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**G.K. Rasheva[1], G.T. Aigarinova[1], Zh.B. Akshatayeva[2*], G.M. Sarsenbiyev[1]**

[1]Al-Farabi Kazakh National University, Almaty, Kazakhstan
[2]Shymkent University, Shymkent, Kazakhstan
*e-mail: akshataeva_j@mail.ru

# LEGAL ISSUES OF DIGITAL TRANSFORMATION IN THE FIELD OF PHYTOSANITARY SAFETY

In the context of rapid development and integration of digital technologies into key sectors of social and economic life, the Republic of Kazakhstan faces the challenge of revising its approaches to the legal provision of phytosanitary security. This study aims to develop scientifically grounded legal solutions that take into account the specifics of digital transformation and focus on updating the current legislation.

The analysis of the existing legal framework revealed inconsistencies and legislative gaps that hinder the full implementation of digital tools in the field of phytosanitary safety. Significant emphasis was placed on studying international experience, as well as assessing the potential for Kazakhstan's integration into the international system of electronic phytosanitary certificates, IPPC e-Phyto, which is an important step toward the international recognition of digital documents and the simplification of procedures in foreign trade.

The methodological framework of the study is based on comparative legal analysis, legal modeling, and forecasting of regulatory risks. As a result of the research, a number of practical proposals have been formulated aimed at eliminating identified barriers, including the normative consolidation of the use of electronic certificates, ensuring legal protection of personal data, expanding digital infrastructure in agricultural regions, and increasing the level of digital competence among representatives of the agricultural sector. The findings of this study may serve as a foundation for the development of a national strategy for the digital transformation of legal regulation in Kazakhstan's agricultural sector.

**Keywords:** digital transformation, phytosanitary security, legal regulation, electronic phytosanitary certificates, digital infrastructure, data protection, digital literacy.

Г.К. Рашева[1], Г.Т. Айгаринова[1],
Ж.Б. Акшатаева[2]*, Г.М. Сарсенбиев[1]

[1]Әл-Фараби атындағы Қазақ ұлттық университеті, Алматы, Қазақстан
[2]Шымкент университеті, Шымкент, Қазақстан
*e-mail: akshataeva_j@mail.ru

## Фитосанитариялық қауіпсіздік саласындағы цифрлық трансформацияның құқықтық мәселелері

Цифрлық технологиялардың әлеуметтік-экономикалық өмірдің негізгі салаларына жылдам ену жағдайында Қазақстан Республикасы фитосанитариялық қауіпсіздікті құқықтық қамтамасыз ету тәсілдерін қайта қарау міндеті алдында тұр. Бұл зерттеудің мақсаты – цифрлық трансформация ерекшеліктерін ескеріп, қолданыстағы заңнаманы жаңартуға бағытталған ғылыми негізделген құқықтық шешімдерді әзірлеу.

Қолданыстағы нормативтік-құқықтық базаны талдау цифрлық құралдарды фитосанитариялық қауіпсіздік саласында толыққанды қолдануға кедергі келтіретін сәйкессіздіктер мен заңнамалық олқылықтардың бар екенін анықтады. Халықаралық тәжірибені зерттеуге және Қазақстанның электрондық фитосанитариялық сертификаттар – IPPC e-Phyto халықаралық жүйесіне қосылу мүмкіндігін бағалауға ерекше назар аударылды. Бұл цифрлық құжаттардың халықаралық деңгейде мойындалуына және сыртқы саудадағы рәсімдердің оңайлауына маңызды қадам.

Зерттеудің әдіснамалық негізі салыстырмалы-құқықтық талдау, құқықтық модельдеу және нормативтік тәуекелдерді болжауға негізделген. Зерттеу нәтижесінде анықталған кедергілерді жоюға бағытталған бірқатар практикалық ұсыныстар жасалды, соның ішінде электрондық сертификаттарды қолдануды нормативтік бекіту, жеке деректерді құқықтық қорғауды қамтамасыз ету, аграрлық аймақтарда цифрлық инфрақұрылымды дамыту және ауылшаруашылық саласының өкілдері арасында цифрлық сауаттылық деңгейін арттыру.

