DOI: 10.15838/esc.2025.3.99.7
UDC 332.13, LBC 65.04

Economic Transformation of Coal Mining Single-Industry Towns in China and Russia: The Experience of Pingxiang and Vorkuta

Marina A. LEBEDEVA
Vologda Research Center, Russian Academy of Sciences
Vologda, Russian Federation
e-mail: lebedevamarina1@mail.ru
ORCID: 0000-0002-7310-6143; ResearcherID: R-8097-2018

ZHANG Dan
Jiangxi Academy of Social Sciences
Nanchang, China

Abstract. The problem of spatial development does not lose its relevance for large countries such as Russia and China. Single-industry towns deserve special attention. Making up a significant part of the country's economy, they are subject to numerous risks, many of which have already been realized. In particular, the risks manifested themselves in those cities where the economy is focused on coal mining, the availability of which began significantly reducing. The aim of the work is to propose scientifically substantiated promising directions of transformation of the economy of single-industry towns specializing in coal mining. We chose Pingxiang in Jiangxi Province of China and Vorkuta in the Komi Republic of Russia as examples. The choice of the cities is conditioned by the fact that coal mining will cease in them in the next 15 years. The article retrospectively analyzes their development and investigates their current state. As a result of the work, we proposed directions for the transformation of the economy of the cities

For citation: Lebedeva M.A., Zhang Dan (2025). Economic transformation of coal mining single-industry towns in China and Russia: The experience of Pingxiang and Vorkuta. *Economic and Social Change: Facts, Trends, Forecasts*, 18(3), 136–152. DOI: 10.15838/esc.2025.3.99.7

under consideration: for Pingxiang, the preservation of industrialization trends, the development of cross-border interregional cooperation between Hunan and Jiangxi provinces in terms of creating logistical infrastructure, strengthening the development of agriculture and creating green infrastructure, ensuring the development of culture and tourism, and modernizing consumption; For Vorkuta, it is the development of the following economic activities: synthesis of artificial diamonds, production of new types of products from coal, extraction of useful elements from overburden dumps, as well as the development of the R&D sector, creative industries and tourism. Scientific novelty of the work consists in substantiating strategic priorities of the development of single-industry towns based on the existing prerequisites and competitive advantages of the territory.

Key words: economic transformation, single-industry towns, coal, coal mining, Pingxiang, Vorkuta.

Acknowledgment

The article has been prepared in accordance with state task FMGZ-2025-0013 "Factors and tools for ensuring balanced spatial development of Russian regions in the face of increasing challenges".

Introduction

Sustainable Development Goal 11 is "Resilient Cities and Communities" according to the document "Transforming our World: The 2030 Agenda for Sustainable Development". Some of the most problematic in terms of sustainability are single-industry towns. Although they have been a significant part of the national economy for many decades (about 40% of Russia's GRP), due to the undiversified nature of their economy, many risks arise in relation to such cities (Uskova et al., 2012; Zubarevich, 2010; Kozhevnikov, 2019). Their different types are considered in the works of leading scientists in the field of spatial economics and urbanism. For instance, works of N.V. Zubarevich, N.Y. Zamyatina[1], E.M. Buchwald, E.V. Manaeva (Zubarevich, 2010; Manaeva, 2018; Buchwald, Kol'chugina, 2019) study the economic problems of single-industry towns. The works of T.S. Lytkina, I.A. Sekushina disclose social risks of single-industry towns development (Lytkina, 2014; Sekushina, 2024).

A separate layer of works is devoted to various models of economic transformation of socio-economic systems with specialization in industries of low technological modes, which are characteristic of single-industry towns. The analysis of works by both Russian and foreign researchers has shown that most of them identify three models: a) development based on traditional industries (neo-industrialization), b) development based on alternative new industries and types of economic activity, c) hybrid, combining the first two (Tatarkin, Romanova, 2013; Shirokova, 2015; Kaigorodtsev, 2022; Aleshina, 2024; Gallas, 2025; Gulzar et al., 2025).

Neo-industrialization can be carried out in two directions: first, improvement of current production through modernization based on the introduction of various technologies (e.g., digital technologies, artificial intelligence, etc.) to reduce losses, enhance energy and resource saving, and increase labor productivity; second, the creation of production interfacing with traditional production to lengthen value chains by increasing the number of redistribution. In the process of neo-industrialization, the main dominant structures

[1] Zamyatina N.Yu. Salekhard and Vorkuta: On opposite sides. Go Arctic. Available at: https://goarctic.ru/news/salekhard-i-vorkuta-po-raznye-storony (accessed: 22.02.2025).

are large corporations that concentrate significant amounts of capital and production (Tatarkin, Romanova, 2013; Shirokova, 2015). This model requires significant costs, so the main tools for its stimulation are various kinds of state programs to support investment in industry, to provide subsidies and loans for development, and in some cases nationalization of enterprises. A significant advantage of neo-industrialization is the preservation and increase of productive capacity (Kaigorodtsev, 2022; Aleshina, 2024).

The model of formation of fundamentally new industries is usually used when it is necessary to change the structure of the economy, if neo-industrialization has not led to the desired results. In this case, key industrial production facilities are either closed or operate with rather low results, but at the same time other types of activities, often not related to industry, are developed. This model is less costly, and the main instruments of transition to it are grants for the creation of non-industrial business. Small business becomes the key subject. This model has worked well in some cities of Western Europe (Manchester, Bilbao, etc.) and negatively in the territories of developing countries (Gallas, 2025; Gulzar et al., 2025).

The problems concerning economic transformation are most typical for single-industry towns specializing in coal mining (e.g., Hanna, Bankhead, Aniox (Canada); Centralia (USA); Ordos and Pingxiang (China); Gukovo, Raichikhinsk, Inta, Vorkuta (Russia)), as a result of decreasing demand for coal in the world, including the desire to comply with the "green agenda" by switching to more environmentally friendly fuels and increasing the share of low-carbon energy sources in the energy balance of the territory (Kravchenko, 2022; Zhang et al. , 2023; Rudneva, 2024), abandoning coal combustion as the main source of carbon dioxide emissions into the atmosphere (Adekoya et al., 2023; Biddau et al., 2024). The development of other energy sources has led to a decrease in the economic efficiency of coal mining, which in turn has been followed by mine closures, displacement of labor force, which has caused a number of social and infrastructural problems (Knotter, 2015). The crisis affected the entire socio-economic system of the town because coal industry enterprises in such towns were town-forming enterprises. The social effects of mine closure were manifested in the high unemployment rate, reduction of social sphere, reduced access to social infrastructure, and growing social tension. Coal mining was carried out on a large scale, therefore, despite the huge reserves explored in due time, their quantity began to decrease and, in some cases, to be depleted, which further aggravates the already crisis situation in single-industry towns. Consequently, promising directions of transformation of their economy are needed.

The aim of this paper is to propose scientifically substantiated promising directions of transformation of the economy of single-industry towns specializing in coal mining.

To achieve the goal, we solve the following tasks: retrospective analysis of the development of single-industry towns specializing in coal mining (case study of Pingxiang and Vorkuta); analysis of the current management of the development of such towns; taking into account the availability and location of productive forces, promising directions for the development of single-industry towns to diversify their economy are proposed.

Materials and methods

The objects of the study are the single-industry towns of Pingxiang (China) and Vorkuta (Russia); the subject is their socio-economic development taking into account economic specialization in coal mining. The choice of these towns is conditioned by the problems characteristic for them, which are expressed in the decline in the level of socio-economic development caused by the curtailment of coal mining: the depletion of coal reserves in Pingxiang has been observed since 2007, coal mining in Vorkuta will cease due to its unprofitability from 2037.

