Determinants for increasing the productivity of single-industry towns in Kazakhstan

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The development of single-industry towns is one of the most important aspects of establishing an effective economy for many post-Soviet states. Single-industry towns (monocities) significantly increase the level of private sector competitiveness, but present a challenging socio-economic situation, considering the vulnerability and dependence of the locality on the welfare of the single industry and on the city-forming enterprise. Sustaining the stability of monocities is the foremost objective for safeguarding the territorial economy. This study explores the factors that influence the productivity of single-industry towns in Kazakhstan using panel data from 2019 to 2022. We construct our econometric model based on previous research, including entrepreneurial, environmental, technological, infrastructural and intellectual factors in 26 monocities in Kazakhstan. The findings reveal that improving infrastructure and securing quality local human resources promote productivity in the single-industry towns of Kazakhstan, the statistical significance of which is consistently demonstrated in different models. In contrast, entrepreneurship, environmentally friendly and research and development activities do not appear to significantly influence productivity. To achieve direct productivity growth in the short-term, the government should focus on improving infrastructure and preventing brain drain as the first priority.

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Introduction

A single-industry town (monocity) is a location that completely or largely depends on the well-being of one enterprise or a certain industry (Nurgalieva et al. 2019). Development of this single industry is extremely important as it echoes throughout surrounding regions and the country as a whole for several reasons. First, economic importance as single-industry towns are the primary centres of production for certain products or services. Second, labour as monocities create a significant number of jobs and provide crucial income for the local population. Third, infrastructure as single-industry towns supports infrastructure development in such cities. Fourth, industrial cluster development as monocities increase competitiveness in the single industry. Finally, scientific and technological as single-industry towns become centres of science and technology. Nevertheless, as with any economic structures, monocities are exposed to risks of economic instability due to excessive specialisation, which can lead to serious vulnerability and socio-economic consequences, which reinforces the fact that it is crucial to assess the contemporary potential of single-industry towns to ensure their stability.

In addition, single-industry towns also face other challenges related to environmental protection. In particular, large industrial companies that ensure a region's comfortable standard of living can heavily pollute the environment, leading to significant health problems among local residents. Difficulties may arise for the development of single-industry towns from other challenges. For example, outdated infrastructure, lack of investment and scarcity of qualified skilled personnel. All of these challenges are inherent aspects of single-industry towns across the globe, including Kazakhstan. Thus, it is essential to consider the current state of single-industry towns in the country, assess their potential for development and establish certain structures to implement effective state policies.

A significant number of scientists have investigated the general principles of urban development. Appio et al. (2019) examined the features of technological development in cities. Some research has drawn attention to the role of the future transformation of cities through innovation, which is also relevant for the Republic of Kazakhstan. Unfortunately, limited studies have examined the development of single-industry towns in Kazakhstan. Nurgalieva et al. (2019) considered some features of Kazakhstan's single-industry towns and prospects for future development, considering specialisation. Rohner (2021) noted how the Soviet past has affected the current state of cities that depend on a single industry or enterprise. The author posited a high probability of monocities following the path of Western industrial cities but did not cite approaches to help them avoid this fate. Kireyeva et al. (2022) considered the current socio-economic state of the depressed territories in Kazakhstan, noting that although single-industry towns in Kazakhstan do not belong to such territories, it is a very real possibility, given the development trajectories of such regions in foreign countries. It is crucial to consider the possibilities of pre-

emptively addressing challenges that may arise in the medium and long-term. The historical trajectories of the development of single-industry towns in other countries can offer important guidance. In particular, Taylor (2020) conducted a similar review to this study in Australia in the context of gradual demographic changes in such regions, providing valuable insights.