 

танның аграрлық секторындағы құқықтық реттеуді цифрлық трансформациялау стратегиясын әзірлеуге негіз бола алады.

**Түйін сөздер:** цифрлық трансформация, фитосанитариялық қауіпсіздік, құқықтық реттеу, электронды фитосанитариялық сертификаттар, цифрлық инфрақұрылым, деректерді қорғау, цифрлық сауаттылық.

Г.К. Рашева[1], Г.Т. Айгаринова[1],
Ж.Б. Акшатаева[2*], Г.М. Сарсенбиев[1]
[1]Казахский национальный университет им. аль-Фараби, Алматы, Казахстан
[2]Шымкентский университет, Шымкент, Казахстан
*e-mail: akshataeva_j@mail.ru

**Правовые проблемы цифровой трансформации в сфере фитосанитарной безопасности**

В условиях стремительного развития цифровых технологий и их проникновения в ключевые сферы жизнедеятельности, Республика Казахстан сталкивается с задачей пересмотра подходов к правовому обеспечению фитосанитарной безопасности. Настоящее исследование направлено на формирование научно аргументированных правовых решений, учитывающих особенности цифровой трансформации и ориентированных на актуализацию действующего законодательства.

Анализ действующей нормативно-правовой базы выявил наличие несоответствий и законодательных пробелов, препятствующих полноценному применению цифровых инструментов в области фитосанитарной безопасности. Значительный акцент сделан на изучении международного опыта, а также на оценке потенциала интеграции Казахстана в международную систему электронных фитосанитарных сертификатов IPPC e-Phyto, что является важным шагом к признанию цифровых документов на международном уровне и упрощению процедур в сфере внешней торговли.

Методологическая база исследования основана на сравнительно-правовом анализе, юридическом моделировании и прогнозировании нормативных рисков. В результате проведённой работы сформулирован ряд прикладных предложений, направленных на устранение выявленных барьеров, включая нормативное закрепление использования электронных сертификатов, обеспечение правовой защиты персональных данных, расширение цифровой инфраструктуры в аграрных регионах и повышение уровня цифровой компетентности среди представителей сельскохозяйственного сектора. Выводы исследования могут служить основой для подготовки государственной стратегии цифровой трансформации правового регулирования в аграрной отрасли Казахстана.

**Ключевые слова:** цифровая трансформация, фитосанитарная безопасность, правовое регулирование, электронные фитосанитарные сертификаты, цифровая инфраструктура, защита данных, цифровая грамотность.

## Introduction

Ensuring phytosanitary safety in the context of modern digital transformation represents a significant and relevant issue. Digitalization, which serves as a key direction of progress in the development of Kazakhstan as an agrarian country, has a substantial impact on the mechanisms for ensuring phytosanitary safety. In the context of the revival and globalization of world trade in the post-covid period, the growing risks associated with climate change and the transboundary movement of quarantine-controlled objects necessitate a review and adaptation of the regulatory framework governing the phytosanitary safety system, taking into account the integration of digital technologies.

In recent years, digital technologies have been actively introduced in the field of phytosanitary safety, specifically, work is underway to develop and implement the «FitoSpace» digital platform based on artificial intelligence for locust control, as well as to integrate the Unified automated management system of the Republic of Kazakhstan with the information systems of the Eurasian economic commission and the Russian Federation in order to ensure a high level of transparency and traceability of certificates for products under phytosanitary certification, simplify inspection processes, and more. The

implementation of artificial intelligence, machine learning, and big data analytics technologies in the field of phytosanitary safety plays an important role in the effective identification of phytosanitary risks and the prevention of the spread of harmful organisms.

However, the need for current legislation to keep pace with the rapid development of technological innovations is a modern imperative. Alongside the implementation of digital technologies, pressing legal issues such as the protection of personal data privacy on these platforms, legal liability in this area, cybersecurity, digital inequality, harmonization of international standards and national legislation, legal regulation of the use of digital platforms, the rights and obligations of users of these platforms, the recognition of electronic phytosanitary certificates in other countries, Kazakhstan's inclusion in the global e-Phyto hub, etc., which await resolution, do not call into question the relevance of this research topic.