We analyzed the economy's transformation of these towns in two stages:

1) highlighting the historical patterns of socio-economic development of the single-industry towns under consideration from the first half of the 20th century to 2023;

2) analyzing the economic development of towns at the current development stage on the basis of indicators available in statistics.

The work used general scientific research methods such as analysis, induction, deduction, synthesis, graphic and tabular visualization methods, as well as cartographic methods.

The information base was the data of the United Nations, the Federal State Statistics Service of Russia and its territorial department in the Komi Republic, the non-commercial web-mapping project Open Street Map, the National Bureau of Statistics of China, the Bureau of Statistics of Jiangxi Province of China.

Retrospective analysis of socio-economic development of the single-industry towns of Pingxiang and Vorkuta

Pingxiang is a town formed more than 1,700 years ago, with an area of 3,831 km^2 and a permanent population of about 2 million people; it is the westernmost town in Jiangxi Province and is located near the border of Jiangxi and Hunan provinces. In the past, with its large coal reserves, Pingxiang was one of the typical resource-oriented towns in China specializing in coal mining. There are three stages in its development: 1) coal-dependent industrial development (1900–1958); 2) culmination of resource exploitation (1958–2007); 3) forced transformation of the economy due to depletion of coal reserves (2007 – present time).

Coal-dependent industrial development (1900–1958). This stage began with the construction of the largest Anyuan coal mine, and with it the first Zhuzhou–Pingxiang railway. Later, in 1908, the joint-stock company Hanyeping Coal and Iron Works and Minus Co., Ltd. was founded in the town, which adopted Western methods of machine production, transportation, washing and coking of coal. After that, 1.1 million tons of coal were mined annually in Pingxiang, and more than 17,000 miners worked in its mines.

After the formation of the PRC during the first five-year plan (1953–1957), the state combined large and medium-sized mines to build one of China's key state-owned enterprises, the Pingxiang Mining Bureau (now known as Pingxiang Mining Industry Group Co., Ltd.). Since then, eight more new large and medium-sized state-owned coal mines have been built in Pingxiang.

Culmination of resource exploitation (1958–2007). Entering the period of the second five-year plan (1958–1962), Pingxiang emphasized the development of ferrous metallurgy and coal industry, but neglected traditional handicrafts and light industry, as a result of which the level of development of light industry significantly lagged behind that of heavy industry, and the industrial structure as a whole was undiversified. Basically, an industrial system was formed, including coal, machine-building, metallurgical and ceramic industries, and products such as steel, electric ceramics and industrial ceramics sold well at home and abroad. At the same time, not enough attention was paid to the light industry[2].

In the period from 1978 to 2008, Pingxiang's annual GDP growth averaged 12.1%. Coal and steel production accounted for more than 40% and 30% of the total production in the province, respectively. The sales volume of chemical fillers in Pingxiang accounted for 70% of the total sales in the country,

[2] *Records of Pingxiang Mining Bureau*. Pingxiang Mining Bureau, 1998.

and the market share of Pingxiang electro-ceramics in China reached more than 60%. In 2001, the volume of float glass production in Pingxiang reached 555 weight boxes (eighth in China). Intercity buses produced in Anyuan have become the best-selling in the country.

At its peak, Pingxiang had more than 1,000 coal mines with an annual coal production volume of 6 million tons, which were supplied in large volumes for industrial and domestic needs to the eastern and central-southern regions of China, as well as for export. The coal industry has created more than 200,000 jobs in Pingxiang and has made a great contribution to the economic and social development of the city itself and China as a whole.

More than 20 large enterprises of heavy industry were built in such areas as ferrous metallurgy, cement production, mining engineering, diesel engine production, industrial ceramics, etc. Thus, an old industrial base was formed in Pingxiang, which accounted for 57.3% of the value of Pingxiang's gross industrial and agricultural output and 74.8% of Pingxiang's tax revenues.

Forced transformation caused by resource depletion (2007 – present time). After more than a century of coal mining, by the beginning of the 21st century, Pingxiang's coal resources were on the verge of exhaustion. The remaining recoverable coal reserves here accounted for only 14% of the proven reserves in 2007. In such conditions, it was difficult to continue developing an industrial system focused on the production of coal, cement, ceramics, glass, and steel. Resource depletion, low mine efficiency in all areas, low added value of products, and an inefficient industrial structure (the share of the secondary sector in Pingxiang reached 61.1% in 2007) based on resource use have led to serious problems such as environmental pollution, lack of jobs, and unsustainable economic development.

In 2008, Pingxiang was included in the first list of Chinese towns with depleted resources as a city whose total recoverable reserves reached more than 70% of the initially estimated reserves, as well as a town that can only mine for five additional years based on existing technologies and production facilities (Li et al., 2021; Dou et al., 2023; Feng et al., 2024). Since then, local authorities have stepped up efforts to close outdated production facilities, as well as refurbish and close coal mines. Currently, only four state-owned coal mines in the town continue mining[3] (Aleksandrova, 2023; Stavrov, 2022).

There are also three stages in the history of Vorkuta's development: 1) the beginning of the development of the coal deposit and the accelerated construction of the city (1930–1962); 2) reaching maximum production capacity and standard of living (1963–1991); 3) the post–Soviet period (1992 – present time).

At the first stage (1930–1962), the coal deposit was developed, which began with the discovery of high-calorie coal in 1930 by geologist G.A. Chernov. A year later, their extraction was already started, and in 1932, the forced construction of a settlement, the construction of which involved the labor of prisoners. The urban district was originally a settlement of the Kapitalnaya mine (later Vorkutinskaya); the territory received town status only in November 1943. At that time, 7,000 people lived in the town (Astakhova, 2024; Cherepko, 2021).

Over the years, about 40 enterprises have been put into operation, including the cement plant, the Vorkutaugol combine, on the basis of which the Pechora branch of the All-Union Scientific Research Coal Institute, as well as processing plants and a lime plant, began operating. About 750,000 square meters of living space have been built, 192 cultural facilities have been built, a swimming pool and a television studio have appeared in the

[3] *Pingxiang Records*. Zhongzhou Ancient Books Publishing House, 2023.

city. The territory has a communal and transport infrastructure. Back in 1958, only 3–4 bus routes operated in Vorkuta, but in 1959 there were 12 of them; 28 buses transported passengers along the ring route. In the same year, an IL-14 aircraft operated daily from Vorkuta airfield to Moscow, Leningrad, Norilsk and Syktyvkar[4].

During the period of reaching maximum production capacity and standard of living (1963–1991), the town's population continued to grow until 1991. Labor productivity also increased. In just one day (January 8, 1963), the miners of Vorkuta produced 1,572 tons of coal in excess of the plan. During the year, more coal was mined in Vorkuta than in Italy, Bulgaria, Hungary, the GDR, Romania, Yugoslavia, Austria, Sweden, Norway combined[5]. The high pace of socio-economic development of the city was evidenced by the number of purchased TV-sets: their number approached 60 thousand, i.e. almost every Vorkuta family watched town television programs. The town was provided with telephones three times better than the capital: in Moscow, there were telephones in every 50th apartment, in Vorkuta – in every 20th[6]. Since 1965, the Northern Lights express train has been running[7].

In the 1970s, the Vorkutaugol Combine created a recreational social infrastructure for workers and their families in other regions. A recreation center for more than 2,000 people was organized in Gelendzhik. In addition, kindergartens, pioneer camps, and tourist bases were built both in the Komi Republic and in the resort regions of the USSR.

