

e-ISSN 3106-1079
p-ISSN 3106-1060



WESTERN UNIVERSITY
caspian

The Research Journal of

Business in Emerging Economics

Vol 2, No1, 2026

Baku - 2026



WESTERN
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Western Caspian University

E-ISSN: 3106-1079

P- ISSN:3106-1060

The Research Journal of Business in Emerging Economics

Vol 2, № 1, 2026

DOI:10.54414/EAPM9892

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<https://doi.org/10.54414/MKAE4791>



Non-Contractual Use of State Treasury Agricultural Properties as a Challenge for Public Asset Management and Business Governance Models

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Received: 24.03.2026

Accepted: 03.04.2026

Published: 28.04.2026

<https://doi.org/10.54414/NYTD9985>

Abstract

Since state-owned lands are considered a strategic national resource, their effective management depends on unified legal frameworks, institutional capacity, and effective monitoring and enforcement mechanisms. This study analyzes non-contractual land use as a manifestation of governance failure situated at the intersection of public administration, business management, and corporate economics. This study employed a multi-methods approach combining desk research, legal and institutional analysis, and the analysis of administrative data from 2006 to 2024. The results show that deficiencies in monitoring systems, the fragmented nature of land registry records, information asymmetry, and limited coordination between institutions significantly weaken the protection of public property rights. Despite legal reforms implemented after 2016, unconditional land use continues, particularly in areas where state-owned land has historically been concentrated. The article proposes governance-focused solutions to improve the efficiency of public asset management and support sustainable rural development. These solutions include digital monitoring tools, geomatic analyses, risk-based control mechanisms, and incentive-based contract models.

Keywords: non-contractual land use, State Treasury assets, public administration, institutional economics, National Center for Agricultural Support

1. Introduction

Established pursuant to the Law "On the Management of State Treasury Agricultural Real Estate" of 19 October 1991, the State Treasury Agricultural Real Estate Fund (hereinafter: the Fund) constitutes the largest centrally managed portfolio of public land in Poland (Act, 1991, Articles 1–2). Until 2017, the Fund was administered by the Agricultural Property Agency (APA), and those powers were subsequently transferred to the NSCA under the National Agricultural Support Centre Act. The problem of using state-owned agricultural land without a contract has existed since the fund was established. However, the first official records regarding this case only began to appear in administrative reports in 2006 (Marks-Bielska & Zielińska, 2016). The intensity, forms, and reasons for unauthorized use vary by region and depend on the functional characteristics of the land.

The long-standing problem of the state treasury's uncontracted use of agricultural land, which has significant socio-economic consequences, has not been sufficiently studied in Polish academic literature. This issue is usually addressed only indirectly, that is, in the context of land markets, land-use conflicts, agricultural policy instruments, or agricultural structural changes (Bański & Stola, 2002; Bański, 2005; Marks-Bielska, 2010; Kaleta, 2013; Zegar, 2010). Studies that systematically examine non-contractual use as a distinct institutional, social, and spatial phenomenon are almost nonexistent.

The unauthorized use of state-owned agricultural land is not unique to Poland; it is observed in various forms in other countries as well. In post-socialist countries (Romania, Bulgaria, Hungary, etc.), this

situation is mainly related to the incomplete return of property and the inadequate implementation of land management systems (Hartvigsen, 2014; Swinnen & Vranken, 2009).

In Western European countries (for example, France and Italy), such cases are less common and are mostly related to abandoned land, administrative delays, or conflicts between central and local authorities (OECD, 2015; Magnan & Fournier, 2016). Research outside of Europe shows that weak protection of public property rights, particularly in the context of subsidies and land-based payments, leads to informal land use and rent-seeking behavior (Deininger & Feder, 2009; World Bank, 2017). These results demonstrate that land use without a contract is not merely a legal problem, but a broader governance failure.

The study by Marks-Bielska and Zielińska (2016) is one of the rare empirical studies in this field. Based on data from 2006-2014, the authors have shown that this phenomenon is systemic in nature and is primarily related to information asymmetry, weak control, and the complexity of organizational procedures. Based on agency theory, they highlighted the conflict of interests between the state (landowner) and the users (especially former tenants). However, this corporate governance and a new security system have not been established since 2017 (Marks-Bielska & Zielińska, 2016). In this regard, the current work tries to fill this gap by considering the period until 2024 and analyzing the use of unprotected land as a problem of systematic management, not a legal issue.

Some authors, such as Bar (2015) and Michałowski (2013), also noted that the weakness of legal mechanisms and procedural problems make it difficult to restore the territory and reduce the effective power of anxiety. Although changes have been made in legislation in subsequent years (Czechowski & Marciniuk, 2021; Suchoń, 2023), field information shows that the problem still remains and is widely spread in some regions (by Bar (2015), Michałowski (2013), and Sieradzka (2024).

Uncontrolled use has spread unevenly in terms of space. The highest levels are observed in the northern and western regions of Poland, which is due to the legacy of past state conquests and structural changes (Bański & Stola, 2002; Bański, 2005). These situations create legal restrictions, affect the structural development of savings, and the system of land utilization. This phenomenon is linked to both social and institutional factors – the legacy of the era of post-socialist transformation, domestic political relations, and competition for land resources (Kaleta, 2013; Milczarek-Andrzejewska et al., 2020; Kryszk et al., 2022). At the same time, non-fixed property laws and weak institutional transparency weaken the social and economic functions of self-savings (Marks-Bielska & Kisiel, 2017; Wilkin, 2018; Rasiński, 2018).

From a legal point of view, it is difficult to resolve the issue. Despite the increase in expenses due to illegal use (5 times → 30 times trading rights), the effective monitoring system could not be formalized (Rasiński, 2018; Wilkin, 2018; Zegar, 2010). One of the problems is the inaccurate land cadastral information and the inconsistencies between the registers (Mierzwa, 2002; Hanus, 2005).

This investigation aims to analyze the balance, causes, and consequences of uncontrolled land use in a complex manner in terms of institutional, social, and spatial aspects. Moreover, it proposes ways to increase the effectiveness of public land management by identifying the systematic causes of this phenomenon. The main question of the investigation is this: Is the uncontrolled use of land mainly due to legal gaps, or is it the result of institutional and organizational failures in the management of social activities?

2. Issues Related to the Management Of State Treasury Lands in Poland

2.1 Institutional Framework of the Administration of the Polish State Treasury's Self-Saving Real Estate Fund

NSCA combines the functions of managing social institution activities, organizing the market, and implementing clear policy. Its mandate is limited to the passive administration of the lands of the State Treasury. At the same time, it is a structure aimed at active intervention in the land market of civil savings, protection of state property rights, and the development of family savings and local lands. Enables the

realization of goals (Wilkin, 2018; Zegar, 2010). The institutional framework that regulates the activities of NSCA is mainly the law dated 1991, the law "On the formalization of the public system," and the law dated 10 February 2017, "On the Civil Registration". "About the National Center for Support" is determined by law (Czechowski & Marciniuk, 2021; Suchoń, 2023).

The size of the fund and its distribution according to space have a direct impact on the effectiveness of the administration. Since its creation, an estimated 4.7 million hectares of land have been included in the composition of the Fund, of which approximately four-fifths have been formalized through state self-saving institutions (Bański, 2005; Marks-Bielska, 2010). Fond lands are mainly concentrated in terms of space in the northern and western regions of Poland, and these regions have historically been lands dominated by large amounts of state savings.

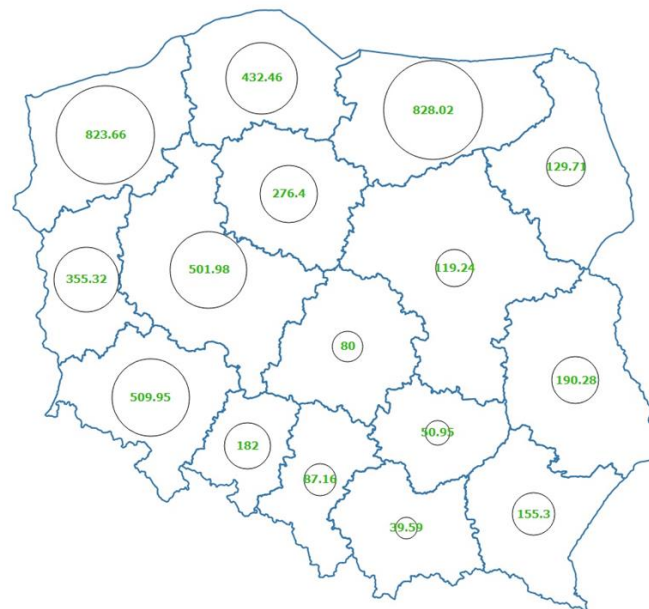


Figure 1. Spatial distribution of the Agricultural Property Stock of the State Treasury in Poland

Note: The figure illustrates the regional concentration of State Treasury land, highlighting areas with historically high shares of former state farm property.

This non-uniform sharing makes it possible for NSCA to influence the structure of the country to the same extent. For example, since there are many lands in the northern and western regions, NSCA can have a serious impact on land use there. But its role remains very weak in the southern and eastern regions. With the legal changes made after 2016, the sale of state lands was severely limited, and trade became the main form of use. This change transformed NSCA from an institution that sold the lands into an institution that managed them for the long term. At the same time, additional rights were given to the state so that, if necessary, it could intervene in private land purchase-sale processes - the main purpose being to prevent land from being collected by any means. It was to buy and protect family savings. These lands are no longer used only for personal savings. They are also used in such fields as infrastructure developments, range politics, and even national risk reduction. In other words, state lands increasingly play the role of "strategy reassurance", which makes their proper management even more important.

2.2. Non-contractual use of land

Simply put, land use without compensation is the use of land without any legal basis. This means either that the former tenants do not give up the land after the end of the contract, or that third parties generally use the land without any legal basis. In these situations, the users act either without the knowledge

of the land owner or clearly against his will. In the case of state lands, the owner of the land is the State Treasury, and it is currently represented by NSCA (formerly APA).

When you look at this issue through the prism of institutional economics, the situation becomes clearer. Here, in fact, illegal economic benefit is obtained from the reinsurance specific to the state. This shows that the control system is weak, the enforcement mechanisms are not functioning, and the signals are not set up properly (Marks-Bielska & Zielińska, 2016).

The problem is big enough. For example, in 2011, a total of 24.2 thousand hectares of land were used without compensation - this was a total of 8% of the undivided lands of the Fund. By the end of the year 2024, this figure decreased to 7.7 thousand hectares, but the problem still remains and is mainly due to past tenants who did not give up the land (95.1%) (KOWR Report, 2025).

Generally speaking, there are two main types of users:

- The first is the former tenants who did not give up the land after their contract ended. This means that they all know that they are illegal.
- The second are generally third parties who seize the land without any legal basis. In some places, this even occurs in an organized manner, unofficially referred to as “night arrests”.

This problem is not new. Even in the pre-Soviet period, there were terrible situations. Especially in the 1970s, such use was sometimes considered social and was even legalized by law in certain cases. According to the 1971 law, if the land was used for a long time, the user could acquire property under certain conditions - it did not matter whether this use was legal or not (Journal of Laws 1971, No. 27, item 250). This led to the formation of a dangerous thought in society, such as "the land of the state is ownerless".

After 1989, instead of improving the situation, it became even worse at certain periods. In the early years, there were neither proper procedures nor real mechanisms to combat this problem. Only in 2006 (ZGZ-dn-4201-41-16/1090/06/EŚ), the first general records related to this issue were implemented. According to the records at the time:

- The tenants were informed in advance, and additional payments were made if they did not transfer the land.
- Third parties were required to evacuate the land immediately, otherwise the penalty would be imposed.

But to be clear: these mechanisms were not sufficient in practice (Marks-Bielska & Zielińska, 2016).

3. Results and Discussion

Given the broad legal and organizational framework that regulates the management of the fund, one of the most persistent problems faced by the NSCA is unsecured land use. This understanding refers to the use of land without a legal basis. This includes both ex-tenants who do not return the land after the lease period ends, and third parties who use the land without any compensation or legal basis (Marks-Bielska & Zielińska, 2016).

When viewed from the perspective of institutional economics, uncontrolled land use is essentially a form of representation of social activities. This situation shows that monitoring, supervision, and information exchange between state institutions are not functioning adequately (Bar, 2015; Michałowski, 2013). Thus, the beneficiaries receive real economic benefits at the expense of the State Treasury and often take advantage of institutional loopholes, even though they have no legal basis, to operate on their own, according to existing territories. They try to collect savings payments (Suchoń, 2021).

The dynamic development of uncontrolled land use over time shows that this problem has not been eliminated despite various legal and disciplinary interventions. Its balance has changed over the years, decreasing or increasing at certain periods, but legal reforms and changes in regulatory mechanisms have

not fully resolved the problem. Figure 2 shows the changes in the overall volume of land areas used without legal basis, based on the annual accounts of APA and NSCA.

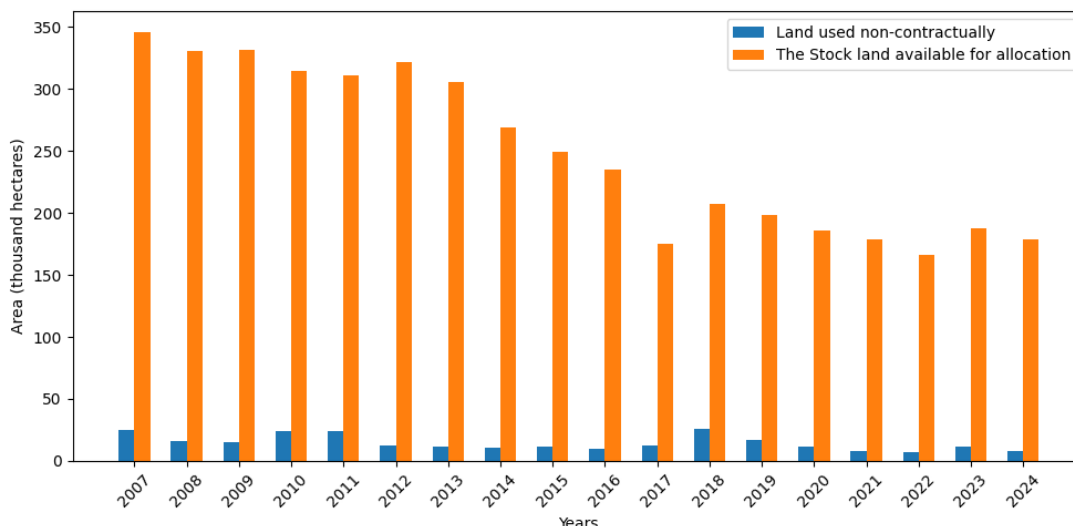


Figure 2. Area of agricultural land used non-contractually within the Stock, 2006–2024.

The figure is the volume of the land areas that are included in the Natural Investment Real Estate Fund of the State Treasury and can be divided in this period (2007–2024), and the land that can be used without comparison. It shows the change in the areas (minimum hectares). This information allows us to see both how the state land fund has changed over time and the amount of unconditional use. A serious decrease is observed in the overall volume of land areas that can be divided in the analyzed period. From 345.6 million hectares in 2007 to 178.3 million hectares in 2024. This means a reduction of approximately 49% and is mainly due to the sale of lands, putting them into permanent use and directing them to non-local savings purposes. The sharpest decrease occurred after 2013, which coincides with the intensification of legislative and institutional changes.

But here is the interesting side: regardless of the decrease in the state lands, the use without compensation does not decrease in the same way. This area is variable over the years, but does not show a steady downward trend. For example, in the years 2007–2011, this indicator was at the level of 24–25 thousand hectares. Then, a gradual decrease is observed and drops to the lowest level in 2021–2022 (8.1 and 7.3 thousand hectares, respectively). However, there is an increase again in the 2023rd year (11.2 thousand hectares), and in the 2024th year it will decrease again to 7.7 thousand hectares.

This is the main point: the decrease in the general land fund does not cause the unpaid use to disappear at the same pace. In other words, this problem does not depend on the overall amount of land. The share of unused land varies from year to year, and this shows that the problem has structure and character. The following tendencies also confirm this: no matter how many laws are changed and the land of the state decreases, the use without compensation will not disappear. This no longer appears as a separate situation, but as a system problem. It is not possible to solve this with only anxiety. Here, supervision systems, enforcement mechanisms, and inter-institutional coordination should be seriously strengthened.

Empirical information shows the same thing: although the overall area decreases after legislative changes, the problem does not disappear completely. On the contrary, it took on a more “deep” and continuous character. This shows that the issue is not just a matter of law; it is related to the gaps in the administration (Marks-Bielska & Zielińska, 2016; Sieradzka, 2024).

Another important issue is the identity of the users. Information shows that a large majority of cases of non-required use are not due to third parties, but to past tenants. That is, with those who do not give up the land in due time. Figure 3 shows the share of these two groups in the overall structure, based on NSCA information.

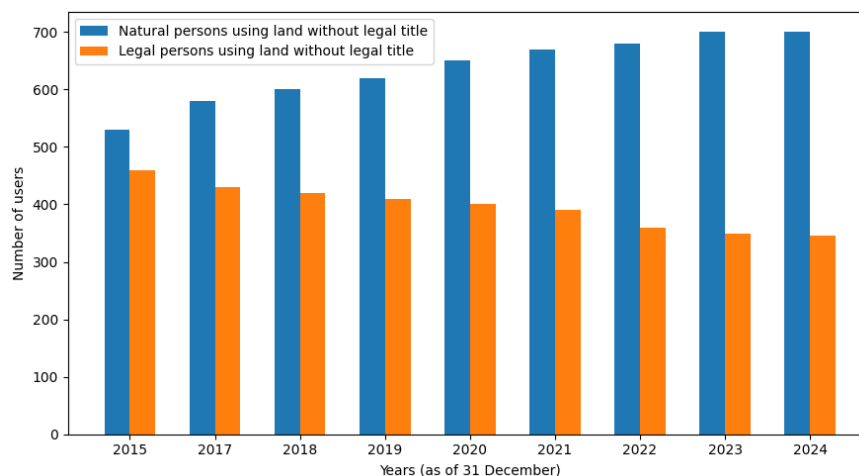


Figure 3. Structure of non-contractual land use within the NSCA by user category.

Information shows that the number of physical persons has increased continuously in this period. Although there were 530 people in the year 2015, this figure approached 700 in the year 2024. This increase shows that, as the use of land without compensation increases, it spreads among more and more individual users and becomes one of the "normal" problems of the system.