Ensuring stable productivity in single-industry towns is the foremost task for maintaining stable growth of the territorial economies in Kazakhstan considering the regional vulnerability and dependence on the welfare of the single industry and the city-forming enterprise. This study examines critical factors of increasing production in single-industry towns in Kazakhstan to benefit the potential development of internal state policies. Previous studies have examined such monocities in Kazakhstan (Turgel et al. 2016, Bozhko 2017, Rakhmetova et al. 2018, Junussova−Beimisheva 2020, Kozbagarova−Tamara 2022, Maimurunova et al. 2022). However, we identify a research gap in topical and methodological aspects. In terms of the topical concern, multiple studies have noted the main challenges, development potential and government policies of monocities in Kazakhstan, while no research has examined potential growth indicators of productivity or their impacts. From the methodological perspective, previous research has been conducted in a descriptive manner, and while such descriptive analyses can be extremely useful for conceptualising the topic and determining trends in the preliminary research stage, such studies are abundant, and do not produce meaningful insights for policy and managerial development based on quantification to predict elasticities of productivity depending on primary socio-economic indicators. To address this lack of relevant insights, we employ econometric modelling, developing a theoretical framework and research hypothesis based on a literature review regarding the growth factors in monocities. The findings open new research opportunities and reveal novel theoretical and empirical insights for this significant research topic.

This paper is composed as follows. First, previous studies are reviewed and research hypotheses are developed. Then data and methodology are presented. After that, the results are described. These results are compared with previous studies in the last section. In conclusion, policy implications are provided.

Literature review and hypotheses development

The risks and opportunities of a single-industry town

It is first essential to conduct a general review of single-industry towns in Kazakhstan to understand specific features and the trajectory of dependence on certain enterprises and sectors of the economy. These details are described in Table 1, encompassing 27 single-industry towns in Kazakhstan.

Kazakhstan's single-industry towns can be divided into three categories according to the functioning of monocities' forming enterprises, including 1. having operational

city-forming enterprises (19 relatively prosperous single-industry towns), which include Abai, Aksai, Aksu, Balkhash, Zhanaozen, Zhezkazgan, Zhitikara, Zyryanovsk, Karazhal, Kulsary, Kurchatov, Lisakovsk, Ridder, Rudny, Satpayev, Temirtau, Khromtau, Shakhtinsk and Ekibastuz; 2. having partially operational city-forming enterprises (five less prosperous single-industry towns), including Arkalyk, Zhanatas, Karatau, Saran and Stepnogorsk; and 3. having inactive city-forming enterprises (three dysfunctional single-industry towns): Kentau, Serebryansk and Tekeli.

Table 1

Description of the single-industry towns of Kazakhstan

Town	The ratio of employees in city-forming enterprise to population (2022), %	Description
Stepnogorsk	52.2	This city produces gold and polymetals. Metallurgical, mining, machine-building and chemical industries are developing.
Hromtau	N/A	Seven schools and a mining college are in this town, which is a leader in the extraction of chrome ores.
Tekeli	N/A	This town supports the production, extraction and processing of ores, lead and cast iron. The role of the Tekeli was invaluable during the Great Patriotic War, when every eighth bullet was made of Tekeli lead.
Kulsary	43.8	Large oil and gas reserves have been discovered in this city, which is a major centre of the oil industry.
Altai	92.8	Mining and manufacturing industries are well-developed, and this town is one of the main producers of agricultural products.
Kurchatov	N/A	This city has a dairy plant, a bread factory and preschool institutions, in addition to a national nuclear centre, including of several branches-geology, nuclear physics and nuclear energy.
Ridder	53.4	This city has abundant metal ore deposits. The first deposits of gold, silver and polymetals were discovered in 1786, the ores in the Ridder deposit received a decent assessment in London in 1850 and the city also hosts the West Altai Nature Reserve.
Serebryansk	N/A	The profile industries in this city include electricity production and the production of personal protective equipment for respiratory organs.
Zhanatas	N/A	This city mines phosphorous ore at the Kok-John deposit and a wind farm is being built in collaboration with China Power International Holding and Visor Investments Cooperatief.
Karatau	45.6	This city is the centre of the Kazakh chemical industry, conducting extraction, primary processing and supply of raw materials, in addition to enterprises producing fur products.
Aksai	52.5	This city engages in extraction from the Karachaganak oil condensate field.
Balkhash	N/A	This city hosts a branch of the West Kazakhstan Technological University, an Agricultural College, gas industry enterprises, a railway station and produces newspaper publications.