During this period, the economy was developing successfully, new housing was being built, and there was a significant influx of migrant workers for high earnings, including due to high "northern allowance"[8]. The town's population was 100,210 people in 1979.

After the collapse of the USSR, negative development trends began manifesting themselves in Vorkuta. Coal prices were liberalized and the coal industry was privatized. The Government was no longer able to subsidize the activities of coal enterprises in 1993. The share of government subsidies in the salaries of Vorkutaugol employees decreased from 80% to 1.5%. In 1993–1999, miners went on strikes demanding higher wages, indexation of working capital, and an end to rising energy prices. A program has been adopted to close unpromising mines.

The Tsentralnaya, Yur-Shor, Promyshlennaya, Yuzhnaya, Yun-Yaga, and Halmer-Yu mines were closed along with the village of the same name, and the Oktyabrskaya mine was liquidated during this period. The social infrastructure began to collapse along with the closure of the mines. In the village of Promyshlenniy, there is a closed school No. 15, and subsequently the village itself, which had 15 thousand inhabitants back in 1977[9], was liquidated. In 2003, OAO Severstal-Resurs bought a federal stake in OAO Vorkutaugol[10], and the task of the new owner was to make this organization profitable, as well as to pay the Vorkuta miners the wage debt. In 2009, a draft general plan of the

[4] Vorkuta is coal. *MV*. Available at: https://gazetamv.ru/vorkuta-eto-ugol.html (accessed: 01.02.2025).

[5] The Pechora coal basin is 90 years old. Coal industry – 1963. Available at: https://xn----7sbbgb7ar5anfxls.xn--p1ai/index.php/kulturno-prosvetitelskaya-deyatelnost/po-stranitsam-istorii/122-pechorskomu-ugolnomu-bassejnu-90-let-1963 (accessed: 16.02.2025).

[6] The history of Vorkuta. *Vorkuta Town*. Available at: http://www.vorcuta.ru/history.htm (accessed: 16.02.2025).

[7] The Pechora coal basin is 90 years old. 1966 was a golden year in the history of Vorkutaugl.Available at: https://xn----7sbbgb7ar5anfxls.xn--p1ai/index.php/kulturno-prosvetitelskaya-deyatelnost/po-stranitsam-istorii/129-pechorskomu-ugolnomu-bassejnu-90-let-1966 (accessed:16.02.2025).

[8] Vorkuta. Historical baggage: Non-profit informational historical and educational project. Available at: https://xn--80aabjhkiabkj9b0amel2g.xn--p1ai/city/vorkuta-%E2%80%94-samyy-vostochnyy-gorod-evropy-136 (accessed: 16.02.2025).

[9] The history of Vorkuta. Vorkuta Town. Available at: http://www.vorcuta.ru/history.htm (accessed: 16.02.2025).

[10] Vorkutaugol has been sold. Available at: https://www.vorkuta-cbs.ru/vorkutinskie-syuzhety/vorkutaugol-prodali (accessed: 17.02.2025).

Vorkuta Municipality was developed, implying the preservation of only the villages of Severny, Vorgashor, Seydu, Yeletsky, and Sivaya Mask within its borders.

Currently, some of the settlements in the town district have been transformed into Vorkuta microdistricts, but this has not prevented their depopulation. For example, the Sovetsky microdistrict (formerly an urban-type settlement with more than 2 thousand inhabitants), located next to the Yunyaginsky section, was completely resettled and disconnected from communications in 2021.

The availability of coal reserves in Vorkuta also played a role, but the key factor was not their depletion, but the unprofitability of mining. An analysis of the data on coal reserves shows that the explored balance reserves of coal at the current production level will last for almost 200 more years (*Tab. 1*), but one of the significant problems is the high level of coal losses during mining, which significantly reduces the service life of existing mines.

For the same reason, the termination of the town-forming enterprise AO "Vorkutaugol" in 2037 is seen as a significant threat to the development of Vorkuta[11]. A decrease in the possibility of profitable coal mining will be accompanied by a reduction in jobs, and at the same time an increase in the already large outflow of residents (Andrukhova, 2024).

Analysis of economic development of single-industry towns specializing in coal mining at the current stage of development

In Pingxiang's case, the implementation of the 10210 Action Plan for the Modernization of Key industrial chains in the manufacturing industry remains important (i.e., it is planned to achieve the following goals by 2026: comprehensively modernize 10 industrial chains, such as metal materials and resources processing, equipment manufacturing, energy conservation and environmental protection, electronic information, new energy, fireworks, construction materials, food, clothing and household items, medicine; to create two efficient and competitive production clusters in the sectors of materials processing and equipment production; to achieve an annual increase in the size of clusters by an average of 10%). To date, six industrial parks have been built in Pingxiang (one in each county), which in 2023 generated revenue of 92.195 billion yuan and profit of 4.284 billion yuan.

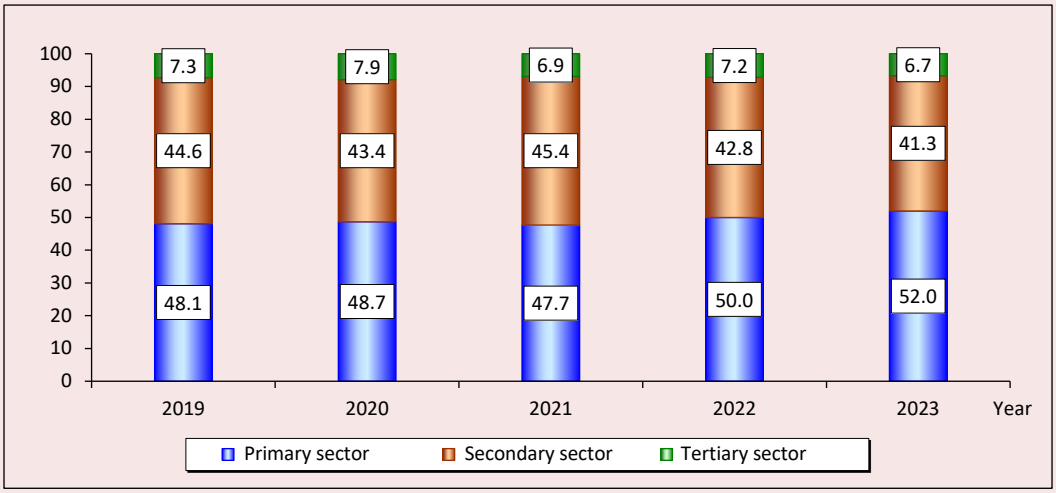
The share of the secondary sector is gradually increasing in the city's economy, but despite this, the primary sector still dominates it (*Fig. 1*). In our opinion, it is advisable to develop Pingxiang within the framework of a hybrid transformation model, that is, taking into account both existing industries and the prerequisites for creating new ones.

Table 1. Balance reserves of coal in Vorkuta, million tons

Deposit	2011	2015	2020	2021	2022	2023	2023 to 2010, %
Vorgashorskoye	1600.0	1530.0	1505.2	1501.1	1493.3	1589.4	99.3
Usinskoe	1460.0	1430.0	1431.6	1431.5	1431.5	1431.5	98.0
Vorkutskoye	920.0	900.0	752.5	748.9	744.7	740.9	80.5
Total	3980.0	3860.0	3689.3	3681.5	3669.5	3761.8	94.5
Mining, total	7.2	9.7	6.7	5.5	6.1	6.1	85.6
Losses, %	-	-	46.7	30.5	50.6	44.6	-
Source: Reports on the state and protection of the Komi Republic's environment in 2011, 2015, 2020, 2021–2023.							