In contrast, the number of legal entities shows a decreasing trend – falling from approximately 500 to 345. This, it is believed, will result in more effective functioning of the supervisory mechanisms against corporations, more sensitivity to their financial concerns, and easier functioning of governmental institutions with their institutional users. It depends on knowing. These two trends together represent a very important change. The problem is no longer tied to large structural users as it was before, but is rather "broken down" into individual users. This makes the situation more difficult in terms of management. Because the same supervision and punishment mechanisms do not have the same effect on both groups. In other words, even if the overall land area decreases, the number of users increases. This shows that the problem has become more widespread and fragmented. In this case, standard approaches do not work; more targeted strategies that suit the user type are requested. This structure also shows that the issue is not accidental land capture. On the contrary, this is essentially a system problem related to trade relations, execution of contracts, and monitoring mechanisms after the contracts.

As a result, unconditional exploitation opens up domestic land markets, affects the development of the savings structure, weakens trust in state institutions, and strengthens the protection of state property rights (Marks-Bielska, 2010; Karwat-Woźniak et al., 2024).

In response to the growth of this problem, stricter and harsher measures began to be implemented in legislation. For example, with the amendments made into law in 2011, compensation for use without compensation was determined at 5 times the level of the right to be granted (Michałowski, 2013). Later, these concerns were further strengthened, and in 2019, 30 times the right to trade started to be implemented if the land was not transferred (Suchoń, 2023). But here is the main problem: although the turnover increases, the problem is not completely solved. Incompatibilities between information systems, poor coordination, and limited disciplinary capabilities reduce the effectiveness of these measures (Mierzwa, 2002; Hanus, 2005). This situation is not unique to Poland. Many problems are also observed in post-



socialist countries. Fragmentation of land records, weak control, and information asymmetry further deepen these problems. From a management perspective, this is clearly an "accountability failure" - that is, the functioning of accountability and supervision mechanisms (Hartvigsen, 2014; Swinnen & Vranken, 2009). Without effective oversight and performance-based management tools, the principles of transparency and accountability remain on paper.

3. Conclusion

Uncontrolled use of state lands remains a persistent and structural problem in the management of social activities in Poland. Regardless of legislative and institutional changes, this phenomenon has not completely disappeared and still hinders the effective administration of state territories. Information shows that, although the land area used without compensation decreases, this decrease does not parallel the decrease in the general land fund. So the problem is not just a matter of balance – it is more a result of institutional and procedural conflicts. The most important structural change is in the profile of the users. The increase in the number of physical persons shows that united supervision mechanisms are no longer sufficient.

Simply increasing costs will not solve the problem. On the contrary, more effective management systems, integrated information bases, and management approaches adapted to user behavior are required. In other words, the approach must change. It is necessary to move from a reactive (penalty-oriented) model to a proactive (management-oriented) model.

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Integration of Financial Systems of The Republic of Belarus and India: Challenges and Prospects

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Received: 19.03.2026

Accepted: 28.03.2026

Published: 28.04.2026

<https://doi.org/10.54414/DDJS5109>

Abstract

Real talk — procrastination is the one flaw I keep attacking and keep losing to. Night after night, I set the intention to start early, and night after night, I end up at 11 p.m. scrolling through my phone with a blank page still open. The maddening part is that the work itself is almost never as hard as the dread that surrounds it. Open the file, and a workable first paragraph usually surfaces within ten minutes. All the suffering happens beforehand: the low-key anxiety, the starts that fizzle out, the guilt over time I cannot get back. At this point, I am pretty certain procrastination is not a laziness issue. It is about shrinking away from the uncomfortable act of beginning.

Keywords: financial integration, Belarus–India economic partnership, bilateral trade, payment systems, investment flows, multipolar world economy, economic sovereignty

1. Introduction

The global financial system is presently experiencing a major change. The current global financial system is changing from being unipolar, where everything was dominated by the American dollar and Western financial system, to a multipolar structure. In this context, diversification of foreign economic relations is of strategic importance for countries such as Belarus and India.

Political and trade relations between Belarus and India have historically been positive and have developed gradually (Rudkouskaya, 2024). However, the financial component of this cooperation is lagging behind. This situation creates certain inefficiencies, prevents the full realization of the existing potential of bilateral economic cooperation (National Bank of the Republic of Belarus, 2023).

The aim of this article is to bridge the existing gap. It is to systematically analyze the relationship between the financial systems of the two countries. Specific directions for their future development.

2. Current Status of Financial Integration: An Analytical View

Trade and economic cooperation between Belarus and India began to take shape after Belarus gained independence in 1991. These relationships have been developed mainly through institutional mechanisms. In particular, the Belarus-India Intergovernmental Commission (on cooperation in trade, economy, industry, science, technology, and culture), established in 1997, has served as the main institutional platform for the development of these relations.

Trade relations built on this institutional basis have long been shaped primarily around one product — potash fertilizers, which Belarus exports to India. Cooperation in this area was once quite strong. For example, in 2020, Belarus' exports to India (mainly potash fertilizers) amounted to \$403.9 million. A

memorandum signed in 2017 between Belarusian Potash Company and Indian Potash Ltd. further strengthened this cooperation.

But geopolitical changes in recent years have seriously shaken this model. In late 2021, tough sanctions were imposed on Belarus. The country was deprived of traditional export routes as a result of losing access to Baltic Sea ports (Zakharov, 2025).

This situation has created serious logistical problems and has made Belarus virtually completely dependent on Russian transport infrastructure. This has led to both limited opportunities and additional risks. Therefore, the effect that this process has had on bilateral trade is very drastic. As is evident from the table below, based on official statistics, the value of India's fertilizer imports from Belarus has fallen from hundreds of millions of dollars to virtually nothing.

Table 1. Dynamics of Trade and Economic Exchanges between the Republic of Belarus and the Republic of India (million USD)

Year	Belarusian Exports	Indian Exports	Total
2020	456.6	171.2	627.8
2021	376	191	567
2022	180.8	42.9	223.77
2023	67.9	43.9	111.8
2024	20.51	64.83	85.34

Source: Department of Commerce of India, National Statistics Committee of Belarus, State Customs Committee of Belarus.

Such an example vividly demonstrates that in the current reality, it is not sufficient anymore for Belarus and India to cooperate in terms of “fertilizer-for-goods.” In order to ensure sustainability of economic and financial processes, it is necessary to develop new financial and trade mechanisms. Financial integration can be examined from three main angles: trade financing, investment processes, and institutional links.

2.1. Trade financing and payment systems

In general, trade relations between Belarus and India have been developing positively. Trade turnover is estimated at about US\$1.2 billion by 2023 (Belstat, 2024). However, there is a very important issue related to such cooperation – the overwhelming majority of transactions are made in US dollars and euros. According to the National Bank of Belarus, while the share of the Russian ruble and the euro in foreign trade settlements is increasing, the use of the Indian rupee is almost non-existent, accounting for less than 1% of total transactions (NBRB, 2023). The main reason is simple: there are no direct correspondent relations between Belarusian and Indian banks, and a working mechanism for converting BYN to INR has not been formed.

2.2. Investment flows

One of the most realistic indicators of financial integration is foreign direct investment. Here, the situation is clearly weak. Currently, Indian investments in Belarus amount to less than \$50 million and are concentrated mainly in the pharmaceutical and IT sectors. Belarusian investments in India are almost non-existent. Although high-level negotiations have taken place and, for example, a \$100 million credit line was announced by India's EXIM Bank in 2015, Many of these projects have either not been implemented or there is no public information about their fate. (Zakharov, 2025).

There are some successful projects — like BHEL's renovation of the Grodno power plant. But bigger plans, like the \$600 million Grodno Azot project, have yet to be realized. The main reasons for this are classic: lack of information, overestimation of risks, and the lack of a bilateral treaty (BIT) to protect investments.



2.3. Institutional cooperation

On the positive side, there is some progress at the institutional level. For example, memorandums of understanding have been signed between the Belarusian Currency and Stock Exchange and the Bombay Stock Exchange, which lay the groundwork for future cooperation (BSE, 2022).

In addition, Belarus participates in the IFSCA platform, which operates in the GIFT City project in the Indian state of Gujarat. This creates a potential opportunity for access to international financial services (IFSCA, 2023). But the problem is still the same: these partnerships have not yet translated into real financial flows and integrated market mechanisms.

3. India's financial system and possible synergies

It is of particular importance for Belarus to gain a deep understanding of India's rapidly modernizing financial system. This is where the main source of integration opportunities is formed. India has made significant progress towards financial inclusion in recent years. India has made significant progress in financial inclusion in recent years. The Financial Inclusion Index reached 67 in 2025. This indicator increased by 24.3 percent compared to 2021 (Government of India, 2025). One of the main reasons for this development is the Pradhan Mantri Jan Dhan Yojana (PMJDY) program. More than 550 million bank accounts were opened under that program. At the same time, digital payments are growing rapidly in India. The UPI system now accounts for about 80% of all digital payments (Anytime Invest, 2025).

One of the most interesting platforms here is GIFT City. It is India's first international financial services center and operates under a special legal and tax regime. This platform creates fewer restrictions on foreign exchange transactions, tax breaks, and a favorable environment for international financial transactions. Belarus' participation in this system gives it a real opportunity to attract capital, simplify currency transactions, and finance trade.

4. Institutional framework and future cooperation directions

The institutional environment plays a crucial role in deepening financial integration. The situation here is mixed — there are both opportunities and serious challenges. On the positive side, high-level dialogue has been ongoing in recent times. For example, in February 2025, the audit institutions of Belarus and India discussed the prospects for cooperation, and it is planned to prepare a memorandum (BelTA, 2025). At the same time, the two countries continue to cooperate through platforms such as the Shanghai Cooperation Organization and BRICS. This serves as an alternative channel for maintaining ties, especially during times when bilateral trade weakens.

5. Strategic Directions for Deepening Financial Integration

A targeted and phased approach is required to address the current problems. The following key directions are proposed for this process:

5.1 Creation of a bilateral payment and settlement mechanism

The most important step is the implementation of the SRVA (Special Rupee Vostro Account) system promoted by the Reserve Bank of India. This mechanism allows Belarusian banks to conduct trade directly in Indian rupees by opening special accounts in Indian banks.

To put it simply, the system works like this:

- When an Indian importer purchases a Belarusian product, he makes the payment in rupees, and this amount is transferred to the Belarusian bank's account in India.
- Payments are made to Indian exporters from the same account. That is, the system creates a "closed loop" and eliminates the need for a third currency.

The main advantages of this approach are:

- Reduced currency risk – reduced dependence on dollar/euro fluctuations
- Cost reduction – double currency conversion is eliminated

Investment of surplus funds – funds remaining in the account can be invested in Indian financial instruments

According to estimates, conducting \$1.2 billion in trade in national currencies could save approximately \$15–20 million annually.

- The most logical approach is to start this system as a pilot project first, rather than implementing it directly. For example:
- Fertilizer export from Belarus
- Importing medicines from India

These areas already have existing collaborations and create an ideal test environment for the system.

5.2. Strengthening interbank and capital market relations

Financial integration should be established not only at the state level, but also at the bank level.

For example:

- Belarusian banks (Belinvestbank, Priorbank, etc.)
 - Large Indian banks (State Bank of India, Bank of Baroda, etc.) should establish direct cooperation.
 - In addition, Belarusian companies can obtain new sources of financing by issuing “Masala bonds” (bonds denominated in rupees) on the Indian market. This both diversifies financing and strengthens market integration.

5.3. Digital finance and fintech collaboration

The IT sector of both countries is strong, and this area creates real opportunities. Possible destinations:

- blockchain-based trade finance platforms
- automation of documentation
- increasing transparency, for example, through smart contracts:
- Payment can be made automatically as soon as the cargo delivery is confirmed
- This process takes hours, not weeks

Such systems reduce paperwork, eliminate delays, and minimize the human factor. These platforms do not replace existing systems — they simply act as an additional layer that connects them. The global trend also shows this: blockchain integration is growing rapidly, and this market is expected to grow rapidly in the coming years.

Table 2. Comparative Analysis of Traditional vs. Blockchain-Based Trade Finance.

Parameter	Traditional Process	Blockchain Solution	Improvement Potential
Documentation	30+ physical documents	Digital tokens on a shared ledger	80-90% reduction
Settlement Time	2-4 weeks	24-48 hours	85-90% faster
Intermediaries	5-10 parties	Direct parties + validators	40-60% reduction
Fraud Risk	High due to document forgery	Minimal due to cryptographic verification	Significant reduction
Transaction Cost	1.5-3% of value	0.25-0.75% of value	60-80% reduction

Source: European Central Bank.



First of all, blockchain technology provides a direct solution to the problem of cross-border payments between Belarus and India. The problem is that currently, such payments are made via several intermediate banks. In addition to the extra fees paid to them, each bank adds unnecessary delays to the process due to different time zones and working hours. As pointed out by the European Central Bank, cross-border payments are still expensive and slow. The average transaction fee for companies is about 1.5 percent, while the money transfer fee is 6.3 percent. Moreover, such transactions may take several days to be processed. It creates a serious obstacle, especially for small and medium enterprises trying to enter the international market, since they will have to pay extra fees. On the other hand, the blockchain-based systems eliminate intermediaries and operate 24/7. They allow making payments almost instantly and provide more transparency. All participants may track the progress of the payment at any time.

Thus, using this technology could help save on operational costs on the Belarus-India financial line from the current 1.5–2 percent to less than 0.5 percent. Thus, savings would be about \$10–15 million per year, considering the \$1.2 billion annual turnover.

As for the example in this field, the Unified Payments Interface (UPI) of India can be considered. At present, the system processes over 640 million transactions daily.

The main advantage of UPI is its simplicity and openness to integration:

- The user can combine multiple bank accounts in one application.
- payments are made immediately
- Transactions are carried out without sharing bank details

This system already connects hundreds of millions of users and millions of business entities on a single platform. Adapting this model for Belarus creates real and promising opportunities. If the UPI system is integrated with the existing financial and payment infrastructure of Belarus:

tourists

- students
- small businesses

It will be much cheaper and faster to pay.

This integration can technically be built through application programming interfaces (APIs). India has already successfully implemented this model with a number of countries. However, the issue is not as simple as it seems. There are a number of serious problems and institutional obstacles in this direction:

Technical risks:

- security issues in blockchain systems
- Billions of dollars in losses in bridge systems
- speed-security-decentralization balance problem

Integration difficulties:

- It is not easy to integrate different financial systems
- It is technically difficult to maintain real-time performance

Legal problems:

- AML/KYC regulations are different
- data protection laws are not consistent
- different regulatory approaches in different countries

Real integration is not possible without solving these problems.

Therefore, the approach should be phased:

- **1. Pilot phase (1–12 months)**
 - small-scale blockchain project
 - specific industries (fertilizer, medicine)
 - limited use of UPI (students, tourists)
- **2. Expansion stage (13–24 months)**
 - more sectors
 - expanding trade finance
 - including small business transactions
- **3. Optimization phase (25–36 months)**
 - AI-based risk analysis
 - broader financial services
 - regional expansion

Table 3. Strategic Partnership Models for Belarus-India Fintech Collaboration

Partnership Type	Implementation Mechanism	Potential Applications	Expected Outcomes
Strategic Partnerships	Long-term collaboration between Belarusian banks and Indian fintechs	Joint development of customized solutions for bilateral trade	Shared intellectual property, deeply integrated solutions
Investment Partnerships	Belarusian financial institutions are taking equity positions in Indian fintechs	Strategic alignment with UPI ecosystem partners	Access to cutting-edge technology, revenue sharing
Incubation Partnerships	Indian fintechs providing technology transfer to Belarusian startups	Adaptation of proven solutions to the Belarusian market	Local capacity building, sustainable ecosystem development

Source: Technocrat IQ

Successful integration in the fintech field is not possible with technology alone. In addition to this, it will require strong institutional partnerships. Indian case studies demonstrate that partnerships can be divided into three types. Firstly, a strategic partnership for product development in the long run; secondly, an investment partnership through equity; thirdly, an incubation partnership through knowledge transfer. The best choice for Belarus and India may be the combination of all these approaches. In other words, the combination of the market expertise of Belarusian financial institutions on one side, and the technical expertise of Indian fintech firms on the other side.

On a practical level, there are a number of real opportunities for collaboration. On a practical level, there seem to be few real opportunities for cooperation. For instance, Belarusian banks and Indian payments firms could cooperate in creating solutions compatible with the UPI system for the Belarusian market. Cooperation between Indian blockchain companies and Belarusian logistic institutions may allow creating new platforms for supply chain financing. But such relationships are not based only on the declaration of intentions. The lack of defined objectives, communication standards, and proper due diligence is enough to break down even the most promising collaboration. Thus, both compliance and realism in expectation setting are equally important here. Governments should not be forgotten in this process too. They may facilitate cooperation by holding bilateral innovation competitions, implementing joint programs, and creating incentives. Such an approach provides an opportunity to experiment with innovative business models without taking unnecessary risks for the private sector.



4. Creation of a joint investment platform

The second step, which can be proposed for further financial integration of Belarus and India, is the creation of the "Belarus-India Investment Fund". It can be financed by state development banks and private institutional investors of both parties, with an objective of co-financing projects in strategic industries (IT, high-tech production, pharmaceuticals, and renewable energy) as well as bridging the existing direct investment gap. As for the initial capital of the fund, it should be formed mainly on the basis of state support. As far as the Indian side is concerned, one of the most suitable candidates for this purpose is EXIM Bank as it is responsible for financing foreign trade operations and international joint ventures. Also, the involvement of such institutions as IDBI and SIDBI would be possible due to the experience of these organizations in financing long-term projects and SMEs. At the same time, on the Belarusian side, the direct financial participation of the government will be required via institutions such as the National Investment and Privatization Agency (NAIP). It is necessary as it will show the political will of the government as well as allow the government to take part in the free risks. After that, when such government support is ensured, it will be possible to attract private investors into the fund, especially insurance companies and pension funds. Finally, the directions of investment of this fund should not be chosen randomly. These investments should correspond to industrial priorities and comparative advantages of the two states. It means that the objective of such investments is not only the investment of money but also the creation of synergy in strategic industries. It is illustrated in the table below.

Table 4. Sector focuses for Belarus and India

Sector	Strategic Rationale & Alignment
Pharmaceuticals	Belarus has an explicit strategy to expand its pharmaceutical industry, with 23 investment projects aimed at modernization and import substitution planned by 2030
Information Technology (IT)	Belarus's High Technology Park (HTP) is a recognized IT hub, and India possesses a globally dominant IT services and software sector. The fund could provide growth capital for joint ventures in software development, deep tech, and digital solutions
Green Energy	India is aggressively scaling up its renewable energy capacity and has identified clean energy as a key area for investment. The fund could finance sustainable infrastructure projects in Belarus, supporting the global climate transition and leveraging Indian expertise in solar and wind energy
High-Tech Manufacturing	This aligns with India's push to scale up manufacturing capabilities and Belarus's interest in developing modern production facilities. The fund could target projects in areas like precision engineering, electric vehicle components, and defense-related manufacturing (within permissible regulatory frameworks)

To make the Fund an efficient and effective tool, the process of risk management has to be incorporated into its framework beforehand. In other words, the fund will not work merely as an institution that allocates financial assets. It is also necessary for the fund to employ financial tools and mechanisms that make the tradeoff between risk and profit more tolerable.

