DOI: 10.63550/ICEIP.2025.97.57.114

Peculiarities of Tyre Production and its Impact on the Regional Economy

A.V. Gumerov[1], A.V. Zaripova[2], F.K. Akhmedzyanova[3] , A.Sh. Galieva[4]

[1]Candidate of Technical Sciences, Kazan National Research Technical University named after A.N.Tupolev-KAI, 10, K. Marx Str., 420111, Kazan, Russia, Professor of the Department of Economics and Management at the Enterprise

[2]PhD in economics, Kazan State University of Architecture and Engineering, 1, Zelenaya str., 420043, Kazan, Russia, Associate Professor of the Department of Urban Planning and Planning of Rural Settlement, Kazan, Russian Federation

[3]Candidate of Pedagogical Sciences, Associate Professor of the Department of Management and Humanities, Bugulma Branch of Kazan National Research Technological University 423243, Russia, Republic of Tatarstan, Bugulma, st. Krasnoarmeyskaya, 9

[3]Undergraduate student Zhejiang Normal University, School of economics and management, Address 688 Yingbin Avenue Postal code / Zip code 321004, Jinhua, China

gumerov_anvar@mail.ru, zaripovaan@yandex.ru, kamilovna@yandex.ru, mvflei@yandex.ru

Keywords: tyre industry, raw materials, production, problems, sanctions, region.

Abstract: Despite all the challenges of recent years, the production of automotive tires is well-developed in Russia, which is explained by both the availability of the necessary production and raw material base and the vast consumer market. The production of automotive tires in Russia continues to grow, which is naturally linked to the successes of the automotive industry in the country and the opportunities to export manufactured products to other countries. However, any problems arising in the automotive sector immediately have a negative impact on the tire industry as well. This can be considered the most important characteristic of the industry.

[1] https://orcid.org/0000-0002-6635-8588
[2] https://orcid.org/0009-0008-2784-9748
[3] https://orcid.org/0009-0000-6907-5885
[4] https://orcid.org/0009-0003-0519-5636

DOI: 10.63550/ICEIP.2025.97.57.114

1 INTRODUCTION

The tire industry belongs to the manufacturing sector, where raw materials for the production of finished goods play a crucial role. In this context, tire enterprises are closely interconnected with and dependent on the chemical and petrochemical industries. In essence, the tire industry acts as a "bridge" between the chemical sector and automotive manufacturing. Accordingly, ensuring the supply of high-quality raw materials to the tire sector is also of great importance to car manufacturers, which constitutes another significant feature of this industry.

The primary raw materials for tire production can be divided into three categories:

- rubber;
- carbon black;
- vulcanization agents.

Rubber is the foremost material required for tire production, forming the base for rubber compounds. It belongs to the polymer group and is characterized by water resistance and elasticity. Rubber may be natural or synthetic. The quality characteristics of the rubber used directly affect the quality of the final product.

Natural rubber is derived from the latex of rubber-producing plants, primarily the evergreen tree Hevea brasiliensis. This plant grows in tropical climates. The largest plantations are located in Southeast Asia and South America. Other annual rubber-yielding plants also grow in warm-climate regions. Since rubber plants do not grow in Russia, natural rubber must be imported, which affects the production cost of rubber compounds.

As a result, synthetic rubber is most commonly used by Russian tire manufacturers. It is produced from hydrocarbon feedstock through deep oil refining at petrochemical complexes. One of the largest producers in Russia, including the Republic of Tatarstan, is the company SIBUR. In addition to domestic production, synthetic rubber was previously imported. However, due to anti-Russian sanctions, importing rubber has become problematic, leading to increased demand for Russian-made synthetic rubber and an expansion of its product range.

The growth of tire production that began in 2023, along with higher quality requirements for final products, has increased the demand for various grades of synthetic rubber. For instance, SIBUR began substituting seven previously imported European synthetic rubber grades during that year. The company is currently continuing research and technological efforts to homologate new synthetic rubber types for upcoming tire models. Moreover, SIBUR, in collaboration with tire manufacturers, has launched R&D initiatives focused on replacing natural rubber in various tire categories with domestic alternatives.