[11] Vorkutaugol will stop producing thermal coal. BNK News Agency. Available at: https://www.bnkomi.ru/data/news/129437 (accessed: 16.02.2025).

Figure 1. Share of value added in the three sectors of the economy in Pingxiang's GRP in 2019–2023, %



Note: The primary sector includes agriculture and forestry, extractive industries, secondary – industry, energy, construction, tertiary – services, financial and insurance services, public administration, science and education.

Source: Statistical Communiqué of Jiangxi Province on the 2023 National Economic and Social Development. Jiangxi Provincial Bureau of Statistics.

In general, if we consider some indicators of economic development, we can see that in 2023, there was a sharp decrease in the volume of investments in fixed assets in the town, while it is most typical for the primary and secondary sectors (the rate of decline in investment was 56.8 and 29.7 percentage points, respectively; *Tab. 2*).

A more negative trend is typical for Pingxiang's budget revenues, which decreased by 23.3% in 2017–2023. Nevertheless, positive trends can also be noticed, such as an increase in household disposable income by almost one and a half times, as well as an increase in retail trade turnover by almost 86 percentage points.

While the results of economic transformation measures are already visible in Pingxiang, they have yet to manifest themselves in Vorkuta. The results of the analysis of the development tools of this territory have shown that their main forms are municipal programs, subsidies, grants, and financing is provided from the federal, regional, and local budgets, as well as with the support of the NPO "Fund for the Development of Single-Industry Towns". The town district receives the

Table 2. Economic development indicators of Pingxiang town

Indicator	2017	2018	2019	2020	2021	2022.	2023	2023 to 2017, %
Retail trade turnover, billion yuan	26.2	29.0	32.3	34.7	41.6	44.7	48.7	185.9
Growth rate of investments in fixed assets, percentage points compared to the previous year	12.8	10.5	9.7	8	10.9	7.8	-7.5	-
Disposable income per capita, yuan	33120.0	35763.0	38502.0	40405.0	43395.0	45278.0	46928.0	141.7
Budget revenues, billion yuan	14.6	16.1	17.2	10.6	10.8	10.7	11.2	76.7
According to: Pingxiang Town Statistical Report on National economic and social development in 2023. Available at: https://tjgb.hongheiku.com/djs/49144.html. (accessed: 10.05.2025); Pingxiang Town Statistical Report on National Economic and Social Development in 2020. Available at: https://tjgb.hongheiku.com/9370.html (accessed: 10.05.2025).								

most extensive assistance from federal authorities as a single-industry town: Vorkuta is included in the list of single-industry towns and is classified as a single-industry town[12] with a stable socio-economic situation. The following development support measures are provided for such towns[13]:

– creation of territories of advanced socio-economic development (PSEDA – Priority Social and Economic Development Area / PDA – Priority Development Area); despite the intention expressed in 2017, work on the formation of PSEDA has not been completed at present;

– financial support for small and medium enterprises (SMEs) within the framework of municipal programs; the administration of Vorkuta, within the framework of the municipal program "Economic Development" for 2024, provides financial support for small and medium businesses in the town in the form of grants[14];

– support for investment projects implemented on the territory of the Russian Federation on the basis of project financing; the municipal program "Economic Development" provides for measures to provide organizational and advisory assistance to subjects of investment activity[15];

– support for socially oriented non-profit organizations (SONPO); in 2021, Vorkuta was allocated a subsidy for further distribution among SONPO on a competitive basis[16].

Some financial and organizational support is provided by the NPO "Fund for the Development of Single-Industry Towns"; in particular, it co-finances the expenses of municipalities to carry out measures for the construction and (or) reconstruction of infrastructure facilities necessary for the implementation of new investment projects in single-industry towns. The Fund for the Development of Single-Industry Towns allocated 104 million rubles in 2017. These funds were used to improve 10 yards and reconstruct the Alley of Pioneers and the town park[17].

The Ministry of Industry and Trade of the Russian Federation provides subsidies to Russian organizations in various sectors of the economy to reimburse part of the cost of paying interest on loans, implementing innovative projects, purchasing transport for urban facilities, etc. Subsidies are also provided for leasing and credit organizations.

In general, the Vorkuta town Administration implements 11 municipal programs aimed at developing the economy and social sphere[18]. For instance, the purpose of the Economic Development program is to create conditions for the growth of investment activity and promote the development of small and medium businesses. The main focus is on co-financing projects of the population within the framework of the National Budget project.

---

[12] List of single-industry municipalities of the Russian Federation (single-industry towns): Approved by RF Government Resolution 1398-r, dated July 29, 2014.Available at: http://static.government.ru/media/files/41d4f68fb74d798eae71.pdf (accessed: 16.02.2025).

[13] Unified list of support measures for single-industry municipalities of the Russian Federation (single-industry towns). Available at: https://xn----7sbckgukdcd3bza3ak.xn--p1ai/netcat_files/userfiles/ekonomika/Edinyy_perechen_mer_podderzhki_monogorodov.pdf (accessed: 10.02.2025).

[14] On Amendments to the order of the administration of the municipal formation of the Vorkuta town district 125, dated December 4, 2024 "On Approval of the comprehensive action plan for the implementation of the municipal program of the Vorkuta Town District Municipality "Economic Development" for the 2024 fiscal year". Available at: https://vorkuta-r11.gosweb.gosuslugi.ru/netcat_files/userfiles/Razvitie_ekonomiki/347_ot_28.12.2024_RS_661.pdf (accessed: 10.02.2025).

[15] Ibidem.

[16] Komi Republic to allocate additional subsidies to support NGOs. *KomiInform*. Available at: https://komiinform.ru/news/213906/ (accessed: 15.02.2025).

[17] The single-industry town of Vorkuta will be improved for 104 million rubles. *TASS*. Available at: https://tass.ru/v-strane/4509659 (accessed: 15.02.2025).

[18] Projects and programs. Administration of the Vorkuta municipal district. Available at: https://vorkuta.gosuslugi.ru/deyatelnost/proekty-i-programmy (accessed: 17.02.2025).

Due to the actualization of spatial development issues in recent years, a master plan has been developed for Vorkuta, which is a document of strategic spatial planning of the city, covering various aspects of development[19].

The current management tools have led to certain results (*Tab. 3*). For instance, despite the unfavorable trends in industry and the social sphere, the volume of shipped products in the urban district has been growing in recent years, as has the retail trade turnover. There are also positive trends in the level of average monthly wages, which increased by 62.9 percentage points during the period under review, and in the level of local budget revenues (an increase of 43.9 percentage points in 2023 compared to 2017).

At the same time, we should say that investment activity in Vorkuta has been curtailed: for most of the years of the period under review, there has been a significant reduction in the volume of investments in fixed assets, which is largely due to the gradual reduction of coal mining in this territory.

Social problems are becoming even more acute. The population of Vorkuta decreased by 12.7% during the period under review due to both natural decline and migration outflow, despite the fact that wages in Vorkuta in 2023 were 1.3 times higher than the national average (74.9 thousand rubles) and 4.5 times higher than the regional subsistence level (22.7 thousand rubles). However, the unfavorable economic situation is evidenced by a decrease in the number of business entities, including profitable ones, and an increase in the number of unprofitable organizations.