(Table continues on the next page)

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Town	The ratio of employees in city-forming enterprise to population (2022), %	Description
Zhezkazgan	N/A	Metallurgy is the basis of the city's economy, with a mining and metallurgical plant, and oil fields are located nearby. The city suffers from poor drinking water quality and air pollution. Deposits of copper and precious metals (gold and silver) are also being developed. Zhezkazgan University named after O. Baikonurov is located here, and 617 plants and 90 medicinal species have been identified in the region. The local mountain spring water, called 'Ulytau', which is known to have healing properties is also produced here.
Karazhal	N/A	This city has a newly discovered rich deposit of iron-manganese ores.
Saran	45.3	The characteristic features of the economy are industrialisation, including mining for coal, limestone and raw materials for building materials.
Satpaev	N/A	The surrounding lands of this city boast a rich copper ore reserve, with the second largest deposit of copper sandstone in the world.
Temirtau	52.5	This is a city of high culture, with an internally known dance ensemble.
Shakhtinsk	43.6	This city is at the stage of growth of the food industry enterprise and has four coal mines.
Abai	53.3	This city includes the Abai garment factory and a central hospital.
Arkalyk	47.6	This city is included in the list of depressed cities with a very high unemployment rate. The region boasts bauxite deposits and raw materials for the production of aluminium.
Zhitikara	44.1	This city hosts 12 gold mines, two chemical plants and produces 100% asbestos. Gold-bearing ore is also mined.
Lisakovsk	54.1	This city hosts Lisakovsky University of Rudnitsky Industrial Institute and 305 small and medium-sized businesses.
Rudny	55.7	Iron ore deposits have been discovered in the region. Rudny is a city of metallurgists and builders and is rich in architectural sights.
Zhanaozen	23.4	This city is oil rich, hosting an abundant population of oil workers.
Aksu	50.0	Coal deposits were discovered in the area of Lake Ekibastuz.
Ekibastuz	53.2	The primary industries of this city include coal mining, electricity generation and feraxico-aluminium production.
Kentauyu	35.7	This city includes brick factories, a building materials plant and a sewing and knitting factory and mines copper, lead and silver.

Source: composed by authors based on information from Agency for Strategic planning and reforms of the Republic of Kazakhstan Bureau of National statistics (2023).

Kazakhstan has 89 cities, 27 of which are single-industry towns with a combined population of 1.4 million. These cities produce about 40% of industrial products. Each of the 27 single-industry towns has different development prospects, from sustainable economic growth to deep stagnation. Some cities have managed to adapt to the market and have diversified their economies; however, overall imbalances in development are obvious. In this regard, Kazakhstan's Ministry of National Economy is developing a corresponding Roadmap, applying an integrated approach to the

development of single-industry towns and systematise and implement new policy measures. The Roadmap provides presents a unified list of state support measures for single-industry towns, comprehensive plans for socio-economic development, the creation of industrial zones and territories of advanced development and other measures.

Kazakhstan's single-industry towns have a significant role in the national economy. Some cities are regional centres, indicating the prevalence of this phenomenon in the country. The most common industries among single-industry towns include metallurgy, oil, coal mining and agriculture, which is generally consistent with the specialisations of the Republic of Kazakhstan in the international arena. However, it is immediately apparent that these circumstances may generate significant problems in the future related to the need for economic restructuring and diversification. It is essential to consider the individual components of the prospects for the development for each single-industry town in Kazakhstan, and the essence of entrepreneurial potential is that such large agglomerations with single-industry specialisation have significant industrial potential for creating and financing new projects due to the considerable number of related enterprises and concentrated resources (Bolter−Robey 2020, Najkar et al. 2020).