4.1. Risk reduction through financial instruments

According to the Global Infrastructure Hub, risk mitigation instruments are very important in ensuring that private investments are attracted. In this respect, there are several main approaches that can be used by the fund. In this respect, there are several main instruments that can be used by the fund:

Guarantees. Political risk guarantees can protect investments from confiscation, currency inconvertibility, and risks such as political violence.

- **Financing in local currency.** In order to reduce exchange rate risk, financing of some projects in Belarusian rubles may be considered. This approach would reduce the dependence of projects on changes in foreign exchange rates.
- **Blended finance models.** Providing additional preferential or subordinate funding via the fund's public capital would help minimize risks for the commercial bank. This will make it easier for them to participate in the projects. According to the Climate Policy Initiative, the use of guarantee mechanisms, despite being underutilized at this time, makes it possible to attract up to 45 percent of private investments in some multilateral financial institutions. The model of managing the fund should also be built on the principle of proactive rather than reactive risk management. This will require moving away from just financial analysis. It is necessary to evaluate political and legal risks as well. The conditions of contracts should be precisely set out. The borrower should not be allowed to undertake certain actions without the approval of the lender.

Moreover, the fund may focus its investments on special economic zones, which provide for better administrative and legal stability. For instance, the China-Belarus “Big Stone” industrial park can be regarded as a safe platform to invest in. The best way forward does not lie in abrupt and large-scale growth but in gradual progress. At the initial stage, it is advisable to choose a particular and more feasible area. For example, it is known that Belarus has already developed some plans for investment. Perhaps the pharmaceutical industry can serve as an option at this stage.

Therefore, such a fund will not only act as a means of financing. It can also act as an institution that helps build trust, prove the advantages of cooperation, and convert the Belarusian-Indian relationship into a more multi-polar one.

6. Conclusion

Financial integration between Belarus and India is important. But this type of cooperation has potential that is still untapped. In the present stage of forming a multipolar world order, this potential functions not only as an economic possibility but also as a strategic necessity. Nowadays, the level of integration is quite low. The use of national currencies in trade relations is low, and investments are practically absent. However, the analysis shows that there is real potential for further development. The strategy described in the article includes the establishment of direct payment systems, the development of interbank cooperation, the introduction of innovations in fintech, and the creation of a joint investment platform. This strategy can be considered a basis for the implementation of this potential. The realization of this potential cannot be done only through technical measures. For that, political will, cooperation of central banks, involvement of financial institutions, and active participation of business circles in this process are required. With such an approach, this cooperation will not only ensure the economic stability of countries but also become a successful example of alternative financial cooperation in the modern world.

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Possible Directions of Influence of Artificial Intelligence on the Development of the Pharmaceutical Industry

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Received: 27.03.2026

Accepted: 04.04.2026

Published: 28.04.2026

<https://doi.org/10.54414/YZUP5934>

Abstract

This article presents the results of a study examining the impact of rapidly developing artificial intelligence technologies on various stages of drug development. The paper examines the theoretical aspects of artificial intelligence's influence on business processes in various areas of socio-economic relations; outlines the stages and duration of drug development; identifies the positive and negative aspects of artificial intelligence's impact on the pharmaceutical industry; identifies the possible directions of artificial intelligence's influence at each stage of drug development; highlights the practical application of AI at various stages of drug development and sales; and presents an algorithm for integrating AI technologies into the activities of a full-cycle pharmaceutical enterprise. The aim of the study is to assess the impact of artificial intelligence implementation at various stages of drug development and subsequently forecast its prospects. The economic and general scientific methods used in the study allowed us to identify the possible prospects for the influence of artificial intelligence on the pharmaceutical industry, as well as formulate the positive and negative aspects of the impact of artificial intelligence technologies on the pharmaceutical industry. The research base was provided by the scientific works of domestic and foreign scientists in the field of applied application of artificial intelligence technologies in various areas of economic development.

Keywords: technology, digitalization, artificial intelligence, pharmaceuticals, pharmaceutical industry

1. Introduction

Artificial intelligence-based technologies are now permeating every area of business and manufacturing. The pharmaceutical industry, considered globally one of the most knowledge- and capital-intensive sectors of the economy, is no exception. The pharmaceutical industry develops, tests, and produces various types of drugs. Drugs constitute the majority of the industry's product range (approximately 70%, according to various estimates). In addition to drugs, pharmaceutical companies also produce dietary supplements, parapharmaceutical products, and other products (Qadamova & Xakimov, 2024). The drug life cycle has a number of specific characteristics, including a lengthy development period, a multi-stage, high-risk, and expensive testing process, a costly market launch, and so on. However, advances in modern AI technologies offer significant opportunities for integration into the pharmaceutical industry, across all stages of the drug life cycle.

2. The Impact of Artificial Intelligence on Various Sectors of the Economy

A wide range of scientific papers devoted to the impact of AI on various sectors of the modern economy is now publicly available. Domestic authors, along with international specialists, are exploring the possible diffusion of AI technologies into various areas of socio-economic relations. AI, in turn, becoming part of a unified economic ecosystem, significantly changes the face of modern trade, economic, and industrial relations.

Among the scientific works of international authors, R.N. Alkaied, Sh. A. Khattab, and I.M. Al Shaar highlight key aspects of AI's influence on consumer decisions to make repeat purchases (Xakimova, 2025). It is important to note that the main principles of this work are also applicable to the sale of pharmaceutical products.

The impact of AI on the development of tourism is examined in G. Khakimova's work (Xie, Miao, Tan, 2024). General aspects of the development of artificial intelligence and machine learning are explored in A. Jumayev and J. Shohradova's work (Niazi, 2025). This article pays particular attention to the ethical aspects and development prospects in this area.

The impact of AI on modern business processes is analyzed in the work of Z. Qadamova and A. Xakimov (Vagan, Ashar & Sidra, 2024). This work describes in detail how AI technologies are transforming operational processes, expanding decision-making capabilities, and stimulating innovation in organizations. This study is complemented by the work of H. Eljaji and R. Reshid Mekuria, which details the prospects and potential impact of mathematical models and AI on the organization of logistics processes in business (Jumayev & Shohradova, 2024).

Also noteworthy is the work of P. Xie, J. Miao, and X. Tan, which provides a comprehensive presentation of the results of a study on the impact of AI on the labor market [22]. This work examines the dual nature of AI's influence on personnel selection based on a comprehensive analysis of empirical data and scientific research. Statistics show that AI-based recruiting tools can reduce hiring time by 40–75% and hiring costs by 30–50% (LinkedIn Talent Solutions, 2023).

Scientists have also addressed the impact of AI on industry-specific aspects of healthcare development. Chinese researchers M.W. Shah, U.A. Muhammad, and S. Sidra concluded that the perceived usefulness and ease of use of AI-based projects are influenced by factors related to management, organization, operations, and IT infrastructure (Taylor, 2015).

Among the works of Russian scientists covering specific issues of AI's impact on the development of various economic sectors, the work of I.B. Starostin and O.V. Vershinina, which reveals general aspects of AI's impact on the Russian economy, stands out [10]. This article examines the application of AI in the economy and analyzes the current state and development prospects of this field in the Russian Federation.

Authors A.V. Minbaleev, M.A. Berestnev, and K.S. Evsikov explore the potential for AI application in the extractive industry (Minbaleev, Berestnev, & Evsikov, 2022). Their analysis revealed that most research in this production sector focuses on technological aspects or resource conservation. However, the safety aspects of using digital technologies in geotechnological processes remain unexplored. An analysis of AI use in geotechnological process management reveals challenges in delineating responsibility for accidents and emergencies.

Author I.T. Perova analyzes the potential for AI applications in agricultural development (Andrianov et al., 2024). The findings demonstrate that the spread of modern technologies in agriculture is accompanied by the emergence of new job functions, professions, and, consequently, competencies. This places new demands on personnel training and also impacts working conditions and lifestyle in rural areas.

Authors E.P. Keleda and N.N. Pronkin explore the application of AI in medicine (Kaleda & Pronkin, 2023). This paper examines the main applications of AI in various fields of medicine, provides real-world examples of AI use in healthcare for disease diagnosis, classification, and visualization, and describes various types of medical robots. Using a generalization method, the key advantages of using AI in medicine are identified.

The prospects for using AI in the nuclear industry are presented in the works of authors such as A.A. Andrianov, A.A. Zaluzhny, and A.V. Mitskevich [8]. This paper discusses the areas of application and possible limitations of AI in the nuclear industry. The authors argue that developing AI can be used at almost all stages of the fuel cycle and in related fields. According to their conclusions, AI methods can



improve the efficiency of activities in nuclear medicine, science, and the search, systematization, and processing of large amounts of information.

Some issues related to the potential use of AI in the development of the oil and gas industry are discussed in the work of author N.A. Eremina and D.A. Selenginsky (Eremin & Selenginsky, 2023). According to the researchers, AI methods that can be trained using an accumulated database of real experiments, computer modeling, and logs from operating fields have the ability to predict the occurrence of complications and emergency situations. Artificial intelligence tools can help optimize production and improve the efficiency of hydrocarbon production and recovery. As content analysis shows, there is currently a very broad body of research examining the potential impact of developing AI technology on various industries. Given the influence this megatrend is having on the modern world, research into the potential impact of AI on pharmaceuticals also appears strategically important. At least four key factors underpinning the relevance of this topic can be identified.

First, the global and domestic pharmaceutical industries are focusing on the production of innovative drugs. Second, the use of AI capabilities allows for a reduction in drug development and production costs. Given that the pharmaceutical industry is one of the most capital-intensive, AI capabilities are of great interest to manufacturers. Third, it supports the development of personalized medicine. Society is approaching a stage in its development where drugs can be produced not for the mass consumer, but specifically, taking into account the individual characteristics of consumers. Fourth, AI opens up opportunities to improve safety for the end consumer.

3. A study exploring the potential impact of artificial intelligence on various stages of drug production

The Russian pharmaceutical industry today has a number of distinctive features, among which it is worth highlighting several of the most significant. These include a general increase in government attention to the pharmaceutical industry, the government's commitment to strategically pivoting the industry toward the development and production of innovative, high-value-added drugs, the implementation of import substitution policies to counteract sanctions pressure from Western countries, the active development of online drug sales, a shift in focus toward training modern domestic personnel capable of developing the latest innovative drugs, and the active integration of digital technology and AI across all industry niches.

As noted previously, the unique life cycle of pharmaceutical products (in particular, drugs) heightens the interest of pharmaceutical manufacturers in finding ways to reduce both the time and financial costs of production. According to some sources, the time from the start of research into new useful molecules to the launch of a drug on the market can take up to 15 years, with financial costs exceeding several hundred million dollars.

Data from Pharmaceutical Research and Manufacturers of America (PhRMA) indicates that the cost of producing a new drug is approximately \$900 million (30 years ago, this figure was no more than \$300 million), with the average development period ranging from 10 to 15 years (Perova, 2025). It should be noted that biotech drugs are even more expensive and time-consuming. Their development costs often exceed \$1 billion, and development periods can reach up to 20 years. The processes associated with the high cost of developing and launching new drugs are fully relevant to the biotech industry.

The range of opportunities offered by AI implementation offers manufacturers a high chance of reducing costs and accelerating the market entry of new drugs. Given the socioeconomic realities in which the modern domestic pharmaceutical industry is forced to develop, the prospect of integrating AI capabilities into individual stages of drug development, testing, production, and sales is becoming even more attractive. The stages of the drug life cycle include: synthesis of new substances, study of new substances, preclinical animal studies, clinical trials, registration, and marketing.

The use of AI at any stage of drug development, testing, or production significantly exceeds the capabilities of human intellectual effort due to its ability to quickly process large volumes of unstructured information, identify connections between disparate information, detect hidden trends and tendencies, and so on. These are the principles upon which the AI training process is built. However, the colossal volumes

of information fed to the AI for training purposes may also contain erroneous data. This introduces the possibility of erroneous conclusions during the development of the AI algorithms.

This implies that the quality of the data used during neural network training directly impacts the effectiveness of its subsequent operation. Despite the wide range of positive effects of AI in pharmaceuticals, the likelihood of errors in its operation can be considered a very serious risk and a potential barrier to its further application.

A study of the impact of AI on the development of the pharmaceutical industry has revealed a wide range of positive and negative aspects. The positive and negative aspects of AI application in pharmaceuticals are visually illustrated in Figure 1.

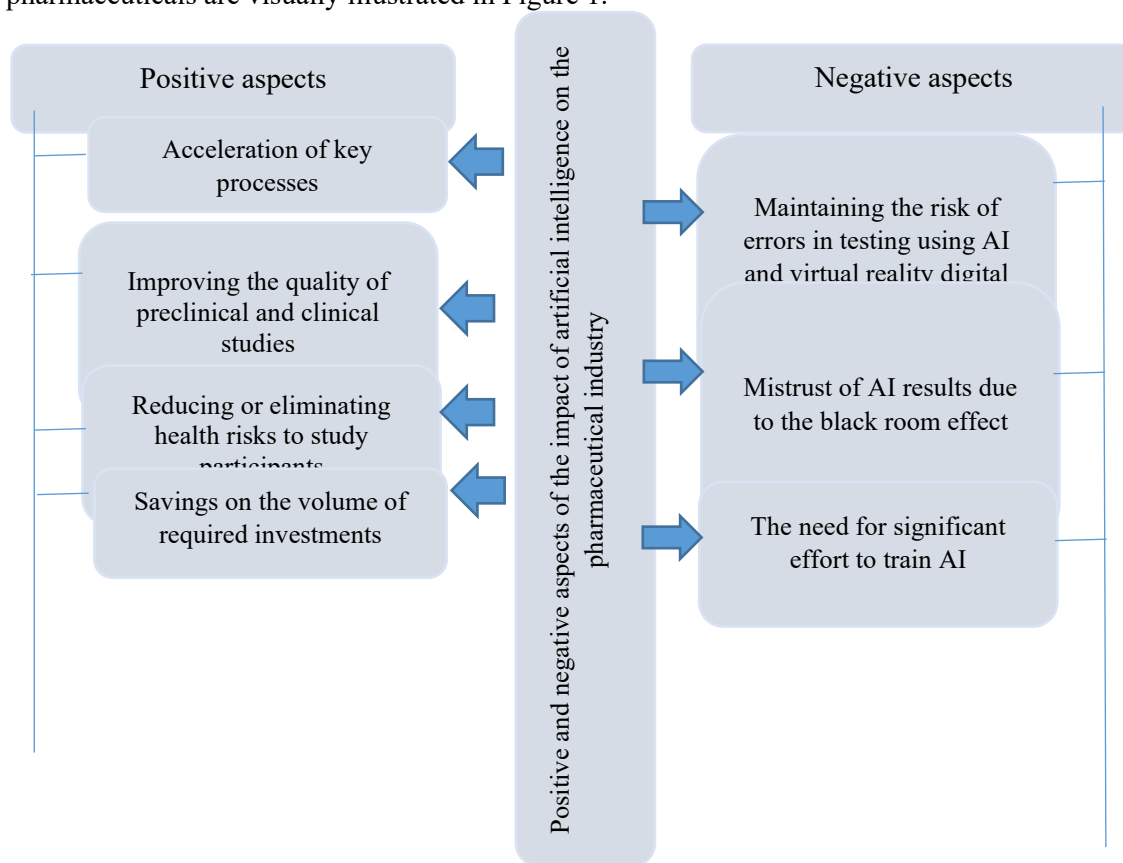


Figure 1. Positive and negative aspects of the impact of artificial intelligence on the pharmaceutical industry

The positive impact of AI on modern pharmaceuticals is outlined by a range of key elements: acceleration of internal processes, time and cost savings, risk reduction, and improved product quality. However, some drawbacks to these processes can be identified, including the critical importance of the underlying data used to train neural networks, the still-low level of trust in the practical application of AI-generated results, and the significant effort required to prepare AI for the required state. When discussing the impact of AI on individual stages of drug development, a wide range of key trends and prospects can be identified, as summarized in Table 1.

*Table 1 – Potential Impact of Artificial Intelligence at Each Stage of Drug Development*

Duration	Название этапа	Важнейшие тренды влияния ИИ на этап	Перспективы влияния ИИ
Duration: 1-3 years	Synthesis of new substances	- Acceleration and optimization of the process of searching for new useful molecules	- Reducing the time from idea to drug candidate from 5-7 years to 1-2 years
	Study of new substances	Accelerated screening and predictive analysis in vitro	- Reducing the number of chemical compounds subject to costly and high-risk testing; - Improving the quality of identifying unpromising and potentially hazardous compounds;
	Preclinical trials	Predictive toxicology and safety	- Reducing the number of animal tests; - Improving the safety level during preclinical trials;
Duration up to 10 years	Clinical trials	Optimization of clinical trial design and planning	- Increasing the success rate of clinical trials; - Reducing the risk of potential adverse effects on human health during clinical trials.
Duration up to 7 years	Registration	Automation of collection and preparation of regulatory documentation	- Reduced dossier preparation time; - Increased accuracy and completeness; - Release of highly qualified specialists;
	Implementation	Continuous pharmacovigilance and patient safety	- Personalization of therapy; - Increased trust in medications

* Compiled by the authors based on [2, 19]

As Table 1 shows, AI can have a multifaceted impact on drug development and production. It's worth noting that this table does not provide an exhaustive list of potential trends and prospects; it focuses on the most significant ones. It is believed that as AI technologies progress, the trends prevalent at any given stage of the drug lifecycle may also change, and the same can be said about prospects.

A content analysis of information covering the potential and prospects for using AI at various stages of drug development and registration revealed a lack of real-world cases of modern pharmaceutical companies using neural networks across all stages. On the contrary, various companies publish their experiences using AI at specific, completely different stages of the drug lifecycle. This suggests that AI is still a relatively new phenomenon, and there simply hasn't been enough time to adapt its capabilities to all stages of drug development, registration, and marketing.

Table 2 below presents case studies of various pharmaceutical manufacturers using neural networks at specific stages of the drug lifecycle.