Overall, the role of digital transformation in ensuring phytosanitary security is of particular importance. On September 2, 2024, the President of the Republic of Kazakhstan, Kassym-Jomart Tokayev, in his address to the people of Kazakhstan, stated: «Kazakhstan must consolidate the achievements made in the field of digitalization. Artificial intelligence technologies must be actively integrated into the 'e-Government' platform. Kazakhstan must become a country where artificial intelligence is widely used and digital technologies are developed.» Special emphasis was placed on the need to secure the progress achieved in digitalization and the implementation of innovations, including the necessity of operating the «e-Government» platform based on artificial intelligence (https://www.akorda.kz).

The Concept of Digital Transformation and Cybersecurity for 2023–2029 have become the fundamental basis for the formation of the legal framework for the use of digital technologies. These strategically important acts are considered the main strategic steps taken on the path of the country's digital transformation. The Concept of Digital Transformation for 2023–2029 includes one of the directions of the country's technological policy (https://adilet.zan.kz).

## Materials and methods of research

The article places particular emphasis on the issues of digital transformation in ensuring modern phytosanitary security, as well as the role of digital platforms in implementing comprehensive phytosanitary measures in the field of plant quarantine and protection, including phytosanitary control at customs borders and in other areas.

By studying national and international legal frameworks regulating the digitalization of phytosanitary certification, the author, in preparing this specific research work, employed both general scientific and specific scientific methods. In particular, historical, empirical, logical, systemic, and other research methods were applied, including a comparative legal analysis of the legislation of the Republic of Kazakhstan and foreign countries in this field.

The article extensively uses the works of not only domestic and foreign legal scholars on issues of digitalization and phytosanitary security, but also specialists in the fields of technical, biological, and agricultural sciences, which ensured a comprehensive interdisciplinary approach to the subject matter under consideration.

## Literature review

Today, there is a growing trend in which legal issues related to the use of digital technologies in the field of phytosanitary security are becoming the subject of research by many domestic and foreign scholars. Researcher Y. Burylo asserts that Ukraine needs an information system aimed at official control over phytosanitary, sanitary, and veterinary certification data. He emphasizes that, as an anti-corruption measure, inspections must be mandatorily recorded via video and audio using digital technologies, and these recordings should be stored in a digital system (Burylo 2022).

A.Yu. Mironkina and S.S. Kharitonov assert that the use of digital technologies, particularly satellites, sensors, and other equipment in phytosanitary monitoring, makes it possible to obtain the most reliable information about the condition of crops and to promptly forecast the phytosanitary situation in a given area (Mironkina 2021).

G. Hasanaliyeva proposes the creation of an integrated digital interaction system to ensure phytosanitary monitoring – monitoring that can be combined with process automation through the use of Internet of things technologies (Hasanaliyeva 2022).

A. Britt, asserting that the use of digital technologies in managing phytosanitary processes can lead to increased productivity and reduced pesticide use,

proposes a comprehensive method for assessing the phytosanitary examination of agricultural products.

According to K.Kh. Ibragimov, the development of digital agricultural law requires the restoration of informational and consultative services for agricultural producers in rural areas and the digital retraining of farmers (Ibragimov 2022).

J. MacPherson notes that, in the context of evolving legal regulations, digital agriculture can become an important tool for achieving the UN Sustainable Development Goals within agri-food systems (MacPherson 2022).

According to N.V. Pogrebnaya, the construction of high-tech agro-zones and parks constitutes a system of state support for agriculture and farmers. At the same time, it is necessary to ensure the use of digital technologies in agriculture for agro-industrial complexes, as well as the preservation of scientific and technological production and scientific progress (Pogrebnaya 2021).

Roosevelt Fabiano Moraes da Silva states that digital transformation in agriculture can contribute to the development of effective governance principles for public policy in agri-food trade systems (Silva 2022).