The state has introduced several programs to support deep processing within the country. Among the state support measures targeting synthetic rubber producers and, consequently, the tire industry, are the following:

- the introduction of a reverse excise tax as of January 1, 2024, for synthetic rubber producers who sign agreements with the Ministry of Energy;
- the inclusion of 40 raw material components used in tire production in the updated import substitution plan.

Carbon black is used to improve the performance characteristics of tires. However, in recent years, global tire producers have increasingly replaced carbon black with silica, a more environmentally friendly alternative. Nonetheless, domestic tire enterprises continue to rely heavily on carbon black.

Vulcanization agents include various substances (metal oxides, hydrocarbons, resins, etc.) that are used in the vulcanization process— a chemical transformation that converts both natural and synthetic rubber into a durable rubber mass.

The Ministry of Industry and Trade noted during a meeting on February 27, 2023: “The Russian tire industry is provided with all major components. The demand for synthetic rubber is being met by domestic companies, while natural rubber is supplied by friendly countries. The production of other components for tire manufacturing is currently being developed by petrochemical enterprises.”

In the updated import substitution program, the Department of the Chemical Industry of the Ministry of Industry and Trade of the Russian Federation has included 40 raw material components used in tire manufacturing. This work is being conducted under the Federal Project “Development of New Materials” and a large-scale project on import substitution of critical chemical products. In 2023, government support for R&D in this area amounted to 390 million rubles, which was allocated to five projects for developing raw material components. In addition, tire producers received over 1 billion rubles in subsidies for the transportation of exported products.

DOI: 10.63550/ICEIP.2025.97.57.114

2 TECHNOLOGICAL FEATURES OF TIRE MANUFACTURING

Tire production is characterized by a complex and multi-stage technological process involving several sequential phases:

Stage 1 – Preparation of Tire Components:

This initial phase includes the production of rubber strips, carcasses, breakers, and sidewall components, as well as the tire assembly process itself.

When producing rubber strips, the proportion of rubber and chemical ingredients is defined by a formulation chart. Up to 30 different chemical components may be involved, depending on the intended purpose of the rubber compounds. The manufacturing process may span from one to four stages based on the required compound characteristics.

Given that significant shear deformations occur between the carcass, breaker, and tread layers during tire operation, achieving high bonding strength between the cord and the rubber is essential. This is accomplished through calendering—a process in which a hot rubber compound is applied to one or both sides of a textile or steel cord on a calendering line.

During tire assembly, a special assembly drum is used to layer the individual components of the tire. All parts are merged into a unified structure using dedicated machinery and automated assembly drums.

Stage 2 – Vulcanization:

This phase imparts the operational characteristics required of the final product. The quality and durability of the tire depend heavily on the efficiency of vulcanization. During this process, the plastic rubber compound transforms into elastic rubber through a high-temperature, high-pressure chemical reaction between rubber and sulfur. The process is conducted in specialized vulcanizing equipment, where compressed steam mixed with catalysts and vulcanizing agents is injected into the tire blank.

Stage 3 – Tread Pattern Formation:

The final stage involves pressing the tread pattern using molding presses. This is the concluding step in the production of automobile tires.

3 KEY INDUSTRY CHALLENGES

One of the most critical challenges affecting the competitiveness of the Russian tire industry is its significant dependence on foreign equipment manufacturers. Prior to the imposition of anti-Russian sanctions, all technological lines and production equipment were imported from countries like Italy and Sweden. For example, in early 2019, KAMA TYRES, part of Tatneft, commissioned new Swedish equipment at its Nizhnekamskshina plant for manufacturing passenger and light truck tires. This included two state-of-the-art MAXX assembly complexes and the APEXER automatic filler cord application line. Additionally, 10 FAS 300 automatic studding machines from the Swedish firm Klöfver AB were procured for winter tire production. Due to current sanctions, sourcing spare parts for repairs has become a major issue.

The overall tire sector, much like many other industries, is experiencing technological lag. Implementing import substitution programs to develop domestic production of advanced tire manufacturing equipment in Russia will take time. Consequently, enterprises have been forced to procure equipment from Asian countries and China, often of suboptimal quality, while simultaneously seeking repair options through parallel imports—factors that contribute to rising costs.