Table 2. AI Application Practices at Various Stages of Drug Development and Implementation

Stage name	Real-life cases of AI applications at various stages of drug development
Synthesis of new substances	Researchers from ITMO University, with support from Sber's Center for Practical Artificial Intelligence, have developed a multi-agent system for searching for new drug molecules. The model not only generates new molecules in virtual space but also fully automates the search and selection process. The program operates with high accuracy—almost 80% of the variants proposed by the system meet the criteria specified by the scientists. The authors have already tested the system and generated molecules with it that could potentially help develop drugs for Parkinson's, Alzheimer's, lung cancer, and other diseases. The scientists presented their research results at the EMNLP 2025 conference in China [11].
Study of new substances	Scientists from the Center for Strong AI in Industry, the Center for AI in Chemistry, and the Infochemistry Research and Education Center at ITMO University, with industrial support from Sber, have developed a multi-agent system for fully automating the process of studying new drug molecules based on natural language queries. MADD (Multi-Agent Drug Discovery) consists of four AI agents that sequentially solve various tasks, such as analyzing a researcher's text query, selecting the

	appropriate algorithms, generating molecules and calculating their properties, and compiling the results into a single report. Each agent operates on large language models: GPT-4o, Gemini 2.5 Flash-Lite, Llama-3.1-70b, GigaChat, and others [11].
Preclinical trials	Insilico Medicine also announced the completion of preclinical trials of ISM8969, a potent inhibitor for the treatment of Parkinson's disease. And most recently, ISM8001, another drug candidate targeting solid tumors of internal organs, was introduced. It is designed to combat cancer cells that have developed resistance to existing drugs. Since its inception, Insilico Medicine has used AI to create 17 drug candidates, 10 of which have already received approval for clinical trials. These achievements demonstrate that AI is not simply "searching" for, but actively participating in, the development of drugs for complex and severe diseases [1].
Clinical trials	The US Food and Drug Administration (FDA) has issued an Inventory Clearance (IND) for clinical trials of ISM8969. This drug, designed to combat Parkinson's disease, was developed, modeled, and optimized using generative artificial intelligence. The use of neural networks has enabled the development cycle to be reduced to record speed. While traditional candidate discovery takes an average of 4.5 years, Insilico completed the process in 12–18 months, synthesizing only a limited number of molecules for testing. In Phase I clinical trials, which will be conducted in the US, scientists will evaluate the safety, tolerability, and pharmacokinetics of ISM8969 in healthy volunteers [9].
Registration	Experience from the Brazilian Health Regulatory Agency (Anvisa) shows that the use of AI algorithms has reduced registration times by 45–60% [15].
Implementation	To date, not a single drug developed by neural networks has yet been commercially released. However, neural networks are now actively involved in automating regulatory analysis, predicting production deviations, optimizing pharmaceutical logistics, and assessing reputational risks based on open data [12].

* Compiled by the authors based on [1, 9, 11, 12, 15]

It's worth noting that domestic AI developers are currently quite active in collaboration with Russian pharmaceutical manufacturers. However, as content analysis has shown, the use of AI in drug development is also being partially reported by companies from around the world. Table 2 above specifically reflects the experience of the United States (clinical trials) and Brazil (drug registration).

However, given the rapid integration of AI technologies into all phases of drug development, registration, and marketing, it can be argued that the comprehensive use of neural networks, from the generation of a useful molecule model to registration and market launch, can be expected in the foreseeable future. This means that comprehensive AI integration will require a specific methodological and instrumental framework in the near future.

Therefore, the authors of the study believe that proposals for algorithms for integrating AI into the entire range of scientific and production business processes at pharmaceutical enterprises are currently considered timely.

Figure 2 below visually depicts the strategy for implementing AI in a full-cycle pharmaceutical enterprise. The algorithm consists of five steps, divided according to the degree of risk of the processes involved: preparatory, organization of low-risk operations, organization of medium-risk operations, organization of high-risk operations, and the full transition of the enterprise to an AI-oriented business model.

Each of the presented steps of the algorithm involves a series of sub-steps. The first preparatory stage involves a full assessment of the enterprise's readiness for the implementation of AI technologies. This sub-stage is necessarily supported by the formation of a team and management structure. The level of preparedness and competence of the specialists involved directly impacts the success of the planned future activities. The selection of pilot projects at this stage is determined by the database that will underlie the models of the generated digital versions of useful molecules.

The expected results of implementing the first stage of the algorithm include identifying the strengths and weaknesses of the enterprise, a precise understanding of the prospects and risks of implementing AI technologies, and an assessment of the expected costs required to implement subsequent stages.

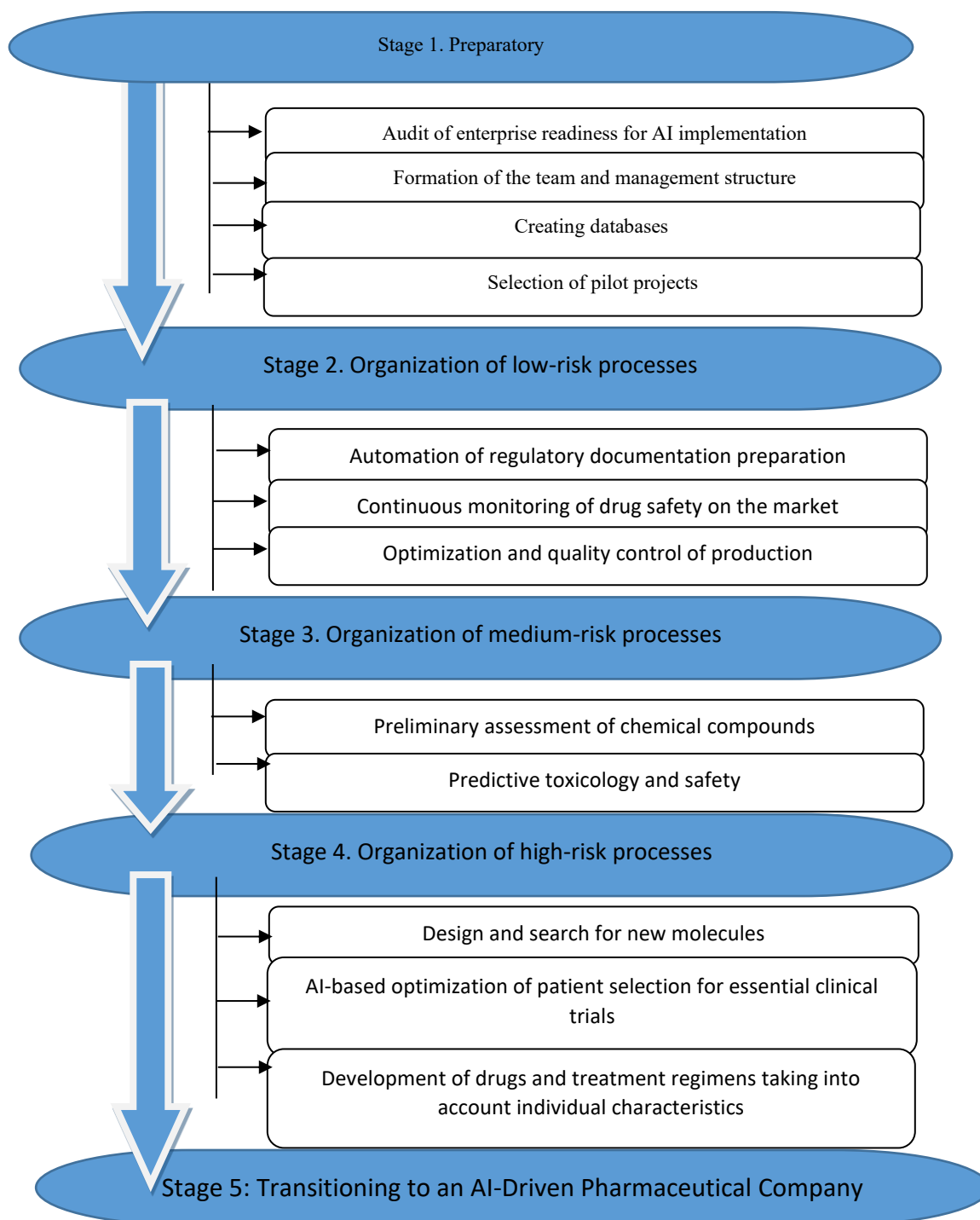


Figure 2 – Algorithm for integrating AI technologies into the activities of a full-cycle pharmaceutical enterprise

The second stage of the algorithm is aimed at organizing low-risk processes. This stage includes the automation of regulatory documentation preparation, continuous monitoring of drug safety on the market, and optimization and quality control of production.

Regulatory documentation governing the production of pharmaceutical products plays a fundamental role in the drug lifecycle. Ensuring manufactured products meet all regulatory requirements is fundamentally important due to the need to eliminate any risk to the health of the end user. However, this stage requires considerable time and effort for various approvals and assessments. Therefore, automation at this stage is primarily aimed at accelerating and optimizing processes.

Continuous monitoring of drug safety on the market aims to identify potentially unsuitable active pharmaceutical ingredients used in existing drugs. This thus opens up opportunities to reduce the risk of developing similar, potentially unsuitable, or dangerous drugs.

The next substage—optimization and quality control of production—flows smoothly from the previous one. Clearly, the integration of AI solutions into production requires a special approach to quality assurance. It follows that the implementation of neural networks in business processes necessitates the development of a comprehensive set of internal regulatory and legal regulations covering all production processes. Implementation of this stage contributes to the achievement of expected results such as a reduction in defective products, reduced equipment downtime, and more.

Implementation of this stage contributes to the achievement of expected results such as a reduction in defective products, reduced equipment downtime, and more. The next stage is aimed at organizing medium-risk processes. These operations include preliminary assessment of chemical compounds, as well as predictive toxicology and safety.

Preliminary assessment involves determining the suitability and potential of the chemical compounds being developed. Errors at this stage can have extremely serious consequences, especially if they involve toxicology control issues. Expected results of this stage include a reduction in the number of animals used in experiments, reduced preclinical costs, and the identification of safety issues at earlier stages.

The fourth stage is aimed at organizing high-risk operations. This stage involves the implementation of sub-stages such as the search for new types of useful molecules that can be synthesized in vitro, AI-based optimization of patient selection for necessary clinical trials, and the development of drugs and treatment regimens tailored to the individual characteristics of test subjects.

The implementation of these sub-stages is based on the implementation of generative models for creating new chemical structures, AI systems for optimizing molecular properties, and the virtual design of molecules for specific targets.

The key expected results of this stage include the following: a reduction in the time from identifying a target for a synthesized molecule to a viable candidate for clinical trials, the generation of patentable structures with low intellectual property risk, and an increased likelihood of overall project success.

The final stage of the transition strategy is aimed at transforming the company into an AI-driven pharmaceutical company. This stage involves key processes such as the formation of new business models, organizational transformation, and the development of ecosystem thinking.

4. Conclusion

In summary, the following conclusions can be drawn:

The trend toward AI-based technologies is currently pervasive in virtually all sectors and industries. This trend underlies the dynamic changes occurring in modern socio-economic relations. Given the specific nature and development trends of AI, we can predict an acceleration of the most significant business processes in all possible areas of production in the foreseeable future.



AI is also actively penetrating the pharmaceutical industry. The specific development characteristics of the pharmaceutical industry necessitate a reduction in drug development and production costs. This suggests that the diffusion of AI technologies into drug production will only increase.

The overall level of AI technology development today entails risks associated with erroneous data generated by neural networks. This means that pharmaceutical products manufactured using AI may be viewed with skepticism by society in the foreseeable future, due to the so-called "darkroom" effect. This means that the degree of trust in AI-based products is directly proportional to the time spent training them.

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Innovative development model in green industry construction in Azerbaijan and assessment of green energy potential

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Received: 19.03.2026

Accepted: 01.04.2026

Published: 28.04.2026

<https://doi.org/10.54414/DAJX1031>

Abstract

The article examines the formation of an innovative development model and the assessment of green energy potential in ensuring green industrial development in Azerbaijan. The problems of developing and modeling the green industry have been explained. The positive impacts of the green industry on the environment have been analyzed and systematized. Taking into account new challenges, an assessment of the development potential of the green energy industry in Azerbaijan has been conducted. The positive aspects of various types of green energy, including clean and inexhaustible energy sources such as solar, wind, water, biomass, and geothermal, were explained. The possibility of taking effective measures to reduce carbon emissions, prevent environmental pollution, and ensure energy security by expanding the green economy and increasing the production of green energy has been substantiated. The potential of green energy types to significantly reduce carbon emissions and make a significant contribution to maintaining ecological balance has been explored. The development of the green energy industry can ensure the economic revival and improvement of the social well-being of regions. In terms of environmental protection in Azerbaijan, the importance of improving the processes of using and neutralizing waste generated by industrial sectors was emphasized. The volume, use, and disposal of waste generated by industrial enterprises in Azerbaijan in 2024 were analyzed. The role of digitalization and innovation in the development of the green industry was examined. The possibilities of artificial intelligence, blockchain, big data, and other digital technologies were explored. The main benefits of implementing an innovative development model in Azerbaijan are given. The benefits of implementing an innovative development model in industry are schematically presented. The importance of forming an innovative development model in ensuring green industrial construction in Azerbaijan was stated. The implementation processes of a number of major projects related to the development of the green energy industry were analyzed. The volume of electricity generation from green sources has been analyzed. The power of hydro, solar, and wind power plants has been given. The need to develop efficient energy storage systems to ensure a stable green energy supply has been highlighted. In the near future, generalizations were made, recommendations and proposals were prepared on the creation of an innovative development model for green industrial construction in Azerbaijan, and the assessment of green energy potential.

Keywords: green industry, green industrial construction, innovative development model, green energy, assessment of green energy potential, alternative energy sources

1. Introduction

It should be noted that in modern times, the issues of sustainable development and environmental safety are among the most pressing problems on a global scale. To address these problems, countries are formulating various strategies and trying to accelerate the green transformation process in key sectors of the economy. In recent years, building green industries in Azerbaijan has become one of the main priorities of economic development strategies. Taking into account some global problems like efficient management of natural resources, environmental protection, and the fight against climate change, our country is taking persistent steps in this field.

It is well known that the green industry is an industrial activities that minimize its negative impact on the environment during the production process, as well as contributes to sustainable development. These include environmentally friendly activities, which embrace energy efficiency, minimizing waste, and

recycling resources. Moreover, the green industry is characterized by the utilization of green energy and sustainable production methods. Rich natural resources, as well as an advantageous geographical position, provide Azerbaijan with wide prospects for developing the green industry. Some innovations in the field of the energy industry and the use of environmentally friendly technologies help to make the process of developing this sphere even faster. In particular, investments in green energy can be viewed as one of the key pillars of the green industrial paradigm. (Yaşıl Sənaye və Azərbaycanca Yaşıl Sənayenin Önəmi, 2024). Unlike traditional industrial models, the concept of green industry involves reconciling economic efficiency with environmental protection, using fewer resources in production processes, minimizing waste, and expanding the use of green energy sources.

As a result of rapid industrialization and population growth in the modern world, energy demand is continuously increasing. It is known that the widespread use of fossil fuels such as oil, gas, and coal, which are traditional energy sources, creates environmental problems in addition to the problem of resource depletion. Against the backdrop of global problems such as climate change, air pollution, and environmental degradation, humanity is forced to turn to green energy sources. In this context, various types of energy produced from these sources are considered the main energy source of the future.

Green energy mainly includes clean and inexhaustible energy sources such as solar, wind, water, biomass, and geothermal. In modern conditions, the development of technology and the increase in the economic efficiency of renewable energy systems have significantly increased interest in this field. The green energy industry, especially in developing countries, creates new economic opportunities and employment potential (Aliyev, Sh., Gulaliyev, M., Pürhani, S., Mehdiyeva, G., & Mustafayev, E. 2024). Let us add that the production of green energy is of great importance in terms of reducing carbon emissions, preventing environmental pollution, and ensuring energy security. The use of this type of energy helps reduce the impact of climate change and limit global temperature increase. Also, the expansion of the green energy sector leads to the creation of new job opportunities, which is considered a key component of sustainable development. In addition, the development of this sector improves air quality by reducing atmospheric pollution. According to expert forecasts, by 2030, approximately 65% of electricity in the world will be provided by renewable or green sources (Azərbaycanın enerji siyasətinin əsas istiqamətlərindən biri – “Yaşıl enerji”, 2024).

Considering some challenges faced at a global level, such as efficient natural resources management, environmental protection, and combating climate change, our state does not stay away from this process. As is known, green industries refer to those industrial activities that minimize the negative influence of industries on the environment in the course of their activity, as well as contribute to sustainable development. This can be seen in the form of environmentally-friendly industries, which involve energy efficiency, waste minimization, and recycling. Furthermore, green industries include the usage of green energy and sustainable production processes. Being endowed with rich natural resources and a favorable geographical location allows Azerbaijan to have great opportunities in the development of the mentioned area. Innovations in the field of the energy industry and environmentally-friendly technologies allow accelerating the process of development. In particular, investments in green energy can be regarded as one of the main pillars of the mentioned paradigm.

2. Research Results

Having regard to certain problems which exist at the international level, such as effective management of natural resources, environmental protection, and overcoming the effects of climate change, our country is not excluded from this process.

As we all know, green industries represent those industrial activities that reduce the harmful impact of industries on the environment as well as make contributions to sustainable development. This can be demonstrated through environmentally-friendly industries which are characterized by energy efficiency, waste reduction, and recycling. In addition, green industries include green energy and sustainable



production. Rich natural resources and favorable geographical conditions create good premises for the development of this area in our country. Advances in the energy industry and environmentally-friendly technologies make it possible to accelerate this process. One of the important components of the discussed paradigm may be the investments in green energy. This is of strategic importance not only in terms of economic profitability, but also in terms of environmental sustainability. The second important direction is the modernization of industrial enterprises and their adaptation to environmental standards. Technological innovations are being implemented, and recycling and waste management systems are being established, in order to reduce the environmental impact of existing industrial facilities. For example, as a result of the application of new technologies in the petrochemical, metallurgical, and construction materials industries in our country, productivity is increasing and harmful effects on the environment are decreasing. In addition, a number of projects are being implemented in the field of waste sorting, neutralization, and recycling.

In Azerbaijan, processes of utilization and neutralization of waste generated by industrial sectors are being implemented in terms of environmental protection. In some years, the volume of waste generated by industrial enterprises is less than that used and neutralized, which is an important step in their greening (see Figure 1).