Table 3. Indicators of the development of Urban district Vorkuta

Indicator	2017	2018	2019	2020	2021	2022	2023	2023 to 2017, % (p. p.)
Retail trade turnover, million rubles	1346.0	2966.4	4287.7	5222.2	6324.5	7479.1	9108.4	In 6.7 times
Local budget revenues, million rubles	3434.6	3976.7	3992.6	4156.1	4692.0	5077.2	4941.3	143.9
Average monthly salary of employees of organizations, thousand rubles	62.2	69.5	74.5	80.7	82.7	93.9	101.3	162.9
Goods of own production were shipped, works and services were performed on our own, billion rubles	42.3	43.9	50	43.6	59.4	70.9	57.5	135.9
Growth rate of investments in fixed assets, percentage points compared to the previous year	-83.5	63.6	-17.5	27.5	-5.9	1.6	-22.4	26.8
Number of business entities, units	No data	No data	522	528	510	495	469	89.8
Number of unprofitable organizations, units	No data	No data	105	130	138	124	146	139.0
Number of profitable organizations, units	No data	No data	417	398	372	371	323	77.5
Average monthly salary of employees of organizations, thousand rubles	62.2	69.5	74.5	80.7	82.7	93.9	101.3	162.9
Natural increase (decrease), people	107	52	-84	-179	-328	-218	-154	-143.9
Migration increase (decrease), people	-2854	-2610	-1549	-515	-816	-204	-1	0.0
According to: Database of municipal indicators. Available at: https://rosstat.gov.ru/dbscripts/munst/ (accessed: 15.02.2025).								

[19] Vorkuta Master Plan. Available at: https://vorkutaugol.ru/pages/master-plan-vorkuty (accessed: 10.02.2025).

In addition to social issues, environmental issues are no less relevant in Vorkuta. For example, it got into the top 10 cities with the most polluted air in 2023[20]. There is also a deterioration in the quality of tap water caused by floods, which indicates the problem of pollution of natural water bodies[21].

Prospects for the transformation of the economy of single-industry towns specializing in coal mining

A special place in the framework of the transformation of the economy of the single-industry town of Pingxiang should be given to cross-border cooperation, in particular, the interaction of the neighboring provinces of Jiangxi and Hunan. This is facilitated by the good transport connectivity of the territories: a 140-kilometer high-speed train ride from Pingxiang to Changsha City takes only 30 minutes. Pingxiang is currently developing cooperation between the western part of Jiangxi Province and the Changsha–Zhuzhou–Xiangtan urban cluster in Hunan Province, as well as building the Hunan–Jiangxi cross-border cooperation center. There are prerequisites for the creation of storage and logistics bases in this territory, as well as bases for processing agricultural products along the Hunan-Jiangxi border (*Fig. 2*).

Taking into account that food security is one of their key priorities for China, the Pingxiang City authorities are making efforts to improve the mechanism by which managers at the city, county, township and village levels control grain accounting and crop cultivation. Currently, the town has six leading national agricultural industrialization companies and 24 large food industry enterprises (industrial enterprises with annual core business revenue of at least 20 million yuan). To the greatest extent, agricultural land occupies the territories of Lianhua and Luxi counties. In our opinion, the knowledge of the local population working on this land can allow not only increasing the collection of agricultural products, but also developing breeding areas, in particular, growing species resistant to certain factors, which is very important in the context of climate change. It will also contribute to the achievement of one of Pingxiang's strategic goals – to become a leader in the seed industry and the industrialization of agriculture.

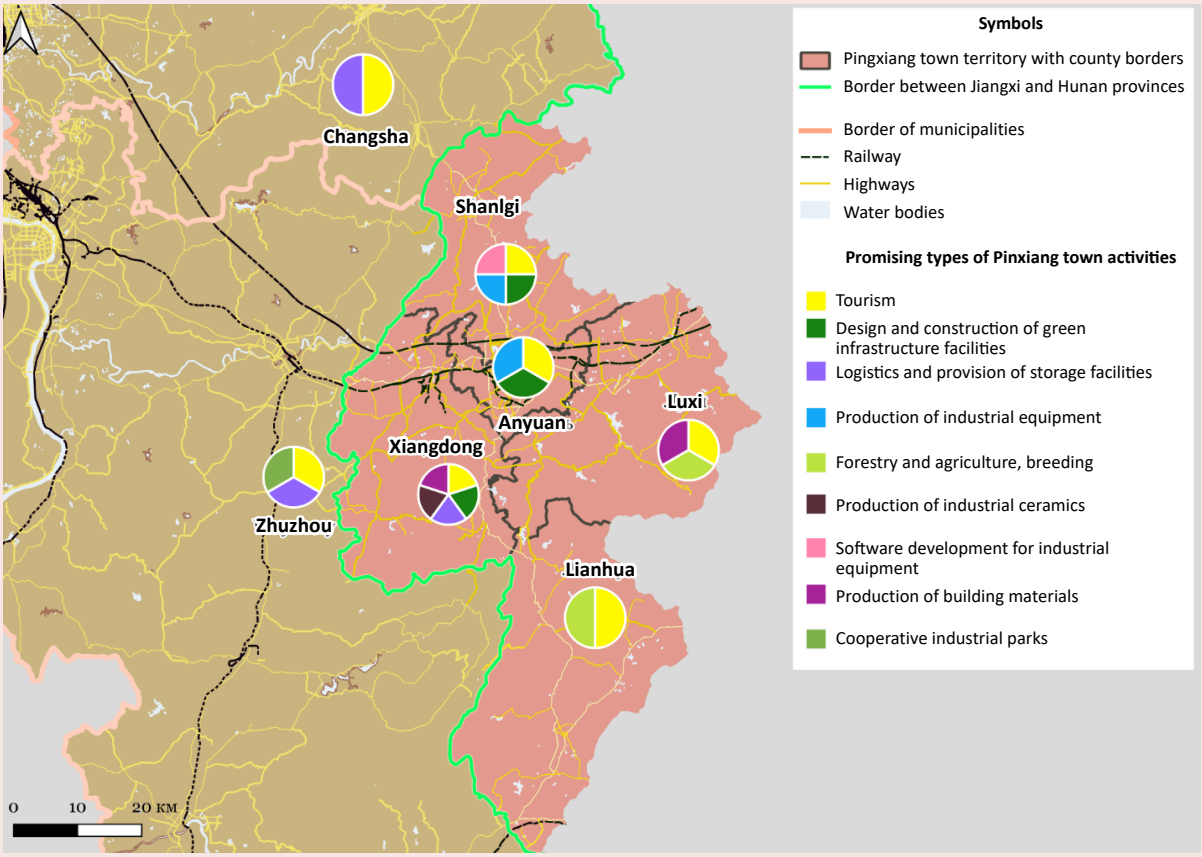
As in any city with a long history of development, Pingxiang has a number of prerequisites for the development of tourism. For instance, it makes sense to develop rural and ecological tourism in Luxi and Lianhua counties, which is facilitated by large areas of farmland, as well as mountains with elements of tourist infrastructure. In other counties, in addition to cultural tourism, it is possible to organize industrial tourism, especially in Shangli county, where the production of fireworks is developed, as well as Xiangdong county, where a number of enterprises producing various kinds of ceramics are located. In general, the town is actively using its rich tourist resources: more than 60 million domestic tourist trips were made here in 2023, which generated tourism revenue of 65.656 billion yuan, while record high income and number of tourists were recorded in the Wugong Mountains.