Another pressing challenge is the increase in the cost of raw materials and energy resources. Additionally, credit costs have risen sharply. To combat inflation, the Central Bank of Russia has been raising the key interest rate, which directly increases lending costs, lowers consumer demand, and slows down economic growth. For instance, the key interest rate stood at 7.5% as of October 5, 2022, but had escalated to 21% by November 26, 2024.

4 IMPACT OF SANCTIONS AND INDUSTRY PROSPECTS

Sanctions have also adversely affected tire exports, leading to a reduction in international shipments. Nevertheless, as shown in Figure 1.1 of Section 1, a recovery trend has emerged. The anticipated relaunch of production at plants formerly owned by foreign companies is expected to significantly boost output. In this context, improving product quality and competitiveness becomes imperative. Expanding partnerships, capturing new markets, and developing export channels will be critical to the sector's long-term success.

The tire industry has a tangible impact on regional economic well-being. The Republic of Tatarstan is home to two major tire manufacturers

DOI: 10.63550/ICEIP.2025.97.57.114

that produce a comprehensive range of tires—from passenger and freight vehicle tires to specialized types for bicycles, ATVs, and even military-grade applications. This sector serves as a crucial link in the production chain: from crude oil extraction and polymer/rubber production to the final manufacturing of vehicles. Importantly, all elements of this chain are present within the region.

From a macroeconomic standpoint, the Republic of Tatarstan ranks among the top-performing regions in Russia. It accounts for 7.2% of national oil production, 41.9% of synthetic rubber output, 60.6% of truck tires, 26.5% of passenger car tires, and 36.3% of commercial trucks. As shown in Table 1, the Gross Regional Product (GRP) continues to demonstrate a stable upward trend, reflecting the successful performance of enterprises within the region.

Table 1: Dynamics of the Gross Regional Product (GRP) in the Republic of Tatarstan.

Indicator	YEARS		
	2020	2021	2022
GRP at basic prices, million RUB:	2631286,8	3533272,5	4179258,6
including per capita, RUB	658311,7	883564,0	1044591,6
GRP physical volume index, % to the previous year	96,9	103,2	105,4

Source: Statistical Handbook of the Republic of Tatarstan

The republic is also demonstrating rapid growth in the volume of shipped own-produced goods, including those from the manufacturing sector. As shown in Table 2, both the relative share and absolute volume of rubber and plastic product manufacturing are steadily increasing.

Table 2: Volume of shipped goods of own production in the Republic of Tatarstan.

Indicator	YEARS			
	2020	2021	2022	2023
Total, million RUB	2780617,2	4109533,3	4531701,6	4742277,6
including manufacturing, million RUB	2007071,1	2871027,7	3250731,6	3375209,1
Of which, production of rubber and plastic products, %	4,9	4,5	4,7	4,9
Of which, production of rubber and plastic products, million RUB	98346,5	129196,2	152784,4	165385,2

Source: Statistical Handbook of the Republic of Tatarstan for 2023.

Industry holds the largest share in the economic structure of Tatarstan—47.1%—of which 19.6% is attributed to mineral extraction and 25.2% to manufacturing. The tire industry contributes to this distribution, influencing the region's economic development both positively and negatively. These key areas of influence, compiled by the author, are illustrated in Figure 1.