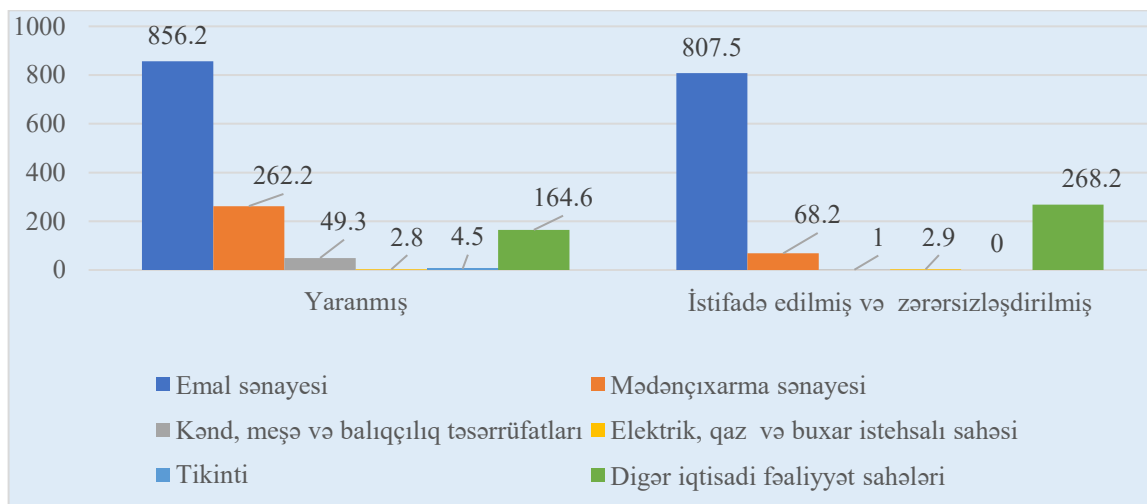


Figure 1 shows that in 2024, the largest amount of waste was generated in the processing industry - a total of 856.2 thousand tons. 807.5 thousand tons of this waste were either used or neutralized, meaning that the vast majority of what was generated - approximately 94.3% - was managed properly. This means that only a small portion of industrial waste (approximately 48.7 thousand tons) has neither been used nor disposed of. This may pose a certain risk to the environment, as uncontrolled waste can cause pollution.

Protecting resources and ensuring environmental sustainability during the establishment of green industries in Azerbaijan leads to important economic, environmental, and social consequences. The application of advanced technologies and green approaches that ensure the efficient use of resources creates conditions for cost optimization, reducing environmental impact, and increasing social responsibility. Together, these factors not only increase the competitiveness of green industries in the market but also have a positive impact on their overall innovative development (Zeynalova, 2023). The role of digitalization and innovation in the development of the green industry is also undeniable. Thanks to the capabilities of artificial intelligence, blockchain, big data, and other digital technologies, production processes are planned and managed more accurately. This creates conditions for minimizing energy consumption and waste. In Azerbaijan, various incentive mechanisms are being implemented to strengthen the innovation ecosystem in this area, startup projects are being supported, and business incubators and technoparks are being created for the development of environmentally friendly technologies.

In addition, green industry encompasses not only technological and economic changes, but also social aspects (Reilly, J.M., 2012). The demand for green skills in the labor market is increasing, which necessitates appropriate reforms in the education system. Vocational and higher education institutions in Azerbaijan are implementing new curricula, establishing international collaborations, and conducting advanced training courses to strengthen personnel training in this area. The development of human capital and increasing the ability to adapt to green technologies are among the key factors ensuring the long-term sustainability of the industry. It can be said that the development of green industries creates the basis for the emergence of new technologies, skills, and practices, which in turn allows for the formation of a more flexible and professional workforce (Jones & Kettlewell, 2021). Green jobs that emphasize sustainability have a positive impact on economic and social stability by reducing dependence on depleting resources. As a result of tightening environmental protection requirements, industries will increasingly need workers who can implement sustainable approaches and have relevant green skills. Investments directed towards the creation of such business areas create conditions for the country to rise to a leading position in the field of innovation and sustainable development, which significantly increases its international reputation and competitiveness (Humbatova, S.R., 2024). The green industry maintains its importance as an important tool in achieving sustainable development goals. This sector makes significant contributions to society not only from an economic and social perspective, but also from an ecologically safe perspective by producing products. Larger-scale research and practical applications in this direction in the future will accelerate the integration of green industrial models into various fields, create opportunities for the formation of innovative approaches and their more efficient implementation (Babayeva, 2025).

It should be noted that in recent years, ensuring ecological sustainability, effective resource management, and developing an industry based on the principle of minimal environmental damage have been among the priorities in Azerbaijan. In this context, the innovative development model is of particular importance, because it is systems built on innovation that can ensure economic efficiency and environmental sustainability in parallel. The application of an innovative development model is considered necessary to increase the competitiveness of all industrial sectors and expand access to world markets. For this purpose, the maximum amount of direct budget funds directed at stimulating innovation activity is determined not only by the state's financial resources, but also by the extent to which that funding is effectively implemented through innovative and anti-crisis measures. When formulating national priorities for technological development, joint activities of government agencies, banking and industrial capital, scientific research institutes, and industrial enterprises are considered more appropriate. Through this approach, coordination between the main directions of scientific-technical and financial policy can be ensured, as well as opportunities to increase innovation activity can be comprehensively assessed (Rasulov, K.A., 2015).

We believe that the innovative development model is a dynamic model that responds to the economic, technological and social challenges of the modern era. Unlike traditional economic development mechanisms, this model is built on creating a sustainable competitive advantage, rapidly commercializing new ideas, and unleashing creative potential in all segments of society. The innovative development model is formed through the synergistic effect of science, technology, and education, and emphasizes the development of sectors that create high added value in the economy. Innovative development has the potential to act as a key factor in ensuring economic prosperity in the future. At the same time, innovations play an important role in shaping the level of national development and the competitive advantage of the state. In a broader sense, the innovation potential of countries is considered a decisive criterion in assessing competitiveness at the global level (Fataliyeva, 2020). Since innovation is centered on the creation of new products, services, and processes, this model leads to serious changes in the structure of the economy.

One of the main conditions for an innovative development model is the existence of a strong scientific and research base. Strong cooperation between universities, research institutes, and the private sector plays an important role in this area. Creating a favorable legal and economic environment for the



commercialization of science and technology ensures the transformation of innovations into real market products, and the role of the state in shaping this environment is indispensable. The state should actively participate not only in terms of improving the regulatory framework, but also in terms of financing and promoting innovative projects. One of the most important benefits of implementing an innovative development model is increasing the sustainability and competitiveness of the economy. The traditional approach of growth is such that there is heavy dependence on external markets as well as the sources of raw materials. But in the case of an innovation-led growth model, the economy becomes more diversified and self-sufficient. The other advantage of adopting the innovation-led model of growth is the development of human resources. An innovative economy creates a demand for highly qualified personnel, which leads to qualitative changes in the education system. Stimulating personal initiative, creativity, and technological literacy raises the overall intellectual level of society, thanks to which sustainable development is observed not only in the economic but also in the social sphere.

An innovative development model in a global context allows countries to strengthen their positions in the international arena. Countries that lead in technological innovation gain economic and political influence. Developing countries based on such a model are more successful in attracting foreign investment and are able to promote their products in international markets, which creates the basis for the formation of a national brand and the improvement of the overall image of the country.

We have reflected the benefits of implementing an innovative development model in the industry in Figure 2.

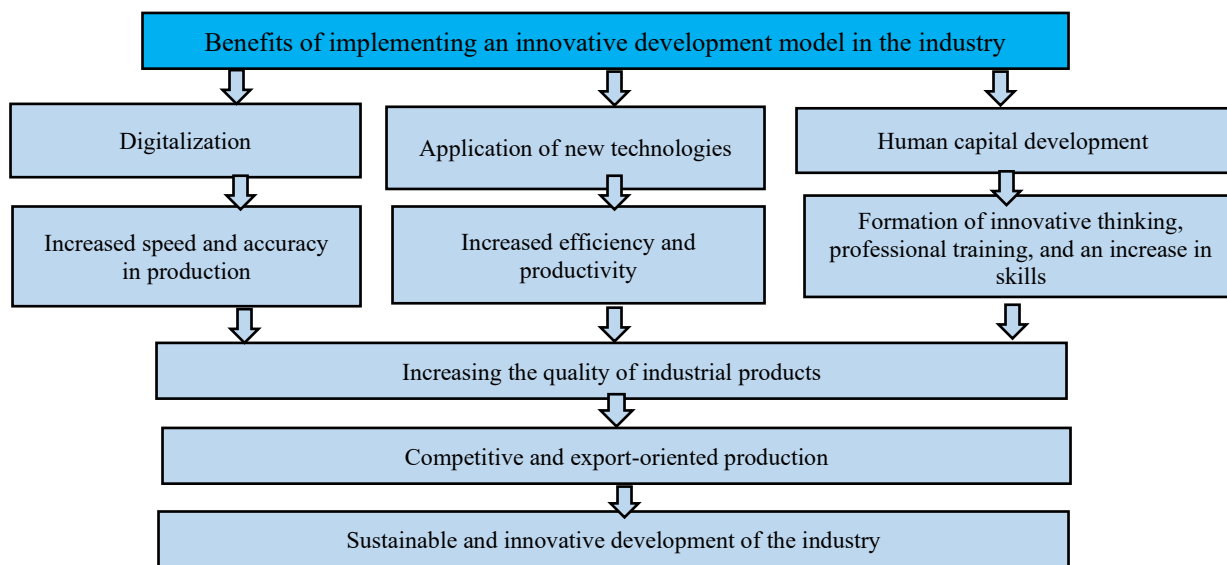


Figure 2. Benefits of implementing an innovative development model in industry (compiled by the author)

The implementation of an innovative development model also offers environmental benefits. New technologies cause less damage to the environment, save energy, and reduce waste. This is especially important in the context of global climate change. Promoting green technologies and green energy sources is an environmentally and economically beneficial strategy. Therefore, investigating the issues of increasing the role of the innovative development model in ensuring green industrial construction in Azerbaijan is of great practical importance.

The formation of a green industry in Azerbaijan is primarily related to the establishment of a more diversified and technology-based economic model, moving away from the dominant position of the oil and gas sector. In recent years, important steps have been taken towards the development of the non-oil sector, the establishment of "green energy zones", the implementation of the "green economy" concept, and the expansion of green energy sources (Gasimli, V.A. et al., 2014). In particular, the development of Karabakh

and East Zangezur as green energy zones marks the beginning of a new phase in the country's energy policy. Innovative technologies such as solar and wind energy production, smart energy grids, digital control, and automated management systems implemented within the framework of these initiatives act as effective tools to minimize the carbon emissions of the industry.

The decree signed by President I. Aliyev's on ensuring coordination in the field of innovative development in Azerbaijan is considered one of the important initiatives towards the realization of green industrial construction in the country. The decree places the responsibility on state authorities to ensure coordination in terms of the creation and implementation of products, services, processes, and solutions based on scientific knowledge, technological innovations, and digital development. This stimulates the development of innovations in industrialization that focus on energy-saving, resource-saving, waste-reduction and environmentally friendly technologies (Azərbaycan Respublikasında innovativ inkişaf sahəsində koordinasiyanın təmin edilməsi haqqında Azərbaycan Respublikası Prezidentinin Sərəncamı, 2019).

The innovative development model is not limited to technology alone; it is also characterized by the renewal of management systems, the development of human capital, the promotion of scientific and research activities, and the openness of business to innovation. A number of initiatives are being implemented in Azerbaijan in this direction. Connecting science and education with industry, supporting startup projects, operating innovation centers, and creating technoparks stimulates the application of environmentally friendly and resource-saving technologies. This approach allows industrial enterprises to operate more efficiently in the areas of energy efficiency, waste reduction, and water conservation.

Specific targets for the development of the green economy have been set within the framework of the socio-economic development strategy of the Republic of Azerbaijan until 2030. This includes environmental protection, mitigating the impacts of climate change, and shaping a competitive industrial model. This includes environmental protection, mitigating the impacts of climate change, and shaping a competitive industrial model (Azərbaycan 2030: sosial-iqtisadi inkişafa dair Mili Prioritetlər, 2021). In addition, the introduction of modern technologies to the country through international partnerships and foreign investments, the promotion of clean production processes, and the establishment of certification systems in line with international standards contribute to the green transformation of the industry.

Against the background of all these measures, developing infrastructure and improving legislation for the wider application of innovation is one of the important issues. In order to encourage green technology initiatives, the use of instruments such as tax incentives, grants, and green certification systems should be included in policymaking. Moreover, environmental risk assessment and sustainable investments may create opportunities for the advancement of green industry models. Specialization of technoparks and innovation centers in green technologies acts as one of the main tools that creates conditions for the synthesis of the country's ecological and economic development (Хмельницкий, 2011). The reforms carried out in the field of technological development in Azerbaijan in recent years, and the innovation infrastructure created, have formed a favorable basis for the transformation of the industry. However, the process of specializing existing technological platforms in green technologies is still at an early stage, and the need to take strategically oriented steps in this area is evident. The application of these technologies in the industrial sector not only provides environmental benefits, but is also of strategic importance in terms of creating new economic opportunities - the creation of export-oriented products, the creation of new jobs, and the formation of a high-tech manufacturing sector.

The process of specializing technoparks in green technologies begins, first of all, with the adaptation of the research and production activities of enterprises operating in these spaces to environmental standards. For this purpose, the application and development of energy efficiency technologies, green energy sources, waste processing, and reuse systems should be encouraged in technoparks. Pilot projects and technology transfer platforms should be established in these centers to achieve innovation-based green transformation



of traditional industrial structures. This will serve to ensure close integration between science, education, and industry. In general, the specialization of technoparks and innovation centers on green technologies will play a key role in accelerating the construction of Azerbaijan's green industry and strengthening its innovative development model. In this direction, coordinated state policy, scientific and industrial cooperation, investor support, and public education should be implemented with a comprehensive approach.

Tax incentives should be considered in a comprehensive manner for the effective implementation of an innovative development model to ensure green industrial development in Azerbaijan. These concessions should primarily aim to stimulate scientific research in areas of priority and strategic importance. Also, incentive mechanisms should be applied to promote innovative programs and projects and support their implementation. In this process, the formation of innovative and scientific potential and its provision with institutional and technological infrastructure are of particular importance, and these processes should be accompanied by tax incentives (Ağayev, 2023). Also, supporting innovation-oriented scientific and marketing research and promoting these activities should be one of the main directions of the concession policy. Finally, it is important to implement an effective tax incentive system to financially and institutionally support and stimulate innovative projects implemented by research institutes and higher education institutions.

Education and awareness also play an important role in successfully implementing innovative development. It is of great importance for society, and especially industrial entities, to have an understanding of environmental responsibility, to understand the advantages of green technologies, and to expand training and professional development opportunities in this direction. Joint cooperation between the public and private sectors is necessary to fill the existing gaps in this area in Azerbaijan.

The following should be mentioned regarding public-private partnership: this approach is not only used as a means of distributing costs, but it is also used to speed up the implementation of innovation, provide for managerial flexibility, and optimize resource utilization. Utilizing this cooperation approach within the context of green industries produces synergy by utilizing the regulation and promotion capacity of the government and the technological knowledge and financial power of private enterprises. Innovative solutions can be implemented through this synergy when it comes to implementing environmental-friendly technologies, managing wastes, saving energy, and using alternative energy resources within industries.

In creating a green industry in Azerbaijan, cooperation between the government and private sector companies as an innovative model of development should not only serve as a facilitation method, but also as a tool for strategic planning and realization. To implement such a model successfully, one needs to enhance institutional structure, introduce efficient partnership models, and build an atmosphere of mutual trust between the parties involved. It will only then that Azerbaijan can ensure its development based on the principles of competitiveness, environmental sustainability, and innovation in the sphere of green industry. In other words, the importance of using public-private cooperation as an innovative development model in green industrial development should be increased, since this work will greatly contribute to the country's sustainable development objectives.

The international obligations of the country are another stimulus for developing the green energy industry. Since the country committed itself to reducing the levels of greenhouse gases in the atmosphere by 35% in 2030 according to the Paris Climate Agreement, the country needs to develop its capability to produce renewable energy to meet the requirements. Moreover, holding the COP29 conference in Baku in 2024 can be considered another chance for the country. The conference can provide a platform for demonstrating the achievements made by the country in the sphere of green energy development and establishing new relationships. In case of the country that has considerable amounts of natural resources such as oil and gas, the green energy industry appears to be a viable sphere. (Hacizade, 2023). It should be noted that geographic position and climate in Azerbaijan make it easy to exploit renewable sources of energy. One of such promising directions may be the wind energy in the regions near the coast of the Caspian sea. Based on some calculations, it is possible to generate about 3,000 Megawatts of wind energy

per year in Azerbaijan (Aliyev, Sh.T., 2025). This is particularly true in regard to Absheron peninsula and the neighboring areas. It should also be mentioned that the installation of wind power stations is of great importance in view of satisfying the demand of the country and further development of export activities. In addition, solar energy may become another promising area for Azerbaijan. According to the data, the number of sunshine hours in Azerbaijan makes from 2,400 till 3,200 hours.

In this regard, one must also mention some achievements made by our country in the sphere of hydro power. Considering the capacity of small rivers existing in mountainous and hilly parts of the republic, building small hydroelectric power stations is carried out. This direction is of great significance as an alternative energy source, especially for those territories where there is agricultural activity, but no industrial enterprises. It is worth mentioning some alternative energy sources like bio-energy and geothermal energy; however, any significant development in these spheres has not yet occurred. As can be seen from the results gained, the overall capacity of renewable energy sources in Azerbaijan makes up about 27 thousand MW, of which 3 thousand are wind, 23 thousand – solar, 380 - small hydro-power, and the rest – bio-energy and geothermal.

Azerbaijan, with a deep understanding of global trends, is taking a proactive approach to international challenges and is taking significant steps towards a transition to a green energy strategy (Eliyeva, 2025). The Azerbaijani government has created a legal and institutional framework for the development of green energy. The law adopted in 2021, which provides for the use of renewable energy sources in electricity production, and the document covering the period until 2030 and reflecting national priorities, define strategic goals in the field of green energy. These legal documents focus on diversifying the energy sector and increasing green energy production. Within the framework of these documents, areas such as improving the investment climate, expanding public and private sector cooperation, attracting foreign investors, and technology transfer have been identified as priorities. The main goal is to increase the share of renewable energy sources in the country's energy production, strengthen energy security, and minimize negative impacts on the environment. Both documents assess the development of the green energy industry as a strategically important area in terms of fulfilling international obligations within the framework of combating climate change and creating new economic opportunities (Elektrik enerjisi istehsalında bərpa olunan enerji mənbələrindən istifadə haqqında Azərbaycan Respublikasının Qanunu, 2021).

