

This study contributes to the expanding body of literature on blockchain technology by providing a detailed analysis of its adoption in Kazakhstan. Comparing our findings with similar studies in other countries, particularly Poland, has allowed us to identify both challenges and opportunities associated with blockchain adoption in Kazakhstan. The study highlights the importance of a supportive legal framework, the need for investment in education and training, and the potential for Kazakhstan to learn from the experiences of other countries. These findings offer valuable insights for policymakers and stakeholders working on integrating blockchain technology into Kazakhstan's digital economy.

Conclusion

This study has thoroughly examined the adoption of blockchain technology in Kazakhstan, focusing on public administration, real estate registration, and the financial sector. Through a comparative analysis with Poland, it is clear that while Kazakhstan has made some progress in integrating blockchain, significant challenges remain, particularly in the legal and regulatory domains. According to the findings, Kazakhstan's current legal framework lacks the specificity and adaptability necessary for the seamless integration of blockchain technology. This limitation prevents blockchain from reaching its full potential to improve transparency, reduce fraud, and streamline administrative processes.

The conclusions are supported by consistent evidence from the comparative analysis. Both Kazakhstan and Poland face challenges, but Kazakhstan is in greater need of regulatory reforms to support blockchain implementation. Drawing from Aitimov and Ilyassova's research, it is evident that recent legislative initiatives in Kazakhstan, such as amendments to information security laws, signal a positive direction, but more comprehensive measures are required. Specifically, the creation of a national regulatory framework for personal data protection through blockchain technology could significantly enhance trust and security in blockchain applications, particularly in sectors like healthcare and public administration. Furthermore, Kazakhstan could adopt a two-stage regulatory approach, similar to that seen in other countries, where foundational laws are supported by sector-specific guidelines for blockchain use.

In terms of specific applications, Kazakhstan's regulatory and technological landscape differs from countries like Poland, where blockchain integration in areas such as land registration and notarial services is more advanced. The analysis by Aitimov and Ilyassova highlights that Kazakhstan

is still in the early stages of developing the necessary infrastructure and expertise. However, there are opportunities for Kazakhstan to leapfrog development in sectors like digital identity management, leveraging blockchain to enhance government services and data security.

This research contributes to the growing body of knowledge on blockchain's interaction with legal frameworks in emerging markets. For Kazakhstan, there is a critical need for legislative clarity and more robust regulatory mechanisms. As highlighted by Aitimov and Ilyassova, the absence of specific regulations on personal data and blockchain usage leaves gaps in the system that need to be addressed. Developing a coherent strategy, particularly in the financial and public sectors, could accelerate blockchain adoption and provide a model for other sectors, such as healthcare and education.

Future research should focus on the long-term impacts of blockchain integration in Kazakhstan's public and financial sectors, with attention to the effectiveness of newly implemented legal frameworks. Additionally, further studies could explore the potential benefits of blockchain in other areas, such as education and healthcare, in line with Kazakhstan's broader digital transformation strategy. As Aitimov and Ilyassova suggest, only through comprehensive legal reforms and strategic investment in education and technical expertise can Kazakhstan fully capitalize on blockchain's potential.

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БЛОКЧЕЙН ЖӘНЕ АЗАМАТТЫҚ ҚҰҚЫҚТЫ ЦИФРЛАНДЫРУ: ПОЛЬША МЕН ҚАЗАҚСТАН ТАЛДАУЫ

Андатпа

Мақалада мемлекеттік басқаруда, жылжымайтын мүлікті тіркеуде және қаржы секторында қолдануға баса назар аударып, Қазақстанда блокчейн технологиясын енгізу талданады. Мақала мақсаты - Қазақстанның ілгерілеуін Польшаның неғұрлым дамыған блокчейн-ландшафтымен салыстыру, негізгі проблемалар мен

мүмкіндіктерін анықтау. Зерттеуде Қазақстандағы ағымдағы нормативтік-құқықтық базаны бағалау үшін талдау, синтез және салыстыруды қоса алғанда, жалпы ғылыми әдістер пайдаланылды. Зерттеу барысында дамымаған құқықтық инфрақұрылым, техникалық сараптаманың болмауы және іске асырудың айтарлықтай шығындары сияқты бірқатар кедергілер анықталды. Осы мәселелерге қарамастан, блокчейн ашықтықты арттыруға және алаяқтық деңгейін төмендетуге айтарлықтай әлеуетке ие. Зерттеу блокчейн интеграциясын қолдау үшін құқықтық реформалар мен халықаралық ынтымақтастықтың қажеттілігін көрсетеді. Зерттеу нәтижелері Қазақстанның цифрлық трансформация жөніндегі шаралары Польшаның озық тәжірибесін қабылдаудан, әсіресе қолайлы нормативтік-құқықтық ортаны құрудан айтарлықтай пайда көретінін атап көрсетеді. Бұл зерттеу блокчейннің дамушы нарықтардағы құқықтық базалармен өзара әрекеттесуі туралы білімнің артуына ықпал етеді. Қазақстан үшін заңнамалық айқындық пен реттеудің неғұрлым сенімді тетіктеріне қажеттілік бар. Мақалада қол жеткізілген прогреске қарамастан, Қазақстан алдағы жылдары блокчейннің әлеуетін толық пайдалану үшін құқықтық реформалар мен кәсіптік даярлыққа стратегиялық қаражатты инвестициялауы тиіс деген қорытынды жасалады.

Негізгі сөздер: блокчейн технологиясы, Қазақстан, Польша, мемлекеттік басқару, жылжымайтын мүлікті тіркеу, қаржы секторы, цифрлық трансформация.

БЛОКЧЕЙН И ЦИФРОВИЗАЦИЯ ГРАЖДАНСКОГО ПРАВА: АНАЛИЗ ПОЛЬШЫ И КАЗАХСТАНА

Аннотация

В статье анализируется внедрение технологии блокчейн в Казахстане с акцентом на ее применение в государственном управлении, регистрации недвижимости и финансовом секторе. Цель статьи - сравнить прогресс Казахстана с более развитым блокчейн-ландшафтом Польши, выявить основные проблемы и возможности. В исследовании использованы общенаучные методы, включая анализ, синтез и сравнение, для оценки текущей нормативно-правовой базы в Казахстане. Исследование выявило ряд препятствий, таких как неразвитая правовая инфраструктура, отсутствие технической экспертизы и значительные затраты на внедрение. Несмотря на эти проблемы, блокчейн обладает значительным потенциалом для повышения прозрачности и снижения уровня мошенничества. Исследование подчеркивает необходимость правовых реформ и международного сотрудничества для поддержки интеграции блокчейна. Результаты исследования подчеркивают, что усилия Казахстана по цифровой трансформации могут значительно выиграть от перенимания передового опыта Польши, особенно в создании благоприятной нормативно-правовой среды. В статье делается вывод, что, несмотря на достигнутый прогресс, Казахстан должен инвестировать стратегические средства в правовые реформы и профессиональную подготовку, чтобы в полной мере использовать потенциал блокчейна в ближайшие годы.

Ключевые слова: технология блокчейн, Казахстан, Польша, государственное управление, регистрация недвижимости, финансовый сектор, цифровая трансформация.

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