M. Ehlers argues that the planning of the digitalization of agricultural policy is a necessary condition. This is due to the fact that the benefits of digitalization can be realized only through systematic training and capacity building of all stakeholders in the sector (Ehlers 2021).

Mehmet Ali Dayioglu notes that one of the key directions is the development of more intelligent machines and systems that will ensure the transition of agriculture from traditional methods to digital ones. This will make it possible to increase production efficiency, reduce resource costs, and decrease the negative impact on the environment. In the era of digitalization, which began with the Industry 4.0 revolution, the production capacities of all industries, including agriculture, must be transformed to meet the food needs of the rapidly growing global population (Dayioglu 2021).

According to the domestic researcher E. Kuandykova, the legal framework regulating public relations in the field of agricultural digitalization needs to be supplemented with regulatory requirements aimed at improving the efficiency of information services provided to agricultural producers (Kuandykova 2023).

Having studied the works of the above-mentioned researchers, we nevertheless found a lack of systematization and comprehensiveness in the study of this issue. The authors mainly focus on general issues of digital transformation of the agricultural sector, on the use of digital technologies in phytosanitary measures, while the legal issues of implementing digital technologies in the field of phytosanitary safety have not been studied.

**Research results and discussion**

The history of digital transformation began with the introduction of computers in the 1960s, with the automation of processes, and since 1989-1990, with the emergence of the Internet and the formation of the information society, it has been characterized by the transition of document flow into digital format. Since 2010, cloud technologies, the Internet of Things, and Big Data, etc., have been rapidly developing – advanced technologies, and since 2020 – platform-based business processes and artificial intelligence.

On Kazakhstan's path from automation to digital transformation, several strategic documents were adopted on the legal regulation of this sector. To speak in more detail, in 2004, by the Decree of the President of the Republic of Kazakhstan dated November 10, 2004, the State Program for the Formation of «Electronic Government» in the Republic of Kazakhstan for 2005–2007 was adopted, then from 2013 to 2020, the «Information Kazakhstan – 2020» program was implemented to ensure electronic accessibility of 50% of public services. On December 12, 2017, the «Digital Kazakhstan» program was adopted, which set the goal for Kazakhstan's economy to enter the top 30 developed countries by 2050 by transforming society and production in accordance with modern technological achievements. On March 28, 2023, the «Concept of Digital Transformation, Development of the Information and Communication Technologies Sector and Cybersecurity for 2023-2029» was adopted, according to which Kazakhstan chooses the «platform-based» path, providing for the improvement of public administration and adaptation to technological progress.

The importance of paying special attention to phytosanitary security is increasing every day. In our opinion, considering that phytosanitary security is a part of the national security of the state, the spread of pests, plant diseases, and weeds within the country poses a threat to national security. In this regard, it is necessary to amend the Law «On Na-

tional Security of the Republic of Kazakhstan» and include phytosanitary security as a separate type of security.

Given the increasing requirements of international phytosanitary standards, especially in food markets, the national control system must meet digital requirements to support the competitiveness of agricultural exports. The concept of phytosanitary security, as part of national security, plays a key role in ensuring the sustainable development of agriculture and food security in Kazakhstan. This approach affects not only production efficiency but also public health and the economic security of the state.

In our opinion, phytosanitary security should be included in the list of types of national security specified in Article 4 of the Law of the Republic of Kazakhstan «On National Security», with the following definition: «Phytosanitary security is the state of protection against harmful organisms (plant pests, plant diseases, and weeds) that may cause harm to human life and health, the environment, animals, and plants, aimed at ensuring a favorable phytosanitary situation.» (https://adilet.zan.kz). This is due to the fact that the current Law of the Republic of Kazakhstan «On Plant Quarantine» directly establishes that phytosanitary security is an integral part of ensuring the national security of the Republic of Kazakhstan.

Since the spread of epiphytotics poses a threat to national security, the «spread of epiphytotics» should be added to the Law of the Republic of Kazakhstan «On National Security» in part 1 of Article 6 in paragraph 18 of the list of main threats to national security.