Recently, a number of major projects related to the development of the green energy industry have been implemented in Azerbaijan. It is planned to build approximately 6 gigawatts of solar, wind and hydropower facilities in our country by 2030. However, this is only a part of the envisaged projects, as contracts and memorandums of understanding for 10 gigawatts of renewable energy projects have already been signed. Azerbaijan's technical potential in the field of renewable energy is 135 gigawatts on land and 157 gigawatts offshore. In 2023, the 230-megawatt Garadagh Solar Power Plant, implemented by the United Arab Emirates' Masdar company, was put into operation. The construction of the 240-megawatt Khizi-Absheron wind power plant was completed by the Saudi Arabian ACWA Power company.

It should be noted that on June 1, 2023, a Memorandum of Understanding was signed between the Ministry of Energy and the Chinese company "China Gezhouba Group Overseas Investment" on the implementation of 2 GW of renewable energy projects in Azerbaijan. This document covers the investigation of investment opportunities in green hydrogen production projects, as well as the introduction of industrial-scale solar energy, onshore and offshore wind energy, energy storage technologies, and smart energy systems in the country. The memorandum also includes the integration of projects into the energy grid, assessment of possible environmental impacts, and conducting geological and topographic surveys (Azərbaycanda bərpa olunan enerji mənbələrindən istifadə, 2025). In addition, as part of the COP29 event, the foundation stone for the 240-megawatt "Shafag" Solar Power Plant was laid in the Jabrayil region in cooperation with the United Kingdom's BP company. Within the framework of that event, Azerbaijan's SOCAR Green LLC, the UAE's Masdar company, as well as the European Bank for Reconstruction and Development, the Asian Development Bank, and the Asian Infrastructure and Investment Bank signed



agreements on financing two solar energy projects to be implemented in the Bilasuvar and Neftchala regions of our country. The total cost of the projects is 670 million US dollars and is planned to be completed and put into operation in 2027. The implementation of these projects is expected to generate more than 1.7 billion kilowatt hours of clean energy annually, thus preventing the use of 380 million cubic meters of natural gas per year. In addition, important contracts for projects with a total capacity of 1,000 MW were signed with the United Arab Emirates' Masdar company during the 2024 Baku Energy Week. These projects include the construction of 445 MW solar power plants in Bilasuvar and 315 MW in Neftchala, as well as a 240 MW wind power plant in Absheron-Garadagh (Bərpa olunan enerji mənbələri, 2024). Implementation of such projects provides for diversification of energy production in the Republic of Azerbaijan, in particular due to the expansion of renewable energy sources usage. Thus, there is a chance to use the resources of the natural gas of the country for export and minimize carbon emission. The introduction of such energy sources is very important and significant for the state being a part of Paris Climate Agreement. Such types of projects might lead to active economic activities in particular areas as well as generate new workplaces. Hundreds of professionals and workers participate in the construction and exploitation of such plants. This might contribute to the enhancement of employment and increase of technological knowledge. In case Azerbaijan will manage to develop this sphere successfully, it will guarantee sustainable development of economy of the country in oil-free future and also help to decrease carbon emission contributing to positive outcomes from this point of view all over the world. One should note that Azerbaijan aims to cut greenhouse gas emissions by 40% by 2050.(Huseyn, 2022).

In our opinion, Azerbaijan has great potential in the field of green energy, and with the right strategies, legal reforms, and technological modernization, this sector can become one of the main pillars of the national economy. Since electricity production in the green energy industry in Azerbaijan is mainly produced in hydro, solar, and wind power plants, let us analyze the current status of their production volume in those areas (Figure 3).

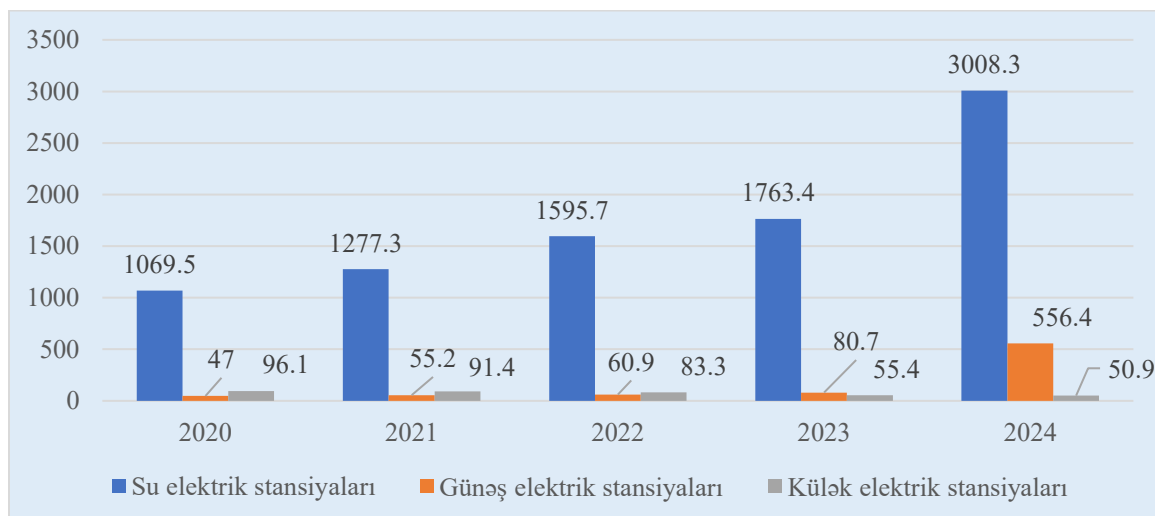


Figure 3. Volume of electricity generation from green sources, million kWh (Source: Prepared based on the State Statistical Committee of the Republic of Azerbaijan, https://www.stat.gov.az/source/balance_fuel/)

Significant changes were observed in electricity production in Azerbaijan in 2024. A total of 28,412.6 million kilowatt-hours of electricity were produced during the year, and the share of renewable energy sources in this production increased significantly. In particular, the combined production of hydroelectric power plants, solar power plants, and wind power plants reached 3615.7 million kilowatt-hours, accounting for 12.8% of the total production. Hydropower plants had the largest share – 3008.4 million kilowatt-hours, which accounts for 10.6% of total production. It should be noted that production at hydroelectric power plants increased by 70.6% compared to 2023, which may be due to increased rainfall, restoration of water resources, or increased operational efficiency of the plants. There has also been a significant increase in

solar power plants, with 6.9 times more energy being produced here than in 2023, reaching 556.4 million kilowatt-hours. This means that the potential of solar energy in the country is increasingly being utilized effectively and clearly confirms that the government's policy regarding renewable energy sources is producing tangible results. In turn, wind power stations faced decline with power production falling by 8.8% from 2023 to 50.9 million kilowatt-hours. The decline could be caused by various factors including purely technical ones or simply because the stations were not working at full capacity. Taking into account the development trends in renewable energy sources in Azerbaijan for 2024, we can conclude that the process can be positively assessed. The growth of hydroelectric power stations and solar power stations, in particular, proves that energy sector development is moving quite quickly, and the transition to renewable energy sources is becoming very effective. It is possible that in the future years, the percentage of green energy sources will continue to grow. Let us summarize the generation capacity of the power plants we examined in Figure 4.

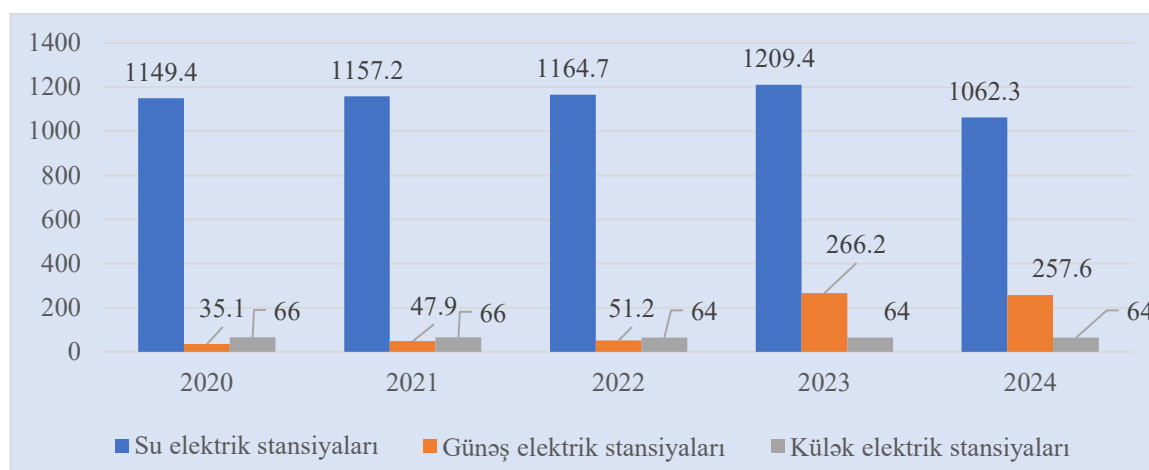


Figure 4. Capacity of hydro, solar, and wind power plants, megawatt (Source: Prepared based on the State Statistical Committee of the Republic of Azerbaijan, https://www.stat.gov.az/source/balance_fuel/)

The total capacity of power plants in the country in 2024 was 7,115.1 megawatts. From the above figures, 1,383.9 megawatts, which amounts to 19.4%, is attributed to hydroelectric, solar and wind power plants which fall under the category of renewable energy sources. The above figures indicate that even though renewable energy sources play a relatively insignificant role in energy production, they form an important part of the total energy structure. All in all, the reductions and stagnations experienced in renewable energy industry during 2024 call for more efforts to promote these energy sources in terms of their involvement in energy production. Climate change, technological advancement and funding problems are some of the issues at hand.

It is worth emphasizing that insufficiency in the development of infrastructure, aging of energy transmission and distribution networks, lack of local qualified specialists in renewable energy technology, and technological dependency may be named among the primary causes that hinder sustainable development in this industry. Additionally, the need to enhance legislation and create incentives for green energy remains topical. Conducting a detailed and comprehensive analysis of this problem shows that the challenges that this sector faces are rather diverse. In the first place, one may name the obsolescence of energy infrastructures and their inadequacy to modern technological demands as a factor that lowers efficiency of energy systems. In particular, it primarily results in the energy losses and decrease in the effectiveness of the system operation. In particular, the fact that energy transmission and distribution systems were constructed decades ago and have no modern technologies does not contribute to efficient exploitation of renewable energy sources (Шипилов, И.А., 2024). In such networks, managing energy flow and overload problems is a complicated issues that result in technical faults and energy supply disruptions.



First of all, the creation of an effective energy storage system is necessary for providing steady access to green energy. Even though such systems may still evolve, their price remains one of the critical problems hindering the process. Investment in R&D will allow for developing energy storage that would be both inexpensive and effective. At the same time, the influence of climate conditions on the effectiveness of using alternative energy sources should not be underestimated. Solar panels are ineffective during cloudy days and winter due to short daylight. The same applies to wind energy; therefore, it is crucial to create a strategy for the use of various types of green energy depending on certain conditions.

The possibility of a stable green energy supply is also a necessary condition, for which the development of effective energy storage systems is of great importance (Hacızade, 2023). Although energy storage technologies continue to develop, their high cost is one of the main factors hindering their widespread implementation. Investments in this area can enable the creation of more cost-effective and highly efficient storage solutions. Also, climatic conditions seriously affect the performance of renewable energy sources. For example, solar panels are less efficient in cloudy weather or during the winter months due to short daylight hours. The operation of wind turbines depends on stable wind flows. Therefore, it is necessary to develop complex strategies that ensure the effective integration of different types of renewable energy sources, taking into account their different characteristics (Попов et al, 2025).

The nature of renewable energy sources is that they are typically produced in smaller and geographically dispersed facilities, which requires their effective integration into the central energy system. However, outdated infrastructure lacks the ability to manage energy flows flexibly and in real time. In such a case, the introduction of energy from solar, wind, and other renewable energy sources into the system is either technically impossible or accompanied by high losses, which makes investments in this area risky and unprofitable. To solve the problem, it is important to gradually upgrade the energy transmission and distribution networks (Hacızade, 2022). This includes replacing old transformers, cable systems, and other physical components with modern technologies, as well as implementing smart grid technologies. These technologies make it possible to monitor energy flows in real time and direct them according to supply and demand, which ensures the seamless integration of renewable energy sources into the system.

Insufficient development of local chains of production and supply leads to the occurrence of significant strategic and economic challenges, mainly in the sphere of renewable energy. Purchasing a majority of technological equipment, like solar panels, windmills, inverters, and battery packs from abroad entails not only financial expenses but also leads to a long process of project implementation. Such a practice threatens the energy security of the country in the sense that disruption or any conflict between countries may cause the delay or even stopping of energy projects on the national level. Moreover, technological dependency makes it impossible for the state to have strategic freedom in the energy sector. Namely, having foreign firms providing key technologies means that it is the conditions and prices established by foreign parties that determine the specifics of technologies that prevent forming an independent energy strategy, innovation, and technology transfer.

The following measures can be taken in order to solve the given problem, and one of the main aspects that needs to be done is developing long-term strategies that aim at fostering the development of local manufacturing. The involvement of the state should be essential in this respect. Another strategy is the encouragement of establishing joint ventures with foreign firms that specialize in the production of technologies, since that would lead to the technology transfer as well as the training of local human capital. The next measure to take is the fostering of cooperation between universities and research institutes on the one hand and industry on the other hand, as well as upgrading educational programs in engineering and other technical specializations. It is impossible to provide for technological development without skilled human capital. The lack of skilled local specialists contributes to higher dependence, especially in terms of high-tech system construction and operations. Moreover, it is necessary to improve the infrastructure related to logistics and supply chains in order to ensure timely delivery of produced elements at the places of their application. On a longer-term basis, such actions will allow not only reducing technological dependency, but also creation of employment, developing export capabilities and promoting further development of the

local industry. Therefore, increasing local manufacturing capacities along with creating a sustainable supply chain should be seen as an essential strategy for ensuring sustainable development of the renewable energy sector.

However, at the same time, another important condition is also necessary, namely, a legal and regulatory framework should meet the current needs. In case the incentive schemes for green energy implemented within the scope of the legislation are badly formed in terms of tax breaks, subsidy programs, long-term contracts, and tariff regulations, such factors create an adverse atmosphere for investments. In case the incentive schemes are not effectively used by the country, then this process will be rather complicated, especially when implementing innovations. Moreover, there are shortcomings in terms of the protection of the rights of local populations, in terms of environmental and social risk assessment in the context of implementation of renewable energy technologies. Sometimes, the lack of public participation in this regard can even become one of the reasons for mistrust between all participants of the process. At last, because of scientific innovation being weak, the creation of relevant technologies becomes complicated. University-industry cooperation, support for startup initiatives, and the development of technology incubation centers can play an important role in this area. Another important issue is that awareness of green energy is still low at the societal level. There is a need to expand educational activities in the field of energy conservation, efficient use of energy, and the application of renewable energy sources. The ability of the population, especially those living in rural areas, to transition to green energy should be stimulated through subsidies and technical support programs.

3. Conclusion

Considering the findings of our research, one can say that the innovation development model acts as an inevitable mechanism for creating a green industry in Azerbaijan. Implementation of the model will be beneficial not only for the environment but also for the economy and society of the country. Introduction of new innovations, development of green energy resources, use of digital technology, and adaptability in management constitute crucial elements for the creation of a green industry. Considering the situation today, the actions of Azerbaijan regarding this issue can be regarded as positive, but additional actions should be taken to ensure faster and more systematic implementation of the process. Such actions can include:

- preparation of a national road map for the implementation of green innovations;
- Introduction of tax incentives for industrial enterprises that encourage the transition to green technologies;
- specialization of techno parks and innovation centers in green technologies;
- strengthening tripartite cooperation between science, education, and industry;
- expanding climate financing and cooperation with international donors;
- Organizing information and awareness campaigns on the green industry, etc.

The implementation of the aforementioned recommendations will allow the restructuring of Azerbaijan's industrial sector on a green and innovative basis, increase the country's sustainability in the domestic market, and create conditions for its recognition as a competitive and environmentally responsible economic entity in the international market.

Research has shown that Azerbaijan has great renewable energy potential in the fields of solar, wind, hydro, and bioenergy. In order to use these potentials purposefully and efficiently, strategic documents on the development of the green energy sector have been adopted at the state level, and specific projects are being implemented. Foreign investors' interest in Azerbaijan's green energy industry is growing, and several international cooperation agreements have already been signed in this direction. The Karabakh and East Zangezur regions have been declared priority green energy zones, and real work is being done in this direction. However, there are technological, personnel, and infrastructure problems, as well as



shortcomings in the legal and educational fields. Therefore, I consider it appropriate to take measures in the following areas to develop the green energy industry in Azerbaijan:

- Development of special laws, incentives, and incentive mechanisms that promote the development of renewable energy sources;
- Minimizing dependence on foreign technology by promoting local production, technology transfer, and establishing innovation centers;
- Creation of green energy curricula in higher and secondary specialized educational institutions, study of foreign experiences;
- Increasing the level of public knowledge about green energy, stimulating the population's transition to green energy;
- Upgrading existing energy transmission and distribution systems and adapting them to green energy projects;
- Prioritizing green energy projects in the regions, especially in the liberated territories, and using these projects as a key element of socio-economic revival.
- Deepening cooperation with international financial institutions and technology companies by taking advantage of globally significant events such as COP29, etc.

Thanks to the implementation of these or other measures mentioned, it is possible to expect an increase in green energy production, diversification of energy exports, and ensuring environmental sustainability in the future, which could become the main pillars of Azerbaijan's energy policy. Through sustained and planned investments, institutional reforms, and international cooperation, Azerbaijan has the potential to become a regional green energy hub.

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Дополнительная информация о причинах ретракции: Статья отозвана редакцией сборника из-за нарушения авторами издательской политики. Пензенский государственный аграрный университет, Пенза КОНФЕРЕНЦИЯ: ГОРОДА РОССИИ: ПРОБЛЕМЫ СТРОИТЕЛЬСТВА, ИНЖЕНЕРНОГО ОБЕСПЕЧЕНИЯ, БЛАГОУСТРОЙСТВА И ЭКОЛОГИИ Пенза, 28–29 марта 2025 года Организаторы: Пензенский государственный аграрный университет, Межотраслевой научно-информационный центр, Пенза Тольяттинский государственный университет, Тольятти.
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Academic Mobility as a Strategic Tool for Human Capital Development in Higher Education

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Received: 24.03.2026

Accepted: 01.04.2026

Published: 28.04.2026

<https://doi.org/10.54414/FGJN7289>

Abstract

In our time, universities are adaptive institutions and part of the academic world. This change brings with it an increasing responsibility: to develop people who are not only knowledgeable in their field, but also internationally minded, adaptable, and ready to collaborate across borders. This article looks at how academic mobility helps universities to fulfil this responsibility, and focuses specifically on what mobility programmes mean for teaching staff. Taking the Erasmus+ program as its main object, the study combines a literature review, qualitative and comparative analysis, and a case study of the author's participation in the Erasmus+ Staff Week on managing the challenges of academic work in times of uncertainty, held at the Nicolaus Copernicus University in Toruń, Poland, from 20 to 25 April 2026. The research highlights that mobility is not just a short professional visit. For teachers, it opens up new ways of thinking about their own experiences, genuine international connections, and a kind of professional renewal that is difficult to achieve otherwise. For universities, investing in staff mobility pays off in more adaptable, more capable, and more globally competitive institutions. The article shows that mobility programs should always be reflected in the university's strategy.