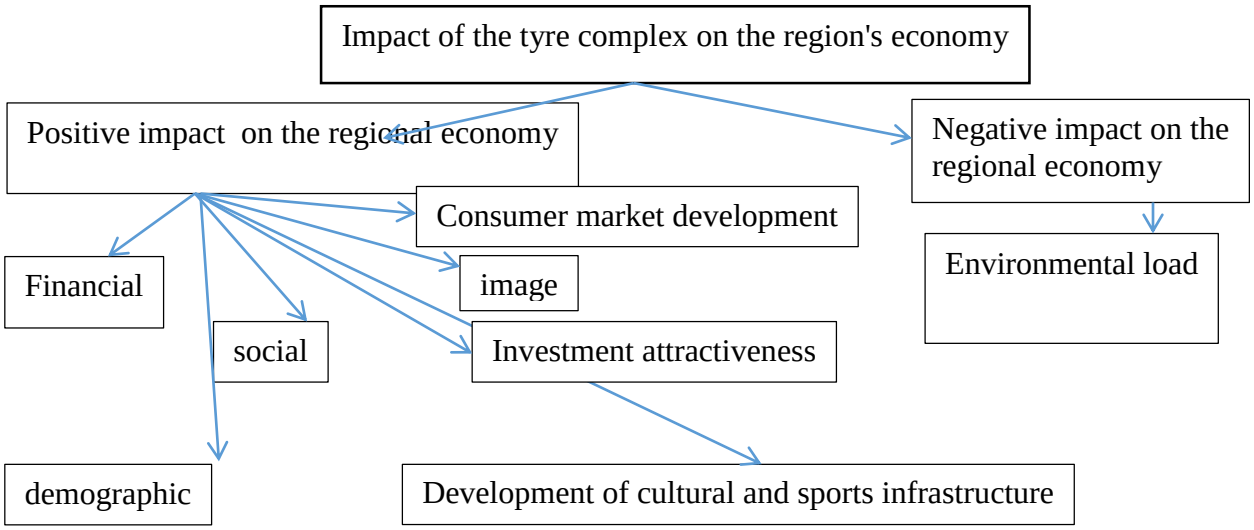

Figure 1: Impact of the tyre industry on the economy of the Republic of Tatarstan.

DOI: 10.63550/ICEIP.2025.97.57.114

The development of industry—specifically, the tire sector—has a positive impact on the regional economy. All components of this impact, whether beneficial or adverse, are interrelated and mutually dependent. Let us briefly outline the nature of these influences as depicted in Figure 1.

3.1 Financial Impact

The region benefits from tax revenues paid by tire enterprises, which form the financial foundation for the regional and national economy. These taxes ensure the functioning of essential public services such as healthcare and education, and enable the implementation of socio-economic development programs.

Tire enterprises located in Tatarstan contribute through federal, regional, and municipal taxes. Federal taxes are established by the central government, while regional taxes are governed by regional authorities and may vary across the country. The region receives 17% of corporate income tax and 100% of personal income tax (PIT), of which 85% is allocated to the republican budget and 15% to the local budget. PIT collected at elevated rates is directed to the federal budget to fund medical treatment for children with rare and severe diseases. Regional taxes include property and vehicle taxes, while municipal budgets are supported by land tax.

Additionally, the Republic of Tatarstan receives income tax revenues from tire enterprises located outside its borders, such as PAO "Tatneft", which contributes 17% of its profit to the region.

3.2 Social Impact

Tire enterprises and related industries provide employment and wages to the local population, along with a range of social benefits: paid sick leaves and vacations, access to health resorts, assistance for young and large families, and support for retired workers. Furthermore, tire plants host cultural and sports events that enhance the physical and social well-being of employees and strengthen corporate unity.

Thanks to the effective performance of businesses, including those in the tire sector—as clearly shown in Figure 2—unemployment in the region is declining, and average wages are increasing.

Source: Statistical Reference Book of the Republic of Tatarstan, 2020–2024, Ministry of Labor, Employment, and Social Protection of the Republic of Tatarstan; as of the end of the year

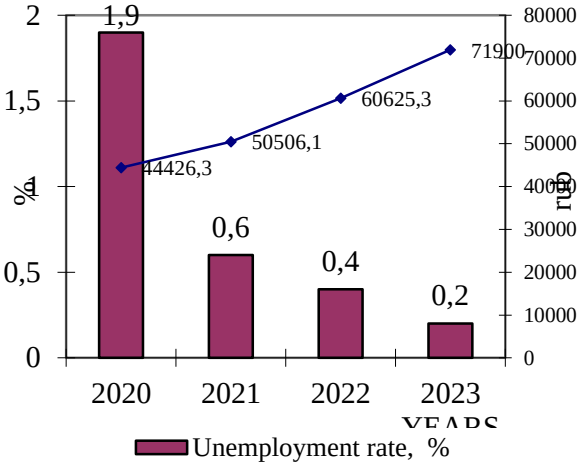

Figure 2**:** Dynamics of Unemployment Rate and Average Wage of Employees in the Manufacturing Sector of the Republic of Tatarstan.