The spread of epiphytotics poses a serious threat, as the spread of plant pests and diseases can lead to the death of plants (complete failure of germination and underdevelopment of plants, extinction of plant species, wilting, and reduced yields). Epiphytotics can spread not only within the territory of a single country, but plant diseases and pests may also threaten the territories of several countries; in such cases, the occurrence of panphytotics is noted. In view of the danger posed by the spread of epiphytotics, we propose amending paragraph 2 of Article 327 of the Penal Code of the Republic of Kazakhstan, to read as follows: «Violation of the established rules for combating plant diseases and pests, resulting in an epiphytotic outbreak among plants and other serious consequences ». Article 3 of the Penal Code defines the concept of serious harm to health, The list of consequences provided therein should be supplemented with the words «resulting in an epiphytotic outbreak».

In addition, the definition of «epiphytotic outbreak» should be included in the list of terms used in the law, namely in Article 1 of the Law of the Republic of Kazakhstan «On Plant Protection» (https://adilet.zan.kz), with the following wording: «Epiphytotic outbreak – the mass spread of infectious plant diseases and increased activity of plant pests».

In the context of the digital transformation of the agricultural sector, the importance of phytosanitary security is a key aspect. Modern digital technologies make it possible to collect and analyze digital data to make informed decisions that help optimize measures to prevent yield reduction caused by pests and to forecast the spread of plant pests and diseases. For the successful implementation of these processes, systematic and comprehensive legislative regulation of phytosanitary security is necessary.

Recently, scientists have been sounding the alarm about the increasing number of new phytosanitary threats due to climate change. Scientists studying the impact of climate change on food security claim that global warming will alter the relationships between plants and microbiomes, including endophytic fungi and organisms. Researchers also recommend cooperating with farmers and utilizing artificial intelligence and remote sensing for early monitoring and control of pathogens (https://www.downtoearth.org.in).

Modern capabilities of digital technologies are actively used in the field of phytosanitary security in the Republic of Kazakhstan. According to the Ministry of Agriculture of the Republic of Kazakhstan, Kazakhstan has launched pilot projects for the digitalization of phytosanitary reporting for entrepreneurs (https://www.gov.kz). For transparency and verification of phytosanitary certificates for plant products within the framework of the Eurasian economic union, a Unified automated system of Kazakhstan is being integrated with the systems of the Eurasian economic commission and Russia , furthermore, in 2025, in collaboration with the National Company «Gharysh Sapary», a geoinformation system based on artificial intelligence and the unified digital platform FitoSpace will be introduced. This system will enhance monitoring accuracy, minimize pesticide use, and reduce environmental risks, thereby contributing to increased agricultural efficiency and strengthened phytosanitary control.

Climate change is leading to an increase in pest populations, and by 2025, locust swarms in Ka-

zakhstan are expected to spread over an area of 2.1 million hectares (https://azattyq-ruhy.kz). This is only one type of pest; in addition, the approved list includes 15 more types of quarantine objects that cause damage to the country's economy and food security: 8 types of insects, 1 type of nematode, 1 type of bacteria and phytoplasmas, 4 types of plants, and 12 types of particularly dangerous harmful organisms (https://primeminister.kz).

In addition to the practical implementation of these digital technologies, it is necessary to pay attention to the issues of maintaining the confidentiality of personal data on these platforms. Digital platforms play an important role in the economy, providing convenience and efficiency in working with large volumes of data in business processes. However, their operation may encounter a number of legal issues, including the confidentiality of digital data. The general rules for the protection of personal data on these platforms are regulated by the Law of the Republic of Kazakhstan «On Informatization» dated November 24, 2015, and the Law of the Republic of Kazakhstan «On Personal Data and Their Protection» dated May 21, 2013, among others. This creates certain difficulties for all those who seek to use modern technologies to increase the efficiency and accuracy of phytosanitary measures. In general, the current legislation lacks specific provisions that would legally authorize the use of digital technologies in this field and regulate their application at the legislative level.