Keywords: Competitive human capital, academic mobility, Erasmus+, higher education, international collaboration, knowledge exchange, global competencies

1. Introduction

Today, universities are not just educational institutions that transmit knowledge. Universities are also centers that appeal to people's way of thinking and have the potential to make them truly professional. Digitalization, new demands of the labor market, and globalization have created a new way of working in universities, giving a new direction to their activities.

Previously, the goal of universities was only to train specialists, but today the goal of universities is to train young people who are world-minded, educated, tolerant of different cultures, and quick to react to the digital environment. Therefore, the development of a university is how many international relations, knowledge exchange opportunities, and academic mobility programs it has.

Researchers show that universities should pay serious attention to equipping students and teachers with international experience, intercultural communication, and the global skills necessary to operate in a rapidly changing world (Guo et al., 2024). This is not only a matter for students - teachers are an integral part of this process. After all, academic staff constitute the living core of the university's human capital. The more teachers are informed about new knowledge, the more familiar they are with different teaching methods and the deeper they enter the international academic world, the more their teaching, research, and the status of the university they represent directly benefit. Within the framework of the knowledge economy, universities have become an indispensable part of the innovation system. They no longer simply transmit ready-made knowledge - they play an active role in the creation, dissemination, and application of new knowledge. In this sense, the university is one of the rare places where human capital is born, matures, and becomes valuable for the benefit of society. Valehova and Streitwieser rightly point out that modern universities constitute one of the main pillars of human capital in the knowledge economy and play an

important role in shaping an environment conducive to innovation (Valehova & Streitwieser, 2022). It is in this context that international academic mobility is of particular importance. Academic mobility involves the participation of teachers, researchers, and academic and administrative staff in activities at foreign universities - training sessions, seminars, exchange programs, international weeks, and joint academic events. However, we should view these visits not as a travel opportunity, but in the context of learning new teaching methods, getting to know the international academic environment, expanding professional networks, launching cooperation projects, and strengthening cooperation between universities.

The strongest European mobility program in this area is Erasmus +. Academic mobility is a strategic step in terms of learning new teaching methods, getting to know the international academic environment, expanding professional networks, opening doors for collaborative projects, and strengthening real cooperation between universities.

Academic staff mobility within the programme allows teachers to see other university environments from the inside, to directly observe different pedagogical approaches, to engage in open dialogue with colleagues, and to reassess their own professional path. Research shows that Erasmus+ academic mobility adds an international dimension to teachers' careers – it significantly contributes to their professional development through both formal and informal channels (Kupriyanova & Psychogiou, 2023). This means that academic mobility is not a short trip abroad – it is a systematic process that deepens a teacher's knowledge capital and broadens their horizons.

2. Literature Review

The concept of human capital has become one of the most frequently cited ideas in economics and management today. Previously, the explanation of the concept of “human capital” was simpler: the sum of a person's level of education, the depth of professional knowledge, skills, and the value they create in the labor market was considered human capital. But as the world has changed, the concept has also changed. It is no longer enough to evaluate a person with the question “What do you know?” Now it would be more correct to ask such questions as: “How quickly can you adapt to changing conditions?” “Can you use new technologies?” “Can you work as part of a team?” “Can you compete in a global environment?”, “Can you create new ideas?” Competitive human capital is where all these questions come together - a more lively, more dynamic, more strategic form of the human capital concept. Here, the main goal is not just for an individual or organization to use its knowledge and skills, but to continuously update, develop, and convert them into real value. Competitive human capital is adaptive, innovative, and creative, applies knowledge in practice, and contributes to work.

The Fourth Industrial Revolution has shown us that human capital is needed more than ever before. We have reached an era when knowledge quickly becomes obsolete; what you know today may not be enough tomorrow, and thus, the task for universities is changing. The main goal is no longer just to provide knowledge in a certain field, but to educate people who are open to learning, ready for change, and have the ability to think creatively. This issue is of particular relevance for Azerbaijan. Zeynalli emphasizes that the development of human capital is one of the priority directions of Azerbaijan's state policy, and increasing investments in this area remains essential against the background of the requirements of the Fourth Industrial Revolution (Zeynalli, 2021). This means that the creation of competitive human capital is no longer an individual matter, nor is it the sole responsibility of universities - it is the foundation on which national development, innovative potential, and international competitiveness rest. All this makes competitive human capital the most critical condition for the development of a university, both in the domestic and international arena. This leads to the fact that competitive human capital is a living unity of knowledge, skills, innovative thinking, adaptability, strategic vision, and the desire to learn throughout life. For universities, this concept has an even deeper meaning: a higher education institution does not simply produce human capital; it continuously renews it through the development of its academic staff. It is for this reason that tools such as international academic mobility deserve to be evaluated not as a simple tool, but as a real mechanism in the formation of competitive human capital. Higher education institutions play



a major role in these issues, as they shape the knowledge and skills of students on the one hand, and strengthen the internal human capital in the academic environment by developing their own academic and scientific staff on the other. Material resources are no longer considered the main strength, the real difference-making factor is the quality of academic staff, their openness to innovation, and the flexibility of scholarship and teaching.

International academic mobility is the most visible, most noticeable dimension of the internationalization of higher education. Simply put, it involves the participation of teachers, researchers, administrative-academic staff, and students in activities at foreign universities for a certain period of time - teaching, training, research, seminars, staff weeks, conferences, or professional development events.

Higher education institutions play a major role in these issues, as they shape the knowledge and skills of students on the one hand, and strengthen the internal human capital in the academic environment by developing their own academic and scientific staff on the other. Material resources are no longer considered the main strength; the real difference-making factor is the quality of academic staff, their openness to innovation, and the flexibility of scholarship and teaching. They exchange ideas with colleagues from other countries, witness new academic approaches with their own eyes, and re-evaluate their professional experience through a comparative lens. This kind of experience changes not only the teacher, but also the entire teaching and scientific environment of the university to which they return.

The Erasmus+ programme is one of the most well-known and prestigious mechanisms in this field. Within the framework of the programme, academic staff organise short-term teaching and learning visits, hold seminars and practical sessions at partner universities, gain direct exposure to new educational approaches, and open new doors for international cooperation. Kupriyanova and Psychogiou note that Erasmus+ academic mobility enhances the international dimension of teachers' careers and supports their professional development through both formal and informal channels (Kupriyanova & Psychogiou, 2023). This shows that the mobility period is the very essence of professional transformation.

One of the greatest strengths of academic mobility is that it creates a vibrant, experiential environment for knowledge exchange. Teaching models, assessment approaches, digital tools, student-centred methods, and management practices of universities in different countries – all of this becomes an open learning space for participants. Here, teachers do not just collect information – they see with their own eyes how these approaches work within a real university. When they return, they are able to look at their teaching with a more critical, more creative eye.

Research on Erasmus+ academic mobility also reveals an interesting picture of participants' motivations. Acquiring new knowledge and skills, getting to know best practices, sharing what they know, building professional relationships, and strengthening cooperation with partner universities – these consistently appear at the top (Kupriyanova & Psychogiou, 2023).

These findings show that academic mobility works in two directions simultaneously: on the one hand, individual professional development; on the other, vibrant collaboration between institutions. In particular, teachers' mastery of new pedagogical methods, engagement with digital learning tools, and observation of different academic cultures significantly strengthen their adaptive and innovative competencies. It is important to note that international academic mobility is invaluable for the development of intercultural communication skills. Working side by side with people from different countries instills in the teacher an open-mindedness, respect for differences, communicative flexibility and a true spirit of cooperation. Higher education institutions year after year want to take part in global academic networks. In this sense, mobility does not simply make teachers better teachers, but also makes them more open, more flexible, and more globally connected academics. At the same time, universities no longer function solely as components of national education systems; they function as active participants in the global knowledge space. A university's competitiveness is measured not only by its internal resources but also by its ability to build international partnerships, participate in joint projects, join academic networks, and adapt to global quality standards.

International cooperation can make a real difference for universities in several ways. First, the established lively relations with foreign universities open up real opportunities to learn new teaching methods, innovative programs, and modern management approaches. Second, the expansion of the scientific potential of universities, i.e., joint research, international projects, co-authored publications, and exchange programs, moves the university forward in science. Third - and perhaps most profoundly - both students and teachers get to know different academic cultures from the inside and become part of the global circulation of knowledge. Academic mobility is the most visible, most vivid form of this cooperation. The participation of teachers and researchers in training, seminars, workshops, and discussions at foreign universities creates deeper connections between institutions than superficial acquaintance. Sometimes this connection goes far beyond the limits of a short visit - the ground is prepared for the development of joint curricula, the creation of new course modules, the launch of joint research initiatives, and the formation of strong institutional partnerships. Kupriyanova and Psychogiou confirm this in their research: Erasmus+ academic staff mobility results in significant changes, including curriculum improvements, development of joint courses and modules, expansion of academic networks, and deepening of research collaboration (Kupriyanova & Psychogiou, 2023). Such changes demonstrate that academic mobility creates real value not only at the individual level but also at the institutional level. When a teacher who has participated in a program abroad returns, they bring with them not only their personal knowledge base, but also new contacts, new ideas, potential collaboration opportunities, and different academic approaches. In this way, a single individual mobility trip can contribute to the overall development and internationalization strategy of a university through a ripple effect. Against the backdrop of globalization, the “entrepreneurial university” - a model that is initiative-based, dynamic, and adds value to its surroundings - is no longer an abstract idea, but a real requirement. According to this model, the university is not just a place of learning; it is an actor that produces innovations, engages in economic and social development, maintains lively relations with the labor market, and strategically uses international partnerships. Universities have become one of the leading forces of innovation and economic development today - especially in an era of increasing global competition (Valehova & Streitwieser, 2022).

Academic mobility directly serves the development of this model. Through mobility, universities not only exchange experience but also gain new program ideas, research topics, international project opportunities, and various cooperation formats. Universities that are open to international cooperation act more flexibly, adapt their curricula to world requirements more quickly, and take a more visible position in the international academic landscape.

In addition, international cooperation leaves its mark on the accreditation indicators of universities, quality assurance, and international rankings. Universities with experience in global cooperation are always one step ahead in updating their curricula, defining learning outcomes in line with international standards, supporting the development of academic staff, and opening broader academic horizons for their students. For this reason, international academic cooperation should no longer be perceived as one of the “additional activities” of the university - it should be considered an integral part of its strategic development.

Academic mobility creates deeper connections between institutions, sometimes extending well beyond a short visit. For example, it paves the way for the development of new curricula, the creation of new course modules, the launch of joint research initiatives, and the formation of strong institutional partnerships.

Speaking about the professional development of teachers, it should be noted that the teacher is also a person who guides the development of students, conducts research, and participates in the formation of the academic quality of the university. This tells us that one of the main indicators that make a university competitive is the development of teachers. The opportunity for mobility creates familiarity with new cultures for teachers.

A teacher entering a foreign university environment encounters a different teaching culture there — student behavior is different, assessment approaches are different, and academic management practices



are different. This difference prompts the teacher to reconsider his or her teaching style and seek more flexible approaches. The teacher works with different audiences, has open conversations with colleagues from different countries, and becomes a direct witness to new pedagogical methods. Research shows that international experience equips teachers with the ability to adapt to different language levels, different academic backgrounds, and different student expectations (Kupriyanova & Psychogiou, 2023). One of the most valuable aspects of mobility programs is the opportunity for the teacher to use new technologies. He or she observes its use in a live university environment. These include interactive seminar formats, student-centered assignments, collaborative methods through digital platforms, and new assessment methods. The teacher uses this knowledge in his or her lectures. This, in turn, allows students to actively participate in the lesson. Academic mobility also contributes to teachers' foreign language skills. English develops in a more international environment. Teachers give presentations in English, participate in discussions, represent their university, and establish academic relationships with colleagues from different countries, as well as express their ideas clearly in front of an international audience, answer questions confidently, and develop professional networking skills. Erasmus+ experiences leave a positive mark on teachers' foreign language communication skills and their ability to express their ideas academically (Kupriyanova & Psychogiou, 2023).

In addition to all this, academic mobility also awakens the spirit of leadership and initiative in teachers. Teachers participating in a foreign academic environment do not just participate - they represent their university, establish new relationships, evaluate future cooperation opportunities, and sometimes take the initiative in implementing new projects. In this sense, mobility shapes the teacher not as a passive participant but as an active academic unifier and carrier of knowledge. Such experience increases teachers' self-confidence and creates the basis for them to approach changes at their universities with a more open, bolder, and more innovative perspective.

Intercultural skills are also an integral part of academic mobility. Communication with people from different countries who share the same academic field develops empathy, tolerance, open-mindedness, and a genuine spirit of cooperation in the teacher. In today's university, these skills no longer belong to the category of "nice to have" - they belong to the category of "can't do without". Higher education is increasingly based on international student bodies, multicultural audiences, and global academic partnerships. The better a teacher can adapt to this environment, the stronger both the quality of his teaching and the relationships he builds with students.

3. Research Goals and Objectives

The aim of this study is simple: to understand how international academic mobility affects the development of competitive human capital. Here, academic mobility is examined as a deeper process, not simply in the sense of "a teacher went abroad and returned". Professional development of teachers, knowledge exchange, expansion of international academic networks, and contribution to the institutional competitiveness of universities - all these are integral parts of this process. In modern higher education, the competitiveness of human capital is no longer measured by the question "how much do you know?" alone. Adaptability, intercultural communication, digital literacy, innovative thinking, and openness to international cooperation are integral parts of this measure (Guo et al., 2024; Zeynalli, 2021).

To achieve this goal, a number of specific tasks have been identified:

To explore the theoretical foundations of the concept of competitive human capital and clarify its role in the development of higher education institutions; to deeply explore the concept of international academic mobility and explain its connection with the professional development of academic staff; to assess what opportunities Erasmus+ academic staff mobility programs open up in terms of knowledge exchange, professional networking and competence development; to identify the institutional advantages of international mobility for universities in terms of international cooperation, curriculum development and academic quality; to analyze how academic mobility affects teachers' adaptability, communication, digital competences, leadership skills and intercultural understanding; and finally, to demonstrate the practical

value of academic mobility through a real example by examining the Erasmus+ Staff Week experience at Nicolaus Copernicus University in Poland through a case-study approach.

4. Materials and Methods

Given the nature of the topic, qualitative analysis was preferred over numerical measurement. The reason is simple, because real experience has shown that the impact of international academic mobility on human capital cannot be explained by statistics alone. Professional experience, knowledge exchange, adaptive skills, institutional cooperation, and academic networking - these are factors that cannot be reduced to numbers, but are what shape reality. For this reason, conceptual and interpretive analysis was considered more appropriate to explore this topic (Kupriyanova & Psychogiou, 2023; Momeni et al., 2022).

Four main methods were used in the study.

The first was an analytical review of the scientific literature. At this stage, scientific sources on human capital, competitive skills, academic mobility, internationalization of higher education and the impact of Erasmus+ programs were systematically examined. This review both created a theoretical basis for the topic and revealed which questions remained unanswered in existing research. Modern approaches to global competencies, international academic experience, and human capital development form the basis of the theoretical framework of the article (Guo et al., 2024; Valehova & Streitwieser, 2022). The second was a comparative analysis. This approach allowed us to comparatively assess how different countries and higher education systems implement academic mobility, what results it leads to, and how it is reflected in the internationalization strategies of universities. The comparative perspective made one thing clear: academic mobility does not end with the individual development of the teacher - it also reaches the development of inter-university cooperation, joint programs, academic networks, and research initiatives (Kupriyanova & Psychogiou, 2023). The third was a text and document analysis. At this stage, reports, program materials, and scientific articles related to the Erasmus+ program, academic staff mobility, international cooperation in higher education, and the competitiveness of universities were examined in detail. Document analysis was of particular importance in demonstrating how the topic is justified not only in a theoretical framework, but also at the level of programs and institutions. Research on Erasmus+ academic staff mobility confirms once again that these programs equip teachers with new skills, accelerate knowledge exchange, expand professional networks, and strengthen cooperation with partner universities (European Commission, 2025; Kupriyanova & Psychogiou, 2023).

The fourth was the Case-study approach. In this context, the author's experience of participating in the Erasmus+ Staff Week at the Nicolaus Copernicus University in Poland was included in the study as a real, live example of international academic cooperation. The case-study approach adds real realities to the topic. The Erasmus+ Staff Week in Poland is of particular importance for this study because it provided an opportunity to see how academic mobility works simultaneously in several different dimensions: international didactic cooperation, knowledge exchange between participants from different universities, lively discussion, and initial steps taken to establish new educational institutions. Within the framework of this experience, discussions were held with colleagues from Switzerland, Portugal, Bosnia and Herzegovina, Ukraine, Moldova, Georgia, Morocco, and Poland. Thus, the article is based not only on the literature, but also on the experience of academic mobility based on personal experience. It is precisely for this reason that the case-study method proves to be the most useful for explaining the impact of academic mobility on human capital in the most convincing and vivid way.

One limitation of the study must be explicitly acknowledged: the article is not based on large-scale empirical surveys or statistical measurements. For this reason, the findings are primarily voiced within the framework of a case study based on conceptual analysis, scientific literature, and observation. However, this limitation is also an opportunity - this approach serves to establish a solid theoretical foundation for the topic and to set the direction for future empirical research.



5. Results And Discussion

5.1 Academic Mobility and Knowledge Exchange

One of the most profound and lasting outcomes of academic mobility is knowledge exchange. By participating in training sessions, seminars, lectures, and panel discussions at foreign higher education institutions, teachers directly observe different academic cultures, teaching methods, assessment approaches, and university management practices. The observing teacher begins to view his or her work from a broader perspective. In other words, knowledge exchange here is not a simple exchange of information - it is a process of renewing pedagogical thinking and deepening academic practice (Guo et al., 2024; Kupriyanova & Psychogiou, 2023). Another important aspect of knowledge exchange is the renewal of teaching methods. An emerging strength is the renewal of teaching methods and the addition of student-centered approaches, interactive lesson models, problem-based learning, project-based assignments, and digital teaching tools to these methods. At the same time, the established relationships in the international environment create the basis for future joint publications, projects, and scientific discussions.