In our opinion, in the counties where industrial enterprises are most concentrated and, accordingly, there is an increased level of negative impact on the environment (Xiangdong, Shanlgi, Anyuan), the development of activities for working out and implementing green infrastructure elements is promising. This will reduce environmental damage, involve by-products of pyrotechnic and ceramic industries, and create an environmental barrier on the border with Hunan Province. In addition, Hanyuan county already has experience in transforming the economy toward a more environmentally friendly option. For example,

[20] Vorkuta is once again in the top 10 cities with the most polluted air. Available at: https://komionline.ru/news/vorkuta-vnov-popala-v-top-10-gorodov-s-samym-zagryaznennym-vozduhom (accessed: 10.02.2025).

[21] Available at: https://gazetamv.ru/rospotrebnadzor-ximicheskie-i-mikrobiologicheskie-pokazateli-vody-v-norme.html (accessed: 10.02.2025).

Figure 2. Promising types of economic activity in the single-industry town of Pingxiang



According to: Open Street Map service data.

38 large and small coal mines were once located in the village of Lyexia, and more than half of the village's 2,000 residents were employed in coal mining jobs. Many villagers were laid off as the coal mines closed one after another in 2003. In 2016, due to its location near the town, the presence of picturesque mountains and clear reservoirs, the village began gradually carrying out environmental rehabilitation of coal mining sites, following the idea of "restoration, protection and reorganization". At the same time, the village coordinated its resources to create the tourist attraction Sunshine Flower Sea, which is visited by over 200,000 people annually. A similar practice was implemented in the village of Wushi in the same county, which was once known as the "dark village" due to severe environmental pollution and high energy consumption caused by the functioning of its main industries (cement and coal) in the past. To improve the living conditions of the villagers and achieve a "green" transformation of development, land restoration work was actively carried out in Qingshan village, and about 66.67 hectares of land were allocated for the development of traditional agriculture. The Wuschi Yinxiang Rural Complex has been built, which houses a 20-hectare fruit farm and a 4-hectare grape farm, and the annual number of free-range chickens for slaughter has reached more than 20,000 units[22].

In Xiangdong and Luxi counties, there are prerequisites (an industrial ceramics factory in Xiangdong and coal mining dumps in Luxi) for the creation of a production facility for the production

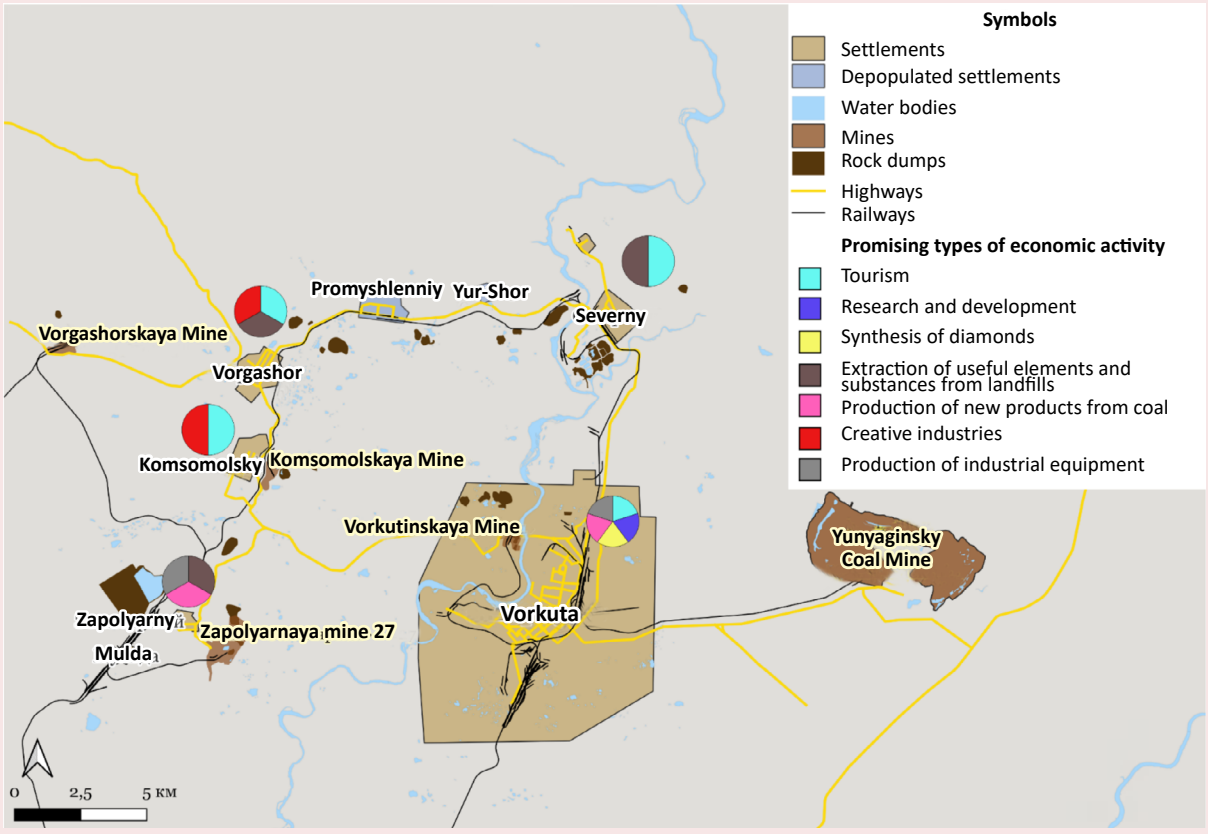
[22] Records of Anyuan District. Publishing House of Local Records, 2006.

of building materials with a new composition and consumer properties. In our opinion, Shanlgi and Anyuan counties have more prerequisites for the production of industrial equipment, which is facilitated by the industrial parks located on their territories that produce elements for electronic equipment.

It is worth noting that Pingxiang already has a successful experience of partial modernization of the economy. For example, in Shanlgi county, known as the "Birthplace of Fireworks" due to the 1,400-year history of their production, the gross sales volume of fireworks produced here accounts for 28% of the total volume in China. At the same time, for a long time such production was carried out manually, which created great risks for safety and the environment. In 2017, an explosion occurred at one of these facilities, which killed 7 people[23]. As a result of the closure of 342 backward fireworks manufacturing enterprises in Shangli, the county authorities began stimulating the mechanization and automation of all processes related to the production of fireworks. Currently, there are 174 fireworks manufacturers in the county, and the number of employees engaged in sales and management in this field is 60,000 people[24].

In the case of Vorkuta, in our opinion, the key direction of development within the framework of

Figure 3. Promising types of economic activity in the single-industry town of Vorkuta



According to: Open Street Map service data.

[23] Seven people were killed in an explosion at a fireworks factory in China. *Life*. Available at: https://life.ru/p/1045966 (accessed: 07.05.2025).

[24] *Records of Shangli County*. Jilin Literature and History Press, 2023.

the hybrid model of economic transformation should be its diversification based on available resources. Of particular importance is the development of the town in conjunction with the surrounding settlements: Vorgashor, Severny, Komsomolsky, Zapolyarny [25]. Given the presence of water bodies, highways, and railways in this area, as well as mines, overburden dumps, and "ghost" settlements, in our opinion, the most promising activities are those outlined in *Figure 3*.

The most diversified set of promising types of economic activity is expected directly for Vorkuta. First, it is the development of the research and development sector through cooperation between the research department of AO Vorkutaugol and the Vorkuta branch of Ukhta State Technical University in cooperation with researchers from other universities and scientific organizations. In addition, it is planned to create a data center for data processing in the town, which may also become an important component of this area[26]. The sector's activities should be aimed primarily at developing solutions to local problems (providing infrastructure, primarily transport, reducing environmental pollution, reducing coal losses during mining and transportation, eliminating a large number of overburden dumps, creating jobs, developing technologies that increase the safety of coal mining, etc.), which can be adapted or applied in other territories with similar problems.