According to these indicators, Tatarstan ranks first among the regions of the Volga Federal District, which in turn is reflected in the low poverty rate. The republic demonstrates a relatively low poverty level—184.8 thousand people or 4.6%—placing it among the leading regions in the Volga Federal District.

3.3 Demographics

In recent years, both the Republic of Tatarstan and Russia as a whole have faced a worsening demographic situation, specifically a decline in birth rates and an increase in mortality, resulting in natural population decline. By the end of 2024, the natural decrease amounted to 6.3 thousand people (36.5 thousand births vs. 42.8 thousand deaths). A labor shortage began to emerge, further exacerbated by the start of the Special Military Operation (SMO).

The only short-term solution to this problem lies in migration. Thus, in 2023, the population of Tatarstan increased by 1.4 thousand people, reaching 4.003 million residents. This growth was achieved solely through the inflow of people from other regions and countries, reflecting Tatarstan's attractiveness for relocation, life, and work. Over the last decade, the population of the republic has increased by almost 6% due to migration flows.

In the long term, the Cabinet of Ministers of the Republic of Tatarstan has developed a birth rate enhancement program for 2023–2025 as part of the demographic policy concept of the Russian

DOI: 10.63550/ICEIP.2025.97.57.114

Federation through 2025, issued under a presidential decree.

Enterprises in the tire industry of the republic include various social initiatives in their collective agreements aimed at supporting families with children, retaining young workers, offering educational programs, increasing labor incentives, and providing various forms of financial assistance to attract and retain workforce. Therefore, the tire sector of the region makes a meaningful contribution to addressing demographic challenges.

3.4 Development of Cultural and Sports Infrastructure

Tire enterprises in the region invest in the development of social infrastructure as a means of caring for their employees and enhancing labor productivity. This includes the construction of sports complexes, children's wellness camps, recreation centers, and health resorts throughout the republic, which are accessible not only to industry workers but also to the general population. Additionally, employees of tire enterprises actively participate in all regional sports and cultural events, contributing both financially and through volunteer efforts.

3.5 Consumer Market Development

The presence of tire enterprises in the region also positively affects retail turnover, as the substantial income of employees stimulates higher sales of food and non-food products across the republic. As shown in Figure 3, retail trade turnover in the region is growing, with tire industry employees contributing to this trend.

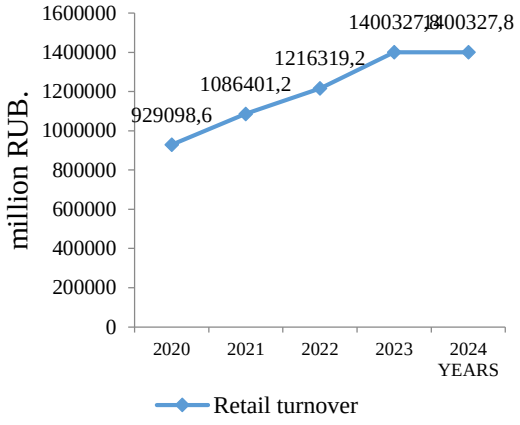

Figure 3: Retail Trade Turnover Dynamics in the Republic of Tatarstan .

3.6 Investment Attractiveness

The successful development of the tire industry significantly enhances the investment appeal of the region. The Government of the Republic of Tatarstan pays close attention to promoting the investment potential of the region by creating favorable business conditions. In 2023, 45.7% of all investment resources were directed toward the development of the manufacturing sector, nearly half of which were allocated for the repair and installation of machinery and equipment. Of the total investment volume, 28.6% were borrowed funds, and 71.4% came from the enterprises' own resources.

The dynamics of capital investment volumes are presented in Table 3.

Table 3: Dynamics of Capital Investment in the Republic of Tatarstan.

Indicator	2020	2021	2022	2023
Total, million RUB.	615593,4	689232,4	888648,8	1180447,9
Per capita, RUB	154013,0	172356,0	222115,0	294940,9
Physical investment index (YoY, %)	92,6	106,4	110,5	122,0
Internal funds, %	59,2	56,2	56,1	67,0
External funds, %	40,8	43,8	43,9	33,0

Source: Statistical Digest of the Republic of Tatarstan.