The Erasmus+ Staff Week at Nicolaus Copernicus University in Poland is a clear example of this. The gathering of academic and administrative staff from different countries created a real environment for knowledge exchange. Seminars, panel discussions, and informal academic conversations not only provided participants with new information but also provided an opportunity to see the teaching and cooperation approaches of different universities in a comparative way. Such an experience demonstrates in the most concrete terms the impact of academic mobility on human capital: a teacher returns to his/her home university with new knowledge, new contacts, and a new perspective.

5.2 Mobility and Competitive Skills

Academic mobility has a direct impact on the development of the competitiveness of teachers. In a modern university, a teacher is no longer just someone who knows his/her subject. They are professionals who adapt to the needs of a changing audience, use digital tools, communicate in international environments and test new pedagogical approaches. For this reason, academic mobility reaches not only the level of knowledge of the teacher, but also their adaptability, digital literacy, communication skills, and leadership skills (Guo et al., 2024; Kupriyanova & Psychogiou, 2023).

The first dimension is adaptability. A teacher entering a foreign university environment is faced with different academic norms, different student profiles, unfamiliar teaching styles, and new forms of communication. This situation is a school in itself - the teacher learns to be flexible, to adapt his pedagogical approach and to manage different expectations. Kupriyanova and Psychogiou (2023) demonstrate this concretely in their research: international academic experience equips teachers with the ability to adapt to different language levels, different academic backgrounds, and changing student needs - making them more flexible and more student-centered in the teaching process.

The second dimension is communication skills. During academic mobility, a teacher presents to an international audience, joins discussions, represents his/her university, and builds relationships with colleagues from different countries. This process develops both academic communication skills in a foreign language and the ability to build professional networks. Expressing one's opinions in an international environment, answering questions, engaging in dialogue with different perspectives, and discussing opportunities for collaboration - all of this continuously strengthens a teacher's academic self-confidence (Kupriyanova & Psychogiou, 2023).

The third dimension is digital and technological skills. In recent years, digital platforms, hybrid learning models, online assessment tools, and interactive learning tools have spread rapidly across higher education. Within the framework of Erasmus+ academic staff mobility, teachers see first-hand how these technological solutions work in different universities and gain ideas that they can take back to their own teaching. The fourth dimension is leadership and initiative. A teacher who represents his/her university in an international environment builds relationships, identifies opportunities for collaboration, brings new

ideas back to his/her university, and sometimes takes the lead in initiating new projects. In this process, the academic leadership and initiative within the teacher manifests itself. Valehova and Streitwieser (2022) emphasize that modern universities should play a more active role in innovation and economic development.

The fifth dimension is intercultural competencies. We believe that higher education institutions should expand international experience and intercultural learning opportunities for both students and academic staff (Guo et al., 2024). In this sense, academic mobility makes a teacher not only a better educator but also a professional who thinks more broadly and understands cultural diversity more deeply.

6. Conclusion

International academic mobility is a strategic mechanism that strengthens the competitive human capital of universities, supports the professional development of academic staff, and accelerates the international integration of higher education institutions. Analysis shows that academic mobility offers invaluable opportunities for teachers to acquire new knowledge, adopt modern teaching methods, expand international networks, and get to know different university cultures from the inside. Programs such as Erasmus+ make all of this possible in a systematic, accessible, and sustainable manner (Kupriyanova & Psychogiou, 2023)

The results of the study show that academic mobility simultaneously affects competitive human capital in several dimensions. First, teachers' knowledge base and pedagogical approaches are updated – academic staff participating in foreign environments are exposed to new teaching technologies, interactive methods, hybrid formats, and student-centered approaches, and begin to integrate them into their teaching upon their return. Second, adaptation, communication, and intercultural skills are developed – being active in a global academic environment requires teachers to adapt to different cultures, collaborate with diverse colleagues, and express themselves in front of an international audience (Guo et al., 2024). Third, mobility creates institutional value for universities that goes far beyond individual development.

In the Azerbaijani context, the relevance of this issue is particularly profound. In the Azerbaijani context, this issue is relevant. Azerbaijani universities have a number of real tasks ahead of them. For example, increasing investments in human capital is an important direction for Azerbaijan's future and adaptation to the requirements of Industry 4.0 (Zeynalli, 2021).

International academic mobility is a strategic investment in human capital.

This investment not only improves the individual knowledge and skills of the teacher but also leaves a positive mark on the institutional development, internationalization, and innovative potential of the university. Programmes such as Erasmus+ Personal Mobility equip teachers with adaptability, leadership, digital literacy, intercultural communication, and academic collaboration skills - making higher education institutions stronger, more agile, and more resilient in a globally competitive environment.

It would be valuable to explore this area through broader empirical research in the future.

In particular, conducting surveys and interviews among teachers who have participated in Erasmus+ and other international mobility programs in Azerbaijani universities, especially among those who have participated in Erasmus+ and other international mobility programs - measuring changes in professional competencies before and after mobility, assessing the impact of programs on the quality of teaching and international cooperation indicators - all these can be valuable directions for future scientific research. Such studies will once again demonstrate what academic mobility really is: not a personal journey, but an indispensable element of the competitive human capital policy of the higher education system.



7. Author Contributions

The author carried out all stages of the research independently.

8. Funding

No external funding was received for this research

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Assessment of Factors Affecting Consumer Decision Making

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Received: 12.03.2026

Accepted: 27.03.2026

Published: 28.04.2026

<https://doi.org/10.54414/PWQM2399>

Abstract

This article examines the key elements that influence consumer decision-making, as well as the challenges that arise when assessing these aspects. We not only examine the cultural, social, personal, and psychological elements that influence consumer behavior, but also explain the research methods used to investigate these factors. According to research reports, increasing the effectiveness of market strategies implemented by businesses and providing them with a competitive advantage can be achieved through an accurate assessment of these aspects. In this sense, studying consumer behavior allows businesses to improve their customer-centric approach. On the other hand, it is considered important to constantly monitor these aspects in order to quickly react to any changes that may occur in the market, for example, changes in consumer preferences or new competitors. As a result, the study and evaluation of enterprises based on scientific principles has a positive impact on the development of enterprises in the long term.

Keywords: Consumer behavior, decision-making process, cultural and social factors, marketing strategies, digital analytics

1. Introduction

Given the current state of the economy, the study of consumer behavior is often considered one of the most important areas of development in marketing activities. The decision-making process of customers develops under the influence of various internal and external elements, and it is important for businesses to understand this process correctly in order to ensure the successful operation of their businesses. As globalization, digitalization, and increased competition are all important factors, we need to delve deeper into consumer behavior. Modern consumer behavior is a dynamic process shaped by rapid digitalization, changing values, and economic factors. Today's consumers are active market participants who demand personalization and high-quality service. The research of leading figures in social science, such as sociologist Pierre Bourdieu and economist Daniel Kahneman, laid the scientific foundation for our modern understanding of consumer behavior and decision-making mechanisms. The history of consumer behavior research shows that early attempts to develop a theory of consumption focused on rationality. However, modern research demonstrates the dominance of emotions. Consumer research is one of the most in-demand types of research because consumers generate revenue by purchasing a company's products. It's no surprise that the focus of any successful company, regardless of size, is on the customer, the consumer. By understanding its customers, their wants and preferences, a company can offer them exactly what they need. Understanding consumer behavior is crucial for developing successful marketing strategies, as it allows companies to align their offerings with specific customer needs and preferences (Mothersbaugh, 2016) This will allow the company to better meet the needs of its customers and consumers than its competitors.

2. Factors Influencing Consumer Decisions

A number of fundamental elements significantly influence the formation of consumer decisions, and among these, cultural factors are particularly important. As a set of values, beliefs, standards, and patterns of behavior shared by members of a community, culture serves as the foundation on which consumer behavior is built. This value system serves as a framework within which individuals formulate their demands, express their opinions about different products, and make decisions about their choices. For example, consumption decisions are more influenced by social conformity and approval standards in collectivist societies. This is because the interests of family and society are prioritized in these cultures.

On the other hand, individualistic cultures place more emphasis on the importance of personal preferences and tastes than more traditional civilizations. The impact of cultural influences is not only manifested in broad ideals, but also manifests itself in more specialized ways through subcultures and social classes. Subcultures develop based on characteristics such as race, religious beliefs, geographic location, or lifestyle, and directly influence the product choices customers make. For example, religious principles have the potential to limit the acceptability of certain products or create demand for certain product categories. In addition, social classes are related to the income level, education, and social position of customers, which leads to different priorities in their purchasing behavior. This is because social classes are related to the social status of consumers (Nelson, 1970, p.120).

Members of higher social classes are more concerned with quality, brand image, and prestige, while members of lower-income groups are more concerned with things like functionality and price. The influence of cultural variables on consumer behavior has also been confirmed by research conducted by scientists. For example, Hofstede's theory of cultural dimensions shows that in many countries, variables such as power distance, uncertainty avoidance, and individualism significantly influence the degree to which consumers are willing to take risks, embrace innovation, and choose brands. This suggests that the same product may be interpreted differently depending on the cultural context in which it is experienced. Therefore, cultural variables are one of the most fundamental determinants of customer behavior, and an in-depth study of these elements allows businesses to better understand the characteristics of the market, build appropriate marketing strategies, and have a greater impact on the audience they are trying to reach. As a result of the individual's functioning within the system of social relations in society, social factors have a significant and multifaceted impact on the formation of consumer behavior. When all these characteristics are considered, the family is considered the most fundamental and long-lasting institution. The consumption behavior of an individual, starting from a young age and continuing for a long time, is influenced by the values, purchasing habits and priorities of family members. For example, the choice of ordinary consumer goods is often influenced by family traditions and routines, and the collective decision of family members plays a significant role in the acquisition of more expensive and long-lasting products. In addition, reference groups, which are social groups to which an individual belongs or aspires to belong, significantly influence consumer behavior. Examples of groupings in this category include friends, colleagues, professional connections, or circles of interest. A person's behavioral standards are shaped by reference groups; individuals develop a need for social acceptance, and as a result, reference groups guide their choices of products and brands. The concept of "status consumption" explains the phenomenon in which individuals often prefer certain brands to achieve social acceptance or represent a certain status. This phenomenon is supported by scientific research.

With regard to the current era, the role of social variables in terms of the digital context becomes even more pronounced. The information acquisition process of consumers has fundamentally been transformed due to social media channels like Instagram, TikTok, and YouTube. Today many individuals tend to be influenced by the views held by influencers and opinion leaders regarding certain products and services. In addition, consumer decision-making involves the views provided by such people. According to numerous statistical analyses, today's consumer is more likely to rely upon reviews and recommendations available in the sphere of social media rather than advertisement. Hence, the impact of social variables on the behavior of the customers takes place both directly and indirectly via the aforementioned sources. It is



crucial for companies to take social variables into consideration when developing their marketing strategy. In contrast to others, personal variables are more concrete and measurable. Such variables are associated with unique characteristics of the individual. Personal variables significantly impact the decision-making process of the consumer. Some factors include age, financial state, occupation, lifestyle, and personality type. All these factors play a role in shaping consumer behavior. As far as modification of consumers' tastes and demands is concerned, the first factor that comes into consideration is age. For instance, consumers aged under 30 years tend to be interested in fashionable products and new items, whereas consumers from middle-aged and elderly groups are likely to give preference to those items that are utility-oriented, durable, and quality-assuring. Life-cycle theory has a direct impact on the consumption pattern of individuals, and that is why there is such a difference between these two types of choice. Another important economic factor influencing the consumption pattern of individuals is their income. Income level of the buyer shapes up their choice options. Viewed from this perspective, Engel's law shows that the proportion of non-food products in the consumption structure increases proportionally to the level of income. A number of other characteristics, including profession and field of employment, also significantly affect consumer behavior. People working in different professions have different needs, which affects the products they choose to buy. For example, people working in offices and doing manual labor have different needs for clothing, food, and technical equipment. The AIO (Activities, Interests, Opinions) model is used in modern marketing to explain the lifestyle of the consumer, which is reflected in his daily activities, interests, and values (Ko et al., p. 97).

It is possible for two people of the same age group and economic class to make very different product choices, even if they lead completely different lifestyles. An individual's personality type is a reflection of their psychological qualities and influences their willingness to take risks, embrace advancements, and the brands they choose to purchase. Individuals who are more risk-averse and innovative are more likely to adopt new products, while more conservative individuals prefer well-known and trusted companies. Therefore, personal characteristics are a reflection of the personalized aspect of customer behavior. An in-depth examination of these elements allows businesses to more accurately segment the market and develop appropriate strategies for the audience they are trying to reach.

Customer decision-making behavior consists of a deep and complex layer of psychological elements. These factors are related to the internal mental processes of the consumer. They explain how an individual structures their desires, perceives information, and justifies their decisions. In the context of this discussion, motivation is considered one of the most important components, and Maslow's hierarchy of needs theory provides a comprehensive explanation for this. According to this theory, the development of consumer behavior occurs in stages and begins with physiological needs such as the need for protection, the need for social belonging, the need for esteem, and the desire for self-actualization. For example, customers who can fulfill their basic needs are more likely to purchase products that symbolize their position and prestige. In the act of selecting, organizing, and interpreting information from the environment, the consumer participates in the process of perception. There is a phenomenon called "selective perception" that describes how different consumers can interpret the same advertising message differently (Qanbarov & Mammadova, 2018, p.76).

Consumers are more likely to readily accept information that is consistent with their preconceived notions and expectations, but tend to ignore information that is inconsistent with them. As a result, perception formation is significantly influenced by both brand image and past experiences. Changes in consumer behavior as a result of experience are called learning processes. According to both classical and operant conditioning theories, customers who have previously purchased a product and had a positive experience are more likely to purchase that product again. Therefore, businesses try to develop long-term loyalty by focusing most of their attention on the enjoyment of their customers. Beliefs and attitudes are expressions that reflect the consistent opinions and emotional approach that a consumer develops regarding a particular brand or product. The likelihood of a consumer making a purchase increases when the brand has a strong and positive image, while the opposite effect occurs when the consumer has an unpleasant

experience. In the context of building and changing these beliefs and attitudes, marketing communications, and advertising in particular, serve as an important tool (Salihova, M. et al., p.650)

Therefore, the psychological elements that are the main driving force of consumer behavior allow for a deep understanding of the decision-making mechanism used by consumers. Taking these factors into account creates the necessary conditions for developing more effective marketing strategies.

3. Factor Assessment Methods

Researchers assess the elements that influence consumer decisions using a variety of methodologies, including both quantitative and qualitative approaches. Such techniques are applied to perform the given assessment. As for the research of consumers' opinions, preferences, and behaviors, one of the most widely applied approaches in this case is associated with conducting surveys and questionnaires. Application of such techniques makes it possible to collect sufficient amounts of data and perform statistical analysis based on which general tendencies can be identified. However, the validity of such information highly depends on proper structuring of questions as well as the representativeness of the sample chosen (Qanbarov & Mammadova, 2018). In accordance with the findings of Nielsen, about seventy percent of all customers make purchases based on the opinions posted in online reviews, thus proving that surveys can provide reliable information about the market in general. However, the validity of such information highly depends on proper structuring of questions as well as the representativeness of the sample chosen (Qanbarov & Mammadova 2018, p.57). Well-structured surveys can help you understand what causes consumers' behavior; yet, incorrectly structured ones can mislead you.

For example, Coca-Cola Corporation conducts large-scale surveys in various areas when introducing a new product. These surveys assess consumer attitudes towards taste, packaging, and pricing, and then the company develops a product strategy based on the information obtained from these surveys. This is why choosing the appropriate methodological approach in the research process is extremely important. On the other hand, focus groups, a more qualitative research tool, allow us to explore the intricacies of customer behavior more than ever before. Within this methodology, a subgroup of participants engages in a conversation about a specific topic and assesses their thoughts, feelings, and perspectives on that issue (Nelson, 1970, p.82).

Evaluating new product concepts and analyzing consumer reactions are two areas where this approach is particularly useful. For example, focus groups are widely used by Apple Corporation to evaluate the design and usability of new technology products. Focus groups have the advantage of revealing consumers' core motivations, values, and behavioral reasons more clearly and concisely. Group discussions create an environment that allows participants to interact with each other and develop new ideas and responses that are more original. It is generally believed that this method is best used in conjunction with other quantitative methods, such as surveys or experiments, to gain a more complete understanding of consumer behavior. This is due to the limited generalizability of the results of this method. Furthermore, the observational approach allows us to observe customer behavior in real-life situations and helps us identify discrepancies between consumers' actual behavior and their expressed opinions. This strategy is particularly widespread in the retail context. For example, IKEA stores optimize store design by tracking customers' movement patterns while they are inside the store, as well as their reactions to the items they purchase. Using experimental approaches, we are able to examine the impact of certain elements on consumer behavior in a cause-and-effect context. For example, researchers will change one or more factors and then examine the effects of these manipulations on consumer responses. For example, the impact of price adjustments on sales can be tracked using A/B testing, which is widely used, especially in e-commerce.

Digital analytics, big data, and artificial intelligence-based tools have made it possible to analyze consumer behavior more accurately and quickly in the current era. Companies like Amazon and Netflix are developing personalized recommendation systems by studying user behavior, which has led to a huge



increase in sales and usage. Studies show that personalized recommendations can increase sales by twenty to thirty percent. Through the application of these approaches, organizations can ensure that they make better decisions and react to market changes faster. The outcome is higher levels of customer satisfaction and customer retention.

4. Conclusion

Consumer behavior analysis is not a matter of mere data collection but rather a strategic tool that enables organizations to understand their customers better and make appropriate changes in business processes. Thanks to the use of advanced tools of data gathering and analysis, the organization gets the opportunity to switch from a reactive strategy to a proactive one, being able to offer solutions to consumers before an open request has been made. Consumer behavior changes due to the impact of various factors, including technological, economic, and sociological. Thus, the analysis of consumer behavior needs to be a continuous process. Customer communication is essential for building a successful business. Thanks to the use of modern tools of IP telephony and customer behavior analysis, you will be able to develop effective communication strategies with your customers.

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WESTERN CASPIAN UNIVERSITY

The Research Journal of Business in Emerging Economics: Volume 2, Number 1

April 2026, 60 p

Editorial Office Address: 17A, Ahmad Rajabli Street, III Parallel, Baku, Azerbaijan

E-mail: www.businessjournal@wcu.edu.az

<https://businessjournal.wcu.edu.az/>

Tel: +994 12 565 39 77

The editorial office is not responsible for the authors's position.

When using materials, reference to the journal is required.

Submitted for collection: 28.04.2026

Print signed: 05.05.2026

Paper format: 60x84 1/16 17.75 cm s.w