In modern practice, insufficient regulation in the field of phytosanitary safety limits the ability to adequately protect plants from harmful agents and pathogens, which is the main objective of quarantine procedures. Therefore, the development and implementation of legal acts regulating the use of digital technologies in this area becomes a key necessity. In particular, the Law of the Republic of Kazakhstan «On Plant Quarantine» should include provisions establishing the legal framework for the use of digital tools in the process of conducting all phytosanitary measures. This includes an objective and scientifically grounded assessment of the potential impact of quarantine organisms on plant resources and plant-based products, as well as the prevention of possible damage through the use of digital technologies for monitoring, forecasting, and risk analysis. According to Article 11 of the aforementioned Law, the necessity of conducting phytosanitary monitoring and implementing corresponding measures is emphasized. It is proposed to supplement this article with provisions establishing the use of advanced digital technologies, such as information systems, remote sensing, unmanned aerial vehicles (drones), geographic information systems (GIS), and other digital tools to enhance the effectiveness of phytosanitary processes. In the modern world, the integration of digital technologies into the plant quarantine process is becoming increasingly relevant, which is reflected in the legislation of various countries. An example of such an approach is the legislation of Turkmenistan, where the Law «On Plant Quarantine» addresses the use of digital information and communication technologies in this field. In particular, Article 7 of this Law, titled «Competence of the Service», contains a provision stating: «The competence of the Service includes the implementation of information support for the introduction and use of digital information and communication technologies in the field of plant quarantine». This indicates that the use of digital tools in phytosanitary control is an important component of state policy aimed at improving the management of quarantine measures (https://mejlis.gov.tm).

Legal liability in the field of phytosanitary security requires that unauthorized access to phytosanitary data, as well as its alteration, destruction, or dissemination without permission, be regulated by law. Cyberattacks on phytosanitary data are common in practice. In the United States, a major cooperative, Crystal Valley, which is engaged in the production of wheat and fertilizers in the state of Minnesota, was subjected to a cyberattack aimed at extortion (https://www.reuters.com).

Recently, the U.S. government has become increasingly aware of the connection between national food security and cybersecurity. This awareness has led to the development of specific policies and regulations aimed at reducing the vulnerability of the food supply chain to cyber threats. For example, the FSMA of the U.S. Food and Drug Administration recognizes the growing cyber threats (Kulkarni 2024).

Another example is a cyberattack on a farm in Europe, which resulted in unauthorized access and modification of crop monitoring data. The perpetrators were able to alter information related to soil conditions and plant health, leading to incorrect agronomic decisions and, consequently, reduced crop yields (Harrison 2020).

Before the intensive implementation of digital technologies, it is crucial to address the issue of

digital inequality in Kazakhstan. According to statistical data, there are currently 6,406 settlements in the Republic of Kazakhstan, of which 4,974 (77%) have access to broadband mobile Internet (https://primeminister.kz). The remaining 23 percent do not have Internet access. If agricultural producers live in areas without Internet connectivity, it is necessary to address the issue of digital inequality so that entities engaged in phytosanitary business in Kazakhstan have 100 percent Internet access to maintain phytosanitary reporting.

The practice of issuing phytosanitary certificates in electronic form has been implemented in Kazakhstan. In accordance with the Decision of the Board of the Eurasian Economic Commission dated March 19, 2019, No. 38 «On the Approval of the Rules for the Implementation of Common Processes in the Field of Information Support for the Application of Quarantine Phytosanitary Measures» the issuance of phytosanitary certificates in electronic form is permitted to ensure the traceability of quarantine products during movement between member states. The Commission performs the functions of creating and maintaining a database for the identification and distribution of quarantine pests within a unified information resource. It also provides information on quarantine pests and related measures upon request from authorized bodies, as well as by publishing such information on the Union's information portal. As part of the implementation of common processes, shared information resources are being developed, including a database of quarantine pests, information on temporary measures, and the quarantine phytosanitary status of the territories of the member states. The issuance of a phytosanitary certificate is carried out through the «electronic licensing» portal when exporting quarantine-regulated products from the Republic of Kazakhstan (https://adilet.zan.kz).