Vorkuta's carbon resources are also a prerequisite for the creation of enterprises for the synthesis of artificial diamonds, which can later be used in jewelry, optics, electronics, as well as in mining to improve cutting and abrasive tools. In terms of physical properties, they are identical to natural ones, and their cost is 70–80% less, besides they are more environmentally friendly, since they do not require the development of entire deposits and the seizure of land[27]. The raw materials for such production can be coal dust and methane produced during coal mining. Production can be organized both on the basis of the HPHT method[28], which is more expensive in terms of costs, but allows for the production of larger diamonds, and the CDV method[29].

Given the presence in Vorkuta of the research department of AO Vorkutaugol and the Pechorskaya processing plant (part of AO Vorkutaugol) in Zapolyarny urban-type settlement, in our opinion, it is advisable to diversify the product line with coal fertilizers, adsorbents (for example, activated carbon), as well as to organize the production of industrial equipment that increases the safety of coal mining (for example, equipment for pumping methane from mines), and its improvement.

Due to the proximity of overburden dumps and water bodies, one of the promising activities for the Severny settlement is the extraction of useful elements from coal mining waste: coal from landfills, extraction of iron, aluminum, lime, and the production of sinter from a charge.

Taking into account the significant methane abundance of the Vorgashorskaya mine, which is extremely high in terms of hazard (in 2013, its relative methane abundance was estimated at 17.4 m^3/t, while mines with a methane abundance of

[25] The village of Mulda is not considered in the context of the search for promising economic activities, since 11 permanent residents were registered in it, and there was no permanent population from 2010 to 2020. There is a high probability that no one actually lives in the village.

[26] An investment project for the construction of data centers is being implemented in the Komi Republic. Available at: https://komigor.com/news/2024/09/13/v-respublike-komi-realizuyut-investicionnyj-proekt-po-stroitelstvu-data-centrov/ (accessed: 10.02.2025).

[27] Grown diamonds. Available at: https://tsarru.ru/product-category/diamond (accessed:20.02.2025).

[28] HPHT – High Pressure High Temperature. The temperature gradient method is used. Its essence is to recreate the natural conditions of diamond growth in the earth's interior. To do this, a growth cell with diamond seed, graphite and a catalytic mixture of metals is placed in a hydraulic press, where further transformations occur under the influence of a temperature of about 1,500 °C and a pressure of 50–70 thousand atmospheres. The carbon crystallizes on the seed, which grows into a diamond after a few weeks.

[29] CVD – Chemical Sarog Deposit. Film synthesis technology involves layer-by-layer deposition of diamond from an ionized hydrocarbon gas medium onto a substrate by means of ultrahigh-frequency radiation.

up to 5 m^3/t are considered the least dangerous) (Zaburdyaev, 2013), it seems important to ensure methane capture. This is advisable both from the point of view of ensuring safety and further use of methane, for example, in the production of synthetic diamonds.

Vorkuta, as well as the urban-type settlements of Vorgashor and Severny, have certain prerequisites for tourism development, in particular industrial and quest tourism. This is due to the regular transport links between these urban-type settlements and Vorkuta, as well as the proximity of "ghost" settlements that attract stalker tourists. To avoid accidents with such tourists, as well as to reduce the level of looting, it is advisable to make visits to such places organized. In this regard, it is necessary to ensure the construction of hotels and tourist infrastructure in these settlements.

In addition, it makes sense to develop creative industries in Komsomolskaya and Vorgashore, which will not only improve the quality of local labor potential, but can also become a source of attraction for event tourism participants.

Conclusion

Thus, the research results showed that it is advisable to ensure the transformation of the economy of single-industry towns specializing in coal mining on the basis of a hybrid model that will preserve the accumulated potential, as well as diversify risks through the development of new types of activities for the territories under consideration, which will increase the sustainability of such settlements.

A retrospective review of the development of both the town of Pingxiang and the Vorkuta urban district indicates that their economies are focused on exploiting the only exhaustible type of resource, which initially allows for high economic growth and a standard of living, but after a certain time poses threats to the socio-economic development of the territories in the form of reduced returns, reduced jobs and population. deterioration of the environmental situation. Therefore, the task of transforming the economy of single-industry towns in order to mitigate such risks is extremely important. Its solution can be carried out both on the basis of a town-forming enterprise due to its availability of material, personnel and organizational capabilities, as well as the creation and implementation of other various sectors of the national economy (a hybrid model of transformation).

Pingxiang's experience proved that some territories can receive a boost in the modernization of traditional activities (Shangli County in the north of Pingxiang, specializing in the manufacture of fireworks), while others require new activities, such as tourism and traditional farming (Anyuan County). At the same time, it is worth noting that counties that haveno industrial base in the present or in the past have fewer opportunities for economic transformation (Luxi and Lianhua counties). On the other hand, the practice of Vorkuta's development also shows the importance not only of controlling existing mineral reserves, but also of making sound policy decisions, in particular, conducting social and industrial policies, since the work of town-forming enterprises and, consequently, the level of town's development may depend on them.

The scientific novelty of the work consists in substantiating the strategic priorities of the development of single-industry towns on the basis of capitalizing on their competitive advantages, consolidating the potentials of towns and adjacent territories. In the long term, this will make it possible to diversify the economy of such towns, thereby increasing their resilience to the challenges of various nature, as well as solving problems such as a decrease in investment activity, a decrease in population, and a high level of environmental damage. The practical significance lies in the possibility of using the results of regional state authorities and local governments in the development of tools for the economic development of single-industry towns with urban coal mining enterprises.

References

Adekoya O.B., Kenku O.T., Oliyide J.A., Al-Faryan M.A.S. (2023). On the COP26 and coal's phase-out agenda: Striking a balance among the environmental, economic, and health impacts of coal consumption. *Journal of Environmental Management*, 328, 116872. DOI: 10.1016/j.jenvman.2022.116872

Aleksandrova M.V. (2023). Resource-based cities of the PRC: Historical background and issues. *Rossiiskoe kitaevedenie*, 3, 33–52. DOI: 10.48647/ICCA.2023.12.82.003 (in Russian).

Aleshina O.G. (2024). The place of technological sovereignty in the system of neo-industrial structural shift. *Ekonomika i upravlenie innovatsiyami*, 1(28), 16–26. DOI: 10.26730/2587-5574-2024-1-16-26 (in Russian).

Andrukhova O.V. (2024). State and prospects of development of the coal industry in the northern regions (on the example of the Komi Republic). In: *Aktual'nye problemy, napravleniya i mekhanizmy razvitiya proizvoditel'nykh sil Severa – 2024: sbornik statei IX Vserossiiskoi nauchno-prakticheskoi konferentsii (s mezhdunarodnym uchastiem), g. Syktyvkar, 18–20 sentyabrya 2024 goda* [Actual Problems, Directions and Mechanisms of Development of Productive Forces of the North – 2024: Collection of Articles of 9th All-Russian Scientific-Practical Conference (with International Participation), Syktyvkar, September 18–20, 2024]. Voronezh: Stroki (in Russian).

Astakhova I.S. (2024). From coal pebble finds to the discovery of deposits (to the 100th anniversary of the Pechora coal basin). *Vestnik geonauk*, 2 (350), 38–45. DOI: 10.19110/geov.2024.2.4 (in Russian).