Notably, the number of single-industry towns in western countries is significantly lower than that in post-Soviet countries, which is due to the unique functioning of these states until the end of the twentieth century. Nevertheless, some cities are worth examining. One of the most famous among them is Detroit, for which the development features were considered in a study by McDonald (2013). This city was one of the main US car manufacturers and an industrial centre in general, but it fell into decline in the second half of the twentieth century due to the crisis in the American auto industry and the 1973 oil crisis, which led to the massive closure of factories, a decrease in the city's population and economic devastation in entire areas. McDonald noted that despite all the negative evidence of the future prospects of the city's development, the circumstances are not completely hopeless; however, but it will be exceedingly difficult for Detroit to recover and restore its economy. Thus, Detroit is a prime example of what the development of single-industry towns can lead to and why the state must find ways to avoid such outcomes. In addition, deindustrialisation caused population migration outflow from former northern industrial cities to southern regions in the US with high earnings. For example, following the decline of the steel industry in Pittsburgh, the state decided to invest in several areas, including healthcare, urban infrastructure, university construction and industrial ecology to save the city. As a result, the city has become one of the largest modern educational and medical centres in the US (Kulai 2019).

The future for the development of single-industry towns carries certain risks. The reason for this is that the currently dominating sectors of the economy are expected to become irrelevant over time. The reason behind this is attributable to the gradual

transition to post-industrial principles. Examples have been documented in history, the most striking of which is the destruction of mines in the UK, which continues to this day. This occurred during Margaret Thatcher's administration and was directly linked to the policies she implemented that led to rapid deindustrialisation, which were partially described in the research framework of Tomlinson (2021). In the UK, many cities had been established around the operation of mines, which the policies of the 1980s and 1990s systematically closed, reducing employment opportunities and economic activity in such regions, causing serious deterioration in the quality of life for local residents. Thus, the Kazakh authorities must consider how addressing the specialisation of single-industry towns can turn out and formulate plans to prevent such negative social consequences.

The development of single-industry towns is an important aspect of establishing an effective economy for many post-Soviet states. Such monocities simultaneously increase the level of private sector competitiveness, while remaining extremely vulnerable and completely dependent on the welfare of this area of activity or even a certain enterprise. The Russian Federation also faces social, economic, infrastructural and environmental challenges of single-industry towns. There is no legislation on the status of single-industry settlements (Gusev 2014). Russia's solution to the problems associated with single-industry towns include the implementation of regional and state development programmes to diversify their economies and eliminate dependence on city-forming enterprises. In 2014, the Government of the Russian Federation established a list of single-industry towns (Decree of the Government of the Russian Federation No. 1398-r dated 29 July, 2014), including 313 municipalities. These single-industry towns were divided into three categories depending on the degree of socio-economic deterioration, including those regarding the problems of functioning of the city-forming industry:

- seventy-five single-industry towns were classified as category 1, with the most difficult socio-economic circumstances;
- category 2 towns had existing risks of deterioration of the socio-economic circumstances, including 149 single-industry cities; and
- category 3, with stable socio-economic circumstances, included 89 single-industry towns.

Updating the list of single-industry towns is conducted at least once a year on the recommendation of the Ministry of Economic Development of the Russian Federation, considering changes in socio-economic circumstances. Associated enterprises primarily include forestry, food, fuel, light industry and mechanical engineering. Each of these cities depends on the city-forming enterprise that is related to more than 50% of the citywide volume of production. In addition, the taxes paid by the enterprise account for more than 20% of all taxes and fees received by the city budget.

Furthermore, multiple monocity cases in developed economies of Europe and Asia are found in which the single industry revitalised the regional economy. First, successful outcomes in Germany may be a useful reference for Kazakhstan. Large-scale population decline has coincided with the process of population ageing and population decline in Germany as a whole, and the supply of apartments in single-industry towns significantly exceeded demand, leading to significant empty housing. In response, the German government launched the 'Transformation of cities–East' programme, aiming to increase the attractiveness of large and small cities in East Germany. The programme provided support for the renovation of city centres to reduce the oversupply of apartments and revalue real estate in cities affected by population reduction (Vasyan 2013). Germany's experience in restructuring the economy of the Ruhr region, which specialises in the coal mining industry, is recognised as the most successful experience in regulating the development of single-industry towns. The German state programme for the revival of single-industry towns included increasing overall regulation of the industry, subsidised support for the coal industry, subsidies for coal consumers, determining the required coal production for the country and allocation of subsidies to support the unemployed population (Kulai 2019). The Ruhr region in Germany is one of the most frequently used examples of the successful transformation of single-industry towns (Starovoitov 2005).