The Decision of the EEC Council was prepared in accordance with the amendments to the Treaty on the Eurasian economic union dated December 10, 2021, concerning the use of phytosanitary certificates in electronic form, which were signed by the heads of the EAEU member states. Within the framework of quarantine phytosanitary control, the use of electronic phytosanitary certificates and accompanying documents is permitted, as well as the issuance of control results in electronic form (https://eec.eaeunion.org/).

In international practice, in developed agricultural countries such as the United States, the Netherlands, Argentina, and others, the ePhyto Solution system is widely used for the creation of electronic phytosanitary certificates. This system enables the issuance of electronic certificates for exported consignments of plants and plant products, as well as the exchange of certificates between exporting and importing countries. The purpose of the ePhyto Solution is to facilitate the development of international trade in plants and plant products and to ensure compliance with the phytosanitary certificate requirements of importing countries.

The ePhyto Solution system consists of two main components: the ePhyto Hub, which serves as the central platform for electronic phytosanitary certificates, and the Generic ePhyto National System (GeNS), a public national system for electronic phytosanitary certification. The development of the ePhyto Solution was carried out by the United Nations International Computing Centre based on Annex 1 to the International Standard for Phytosanitary Measures (ISPM) № 12 «Phytosanitary Certificates», which is aimed at harmonizing the format of electronic phytosanitary certificates ` (https://www.ippc.int).

The implementation of the ePhyto Solution system contributes to a more cost-effective, faster, and more secure exchange of phytosanitary certificates between countries, simplifying and accelerating operations related to the export and import of plants and plant products. Thus, the use of the ePhyto Solution system enhances efficiency and streamlines the trade of these goods. The ePhyto Solution is an innovative system for electronic phytosanitary certificates (https://openknowledge.fao.org).

In 2021, Uzbekistan implemented electronic phytosanitary certificates in the region and successfully integrated with the international «ePhyto Solution» system. Thanks to this system, Uzbekistan can receive advance information about consignments intended for import into its territory and verify the authenticity of phytosanitary certificates (https://catradeforum.org).

According to the Commission on Phytosanitary Measures, Kazakhstan is classified by the World Bank as a «higher-middle-income» country, but it has not yet implemented the ePhyto system. Experts note that the country has already established a legal framework for the exchange of electronic phytosanitary certificates. In Kazakhstan, the industrial implementation of this system is scheduled to begin only in 2025. Such exchange requires an information system capable of issuing phytosanitary certificates

in electronic form, as well as its integration with a compatible system of another country. It is also important to comply with international standards and agreements related to the exchange of electronic documents. Joining the Framework Agreement on facilitation of cross-border paperless trade in the Asia-Pacific Region could be beneficial for Kazakhstan. This agreement aims to simplify cross-border paperless trade through the mutual recognition and exchange of trade documents and data in electronic form across borders, thereby enhancing the efficiency and transparency of foreign trade operations. According to Prikhodko, even if Kazakhstan adopts ePhyto after testing it, trucks transiting through Kazakhstan to the Russian Federation will only benefit from ePhyto if the Russian Federation, as the importing country, also accepts it (Prykhodko 2025).

Kazakhstan's accession to the system facilitates accelerated and transparent exchange of information on phytosanitary certificates in electronic format, leading to reduced delays and simplified procedures for processing export and import consignments. Integration with the ePhyto system contributes to enhanced security and trust, as electronic certificates are less susceptible to forgery and errors compared to traditional paper documents. In addition, joining this international system supports compliance with the standards and requirements of international organizations, thereby enhancing Kazakhstan's reputation in the field of phytosanitary control and opening new opportunities for access to global markets.

## Conclusion

The process of digital transformation in the field of phytosanitary security in the Republic of Kazakhstan requires appropriate legislative support. To address this issue, the following scientific and legal recommendations are proposed:

- It is necessary to develop and implement a legal framework that ensures transparency and efficiency of legal regulation in the digital environment, as well as balances the interests of all stakeholders.