Biddau F., Rizzoli V., Sarrica M. (2024) Phasing-out 'coal tradition' in favour of 'renewable colonialism': How the press contributes to the discursive (de)legitimization of coal and renewables in a coal region in transition. *Sustainable Science*, 19, 381–402. DOI:10.1007/s11625-023-01420-2

Buchwald E.M., Kol'chugina A.V. (2019). *Malye i monogoroda v Strategii prostranstvennogo razvitiya Rossiiskoi Federatsii: doklad* [Small and Monotowns in the Strategy for Spatial Development of the Russian Federation: Report]. Moscow: Institut ekonomiki RAN.

Cherepko V.A. (2021). Vorkuta – a city of permafrost. In: *Gumanitarnye nauki v sovremennom vuze: vchera, segodnya, zavtra: materialy IV Mezhdunarodnoi nauchnoi konferentsii, g. Sankt-Peterburg, 10 dekabrya 2021 g. T. 3* [Humanities in the Modern University: Yesterday, Today, Tomorrow: Materials of the 4th International Scientific Conference, Saint Petersburg, December 10, 2021. Volume 3]. Saint Petersburg: Sankt-Peterburgskii gosudarstvennyi universitet promyshlennykh tekhnologii i dizaina (in Russian).

Didyk V.V., Ryabova L.A. (2014). Single-industry towns of the Russian Arctic: Development strategy on the case of the cities/towns in the Murmansk Oblast). *Ekonomicheskie i sotsial'nye peremeny: fakty, tendentsii, prognoz=Economic and Social Changes: Facts, Trends, Forecast,* 4 (34), 84–99. DOI: 10.15838/esc/2014.4.34.8 (in Russian).

Dou Sh., Zhu Yo., Xu De., Amuakwa-Mensah Fr. (2023). Ecological challenges in the economic recovery of resource-depleted cities in China. *Journal of Environmental Management*, 333, 117406. DOI: 10.1016/j.jenvman.2023.117406

Feng Ya., Gao Yu., Pan Yu. (2024). Identifying the antecedents for the green transformation of resource-exhausted cities in China. *Humanities and Social Sciences Communications*. DOI: 11.10.1057/s41599-024-03924-3

Gallas A. (2025). Deindustrialization and dwindling union density: *Labour in Western Europe*. DOI: 10.1332/policypress/9781529242225.003.0005

Gulzar F., Khalid Sh., Bibi K. (2025). Deindustrialization and poverty in developing countries: Examining economic shifts and policy responses (1990–2022). *Review of Applied Management and Social Sciences,* 8, 81–97. DOI: 10.47067/ramss.v8i1.436

Kaigorodtsev A.A. (2022). New industrialization as a condition for ensuring Russia's technological sovereignty. *Vestnik MFYuA*, 4. Available at: https://cyberleninka.ru/article/n/novaya-industrializatsiya-kak-uslovie-obespecheniya-tehnologicheskogo-suvereniteta-rossii (accessed: 27.01.2025; in Russian).

Knotter A. (2015). Migration and ethnicity in coalfield history: Global perspectives. *International Review of Social History,* 60, 1–27. DOI: 10.1017/S0020859015000413

Kozhevnikov S.A. (2019). Strategy for Russia's spatial development and prospects for Russian space transformation. *Voprosy territorial'nogo razvitiya=Territorial Development Issues,* 3(48). Available at: http://vtr.isert-ran.ru/article/28193/full?_lang=ru. DOI: 10.15838/tdi.2019.3.48.1 (in Russian).

Kravchenko A.A. (2022). Coal mining in the world: Geopolitical and regional aspects. In: *Ekonomika i marketing v XXI veke: problemy, opyt, perspektivy: sbornik materialov XVIII Mezhdunarodnoi nauchno-prakticheskoi konferentsii, posvyashchennoi 95-letiyu kafedry «Ekonomika i marketing», g. Donetsk, 24–25 noyabrya 2022 g.* [Economics and Marketing in the 21st Century: Problems, Experience, Prospects: Collection of Materials of 18th International Scientific and Practical Conference Dedicated to the 95th Anniversary of the Department of Economics and Marketing, Donetsk, November 24–25, 2022]. Donetsk: Donetskii natsional'nyi tekhnicheskii universitet (in Russian).

Li X., Xu Zh., Fu Yu. et al. (2021). Ecological security evaluation algorithm for resource-exhausted cities based on the PSR model. *Computers, Materials & Continua,* 69, 985–1001. DOI: 10.32604/cmc.2021.017357

Lytkina T.S. (2014). Social potential of a northern city: From neglect to recognition. *Zhurnal sotsiologii i sotsial'noi antropologii*, 17(3), 33–47 (in Russian).

Manaeva I.V. (2018). Cities and towns of Russia: Classification and typology. *Regional'naya ekonomika: teoriya i praktika=Regional Economics: Theory and Practice*, 16, 7(454), 1235–1249. DOI: 10.24891/re.16.7.1235 (in Russian).

Morozov N.A. (2017). Vorkuta: Socio-demographic aspect of regional development (to the 70th anniversary of the city). *Istoricheskaya demografiya*, 1(19), 43–50 (in Russian).

Rudneva A.O. (2024). Key factors in dynamics of Russia's coal export to Europe during the sanctions period in the context of the EU green agenda. *Vestnik universiteta*, 12, 102–114 (in Russian).

Sekushina I.A. (2024). Small and medium-sized single-industry towns of the European North of Russia in the context of socio-economic challenges of 2020–2023. *Ekonomicheskie i sotsial'nye peremeny: fakty, tendentsii, prognoz=Economic and Social Changes: Facts, Trends, Forecast,* 17(5), 74–94. DOI: 10.15838/esc.2024.5.95.4 (in Russian).

Shirokova E.S. (2015). Neo-industrialization: Factors of sustainability and innovativeness. *Ekonomika, statistika, informatika*, 3, 139–144 (in Russian).

Stavrov I.V. (2022). China'a policy on the sustainable development of monocities between the end of the 20th and the beginning of the 21st centuries. *Rossiya i ATR*, 4, 175–186. DOI: 10.24412/1026-8804-2022-4-175-186 (in Russian).

Tatarkin A.O., Romanova O.A. (2013). On the possibilities and mechanism of neoindustrialization of old industrial regions. *Ekonomist*, 1, 21–37 (in Russian).

Uskova T.V., Iogman L.G., Tkachuk S.N. et al. (2012). *Monogorod: upravlenie razvitiem: monografiya* [Single-Industry Town: Development Management: Monograph]. Vologda: ISERT RAN.

Zaburdyaev V.S. (2013). Methane hazard in coal mines. *Bezopasnost' truda v promyshlennosti*, 8, 60–64 (in Russian).

Zhang F., Lu J., Chen L. (2023). When green recovery fails to consider coal pushback: Exploring global coal rebounds, production, and policy retrenchment post Covid-19. *Energy Research & Social Science*, 101, 103142. DOI 10.1016/j.erss.2023.103142

Zubarevich N.V. (2010). *Regiony Rossii: neravenstvo, krizis, modernizatsiya* [Russian Regions: Inequality, Crisis, Modernization.]. Moscow: Nezavisimyi institut sotsial'noi politiki.

Information about the Authors

Marina A. Lebedeva – Junior Researcher, Vologda Research Center, Russian Academy of Sciences (56A, Gorky Street, Vologda, 160014, Russian Federation; e-mail: lebedevamarina1@mail.ru)

Zhang Dan – Junior Researcher, Institute of History, Jiangxi Academy of Social Sciences (649, Hongdu North Road Street, Nanchang, Jiangxi Province, China)

Received March 20, 2025.