Each year, the Autonomous Non-Profit Organization "Agency for Strategic Initiatives to Promote New Projects" evaluates the regions of the Russian Federation within the framework of the National Investment Climate Ranking. According to this assessment, Tatarstan consistently ranks among the top three regions. In 2022, the region scored 286.48 points; in 2023, this figure increased by 15.97 points to reach 302.45 points—placing it second among all Russian regions.

3.7 Growth of the Region's Image

The presence and successful development of the tire industry in the region has undoubtedly had a positive impact on its public image. By purchasing high-quality and reasonably priced tires, consumers from across Russia and abroad become acquainted with the Republic of Tatarstan. As a result of industrial development, including the activities of tire

DOI: 10.63550/ICEIP.2025.97.57.114

enterprises, Tatarstan has secured leading positions in key macroeconomic indicators, as shown in Table 4.

Table 4: Ranking of the Republic of Tatarstan by Socio-Economic Development Indicators.

Indicator	Rank in Russia	Rank in Volga FD
GRP volume	6	1
Industrial output	5	1
Fixed capital investment	5	1
Average monthly wage (nominal)	29	1
Registered unemployment rate	1	1

Source: Socio-Economic Development Report of the Republic of Tatarstan.

3.8 Environmental Impact

One negative aspect of industrial enterprises, including tire factories, is their environmental footprint—specifically the emission of harmful substances that contaminate soil, air, and water, as well as the generation of production and consumption waste. The dynamics of this waste are shown in Figure 4.

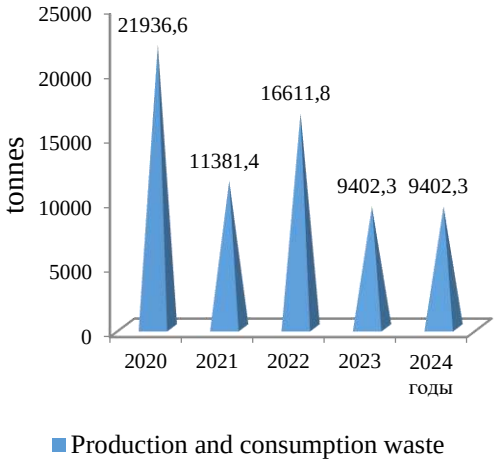

Figure 4: Dynamics of Production and Consumption Waste at PJSC “Nizhnekamskshina”. Source: Annual Report of PJSC “Nizhnekamskshina”.

As depicted in Figure 4, the volume of production and consumption waste has declined in recent years. This trend is the result of consistent efforts to minimize the environmental impact through collection, resale, neutralization, and recycling of waste in the tire manufacturing process.

Since 2006, tire enterprises in the republic have implemented an Environmental Management System (EMS) that complies with the international ISO 14001:2015 standard (GOST R ISO 14001:2016). This system is aimed at environmental protection. SWOT analysis was conducted at tire plants to assess the operating environment, identifying internal factors (strengths and weaknesses) and external ones (opportunities and threats). The outcome of this research led to the formulation of strategic directions for ecological initiatives. The creation and implementation of EMS in the tire industry enables enterprises to address environmental issues effectively and contributes to the overall improvement of the region's environmental quality, thereby reducing their negative impact.

3.8 Recycling Used Tires

Used tires also pose a threat to the environment after their life cycle ends. To address this problem, in 2024, PJSC “Tatneft” launched an environmental project within the framework of circular economy principles. It organized the collection of used tires in 17 cities across Russia (Volgograd, Voronezh, Yekaterinburg, Zernograd, Kemerovo, Krasnoyarsk, Leninogorsk, Nizhnekamsk, Nizhny Novgorod, Novosibirsk, Omsk, Orekhovo-Zuyevo, Perm, Podolsk, Samara, Saint Petersburg, and Chelyabinsk) for subsequent recycling. Recycling operations have already begun in Zernograd, Leninogorsk, and Kemerovo, with equipment being installed at ten more locations.

The recycling process proceeds as follows: the used rubber is cut into large fragments, then into smaller “rubber chips,” and finally ground into crumb rubber. This crumb is fed into a pyrolysis unit, where pyrolysis condensate is extracted. The condensate is processed at the “TANECO” refinery (Nizhnekamsk), where a series of fractional distillations produces isobutane. The isobutane is then converted into raw material for isoprene rubber at the “Togliattikauchuk” plant, which is used to manufacture new cycle-ready tires.