- Within the current legislation of Kazakhstan, external legal norms and procedures related to the use of digital technologies in the field of phytosanitary security must be established.

- Specific legal norms should be defined to regulate the rights and obligations of various participants (government authorities, exporters, importers, agricultural producers) when using digital tools, with particular attention given to the protection of personal data and commercial confidentiality.

- In order for electronic phytosanitary certificates issued by Kazakhstan to be recognized by the international community, it is strategically important to join the international IPPC e-Phyto system, which will simplify and increase the transparency of international trade.

- For the effective implementation of digital tools in agriculture, it is necessary to ensure Internet access in remote areas, improve the level of digital literacy among agricultural producers, and establish legislative mechanisms for providing explanatory, educational, and legal support.

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***Information about the authors:***

*Gulnur Koishynovna Rasheva – Senior Lecturer at the Department of Customs, Financial and Environmental Law, Al-Farabi Kazakh National University, PhD in Philosophy (Kazakhstan, Almaty c., e-mail: gulnur1989@mail.ru).*

*Gulnar Tuleukhadirovna Aigarinova – Candidate of Legal Sciences, Professor, Department of Customs, Financial and Environmental Law, Al-Farabi Kazakh National University (Kazakhstan, Almaty c., e-mail: 87012178280g@gmail.com).*

*Zhanna Baibekovna Akshataeva (corresponding author) – Candidate of Legal Sciences, Associate Professor, Director of the Department of Science at Shymkent University, (Kazakhstan, Shymkent c., e-mail: akshataeva_j@mail.ru).*

*Gani Miyatbekovich Sarsenbiyev – Researcher at the Institute of Philosophy, Political Science and Religious Studies of the Committee of Science of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Kazakhstan, Almaty c., e-mail: g.sarsenbiyev_77@mail.ru).*

***Авторлар туралы мәлімет:***

*Рашева Гульнур Койшыновна – әл-Фараби атындағы Қазақ ұлттық университеті, кеден, қаржы және экологиялық құқық кафедрасының аға оқытушысы, философия докторы (PhD), (Қазақстан, Алматы қ., e-mail: gulnur1989@mail.ru).*

*Айгаринова Гулнар Тулеухадировна – әл-Фараби атындағы Қазақ ұлттық университеті, кеден, қаржы және экологиялық құқық кафедрасы, заң ғылымдарының кандидаты, профессор (Қазақстан, Алматы қ., e-mail: 87012178280g@gmail.com).*

*Акшатаева Жанна Байбековна – заң ғылымдарының кандидаты, қауымдастырылған профессор, Шымкент университеті ғылым департаментінің директоры (Қазақстан, Шымкент қ., e-mail: akshataeva_j@mail.ru), автор-корреспондент.*

*Сарсенбиев Ғани Миятбекович – ҚР ҒЖБМ ҒК Философия, саясаттану және дінтану институты, ғылыми қызметкер, (Қазақстан, Алматы қ., e-mail: g.sarsenbiyev_77@mail.ru).*

***Сведения об авторах:***

*Рашева Гульнур Койшиновна – старший преподаватель кафедры таможенного, финансового и экологического права, доктор философии (PhD), Казахский национальный университет им. аль-Фараби (Алматы, Казахстан, e-mail: gulnur1989@mail.ru).*

*Айгаринова Гульнар Тулеухадировна – кандидат юридических наук, профессор, кафедра таможенного, финансового и экологического права, Казахский национальный университет им. аль-Фараби (Алматы, Казахстан, e-mail: 87012178280g@gmail.com).*

*Акшатаева Жанна Байбековна (автор для корреспонденции) – кандидат юридических наук, доцент, директор факультета естественных наук Шымкентского университета (Алматы, Казахстан, e-mail: akshataeva_j@mail.ru).*

*Сарсенбиев Гани Миятбекович – научный сотрудник Института философии, политологии и религиоведения Министерства образования и науки Республики Казахстан (Алматы, Казахстан, e-mail: g.sarsenbiyev_77@mail.ru).*

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