This recycling technology allows for the large-scale processing of used tires, significantly reduces the carbon footprint, and helps eliminate illegal tire dumps. The zero-waste process ensures high environmental safety standards.

DOI: 10.63550/ICEIP.2025.97.57.114

4 CONCLUSION

Thus, the tire industry has both unique features and challenges in its production activities, linked to both internal and external environments. External challenges relate to the industry's position within adjacent sectors, while internal issues concern raw material availability, the complexity of technological processes, dependence on imported equipment, and technological lag. Nonetheless, the successes and challenges of the tire industry directly influence the overall well-being of the region.

REFERENCES

Gabdullina, G., Vyachina, I., Akhmetgareeva, A**.,** 2023. *Problems of Implementation of Modernization Processes in the* Petrochemical Industry at the Present Stage**.** Lecture Notes in Networks and Systems, Springer Nature.. 2516-2522

Gabdullina, G., Akhmetgareeva, A., Vyachina, I, Repina, J., Khusainova, S., Jano Jomaa, 2023. The need to improve the method for assessing the competitiveness of enterprises of the oil refining complex. Lecture Notes in Networks and Systems, Springer Nature. 2499-2507

Gumerov, A. V., Ladykova, T. I., Minsabirova,V. N., 2016. The analysis of regional development on the basis of corporate structures' activity. *International Review of Management and Marketing*. Vol. 6, No. 1. P. 101-105.

Kratkij statisticheskij sbornik RT. Federal'naya sluzhba statistiki. - URL: https://16.rosstat.ru

Ministr promyshlennosti i torgovli provel soveshchanie po razvitiyu proizvodstva shin. Tekst elektronnyj. - URL: https://www.4tochki.ru/news/novosti-rynka-shin-i-avtokomponentov/2024/fevral/27/

Minpromtorg Rossii: oficial'nyj sajt. URL: https://minpromtorg.gov.ru/?http://minpromtorg.gov.ru (data obrashcheniya: 11.11.2024)

Ministerstvo promyshlennosti i torgovli RT: oficial'nyj sajt. URL: www.mpt.tatarstan.ru (data obrashcheniya: 26.11.2024)

Minpromtorg otmetil, chto proizvoditeli shin adaptirovalis' k novym realiyam.- URL: https://www.Interfax.ru/ 27.02.2024.

Na «Nizhnekamskshine» ustanovleno novoe shvedskoe oborudovanie dlya oshipovki zimnih shin - novosti mira shin - internet-magazin 4tochki. Tekst elektronnyj. - URL: https://www.4tochki.ru/news/novosti-rynka-shin-i-avtokomponentov/2019/dekabr/06/

Novosti kompanii «Tatneft». - URL: https://www.ikontyres.ru/o-kompanii/publikatsii/press-relizy/2024/generalRelease/rukovoditel-biznes-napravleniya-shinnyy-biznes-tatneft-obyavil-o-seriynom-zapuske-proizvodstva/

Osnovnye pokazateli social'no-ekonomicheskogo razvitiya Respubliki Tatarstan v 2023 godu. Tekst elektronnyj. - URL: https://mert.tatarstan.ru/

Soobshchestvo professionalov «Nalog-nalog.ru» Federal'nye, regional'nye i mestnye nalogi. - URL: https://nalog-nalog.ru/nalogovaya_sistema_rf/federal_nye_regional_nye_i_mestnye_nalogi-23/.

«Tatneft'» stala vladel'cem shinnogo zavoda pod Peterburgom: Tekst elektronnyj. - URL: https://www.rbc.ru/spb_sz/26/03/2023/642072f09a7947164d69dd16.

«Tatneft'» realizuet proekt po vtorichnomu ispol'zovaniyu shin. Press centr 08.02.2024. Tekst elektronnyj. - URL: https://www.tatneft.ru/news/5169

Soobshchestvo professionalov «Nalog-nalog.ru» Federal'nye, regional'nye i mestnye nalogi. - URL: https://nalog-nalog.ru/nalogovaya_sistema_rf/federal_nye_regional_nye_i_mestnye_nalogi-23/.