The first signs of a systemic crisis in the Ruhr region appeared in the 1950s, when oil began to displace coal as the main fuel and energy resource. In 1970, with the onset of the metallurgical industry crisis, the strengthening of nuclear energy and intensive gasification, the Ruhr region began to experience depressive tendencies (Mikryukov 2016). The main cause of the crisis was the competition of cheaper energy-imported oil. Regional policy responses in Ruhr were insufficient. After some time, challenges also arose for steel industry enterprises. These combined circumstances led to stagnated economic development, which eventually evolved into depression and unemployment for a significant proportion of the population. Germany developed a complex 'neo-industrialisation' initiative to address this problem, which is focused on innovative development (Turgel−Ulyanova 2023). The first step was to support the coal industry by allocating subsidies and providing subsidies for coal consumption to maintain consumer demand for coal.

After adopting the law to rehabilitate the coal industry, the state determined the minimum required amount of coal mining, subsidies to released workers and the number of subsidies, and agreements were concluded between the state, the land authorities and coal mining owners. The state's determination of the required amount of coal established a stable demand for coal from consumers, including metallurgical plants and power plants. Coal mining enterprises were given the right to conclude long-term contracts for the supply of coal to consumers. The German government also introduced a special coal mining tax, the funds from which were allocated to the purchase of nationally produced coal instead of cheap foreign sources, which

stabilised coal sales in the country. This tax made it possible to reject buying imported, cheap coal in favour of coal produced in Germany. The main directions of economic restructuring in coal regions were modernisation of outdated industries, development of higher education, creation of technology centres based on high-tech industries and improvement of the environment. The modernisation conducted in Germany covered the majority of metallurgical and chemical plants and heavy machinery enterprises. Polluting production was abolished, product ranges were updated and territories were reduced. During this restructuring, all enterprises in the coal industry were merged into a single concern, called Rourkole.

The programme paid special attention to the financial support of measures to improve the environment, and industries that violated environmental standards were eliminated (Li−Zhuang 2022). During the renewal of the product range, the economies of single-industry towns were diversified, significantly altering the employment structure of the population of the Ruhr lands in Germany (Scott−Bennett 2015). These measures made it possible to avoid the collapse of coal production, decreased employment and increased unemployment. The German state also focused on the development of higher education. In particular, to address unemployment and migration, five new universities were opened (Storey−Hall 2018), creating technological centres and knowledge-intensive production facilities in the Ruhr region. The German state policy was based on overall financial support for the coal industry, the creation of high-tech centres and knowledge-intensive industries and the renovation of former industrial buildings and technological museums. The German authorities prevented serious problems in the coal industry and restructured the economy of the Ruhr region, relying on human capital through the development of the higher education system, including increasing the number of students and the number of educational institutions.

In France, following the Second World War, Territorial Reconstruction programmes were implemented to rehabilitate depressed territories and develop multi-profile industrial enterprises. For example, Ardennes, Lorraine and Alsace became central areas of the coal and metallurgical industries. Large-scale industrial construction was overseen under state leadership to modernise the economy of the whole country, and the state guaranteed private investors a return on investment of up to 25%. The French government established various institutions and state support programmes, the main focus of which was the development of cooperation between large organisations and SMEs, support of coal mining enterprises and development of innovative technologies. The French authorities succeeded in solving the problems of single-industry territories based on an awareness of the role of the state (Kulai 2019).

In another example, the problems of mono-industry regions affected the UK with a sharp jump in oil prices, particularly affecting old industrial regions. The UK authorities implemented measures to restructure and modernise key sectors of the

economy. The development of territories was an important aspect of state policy, about half of the industrial zones were restored and the remaining portion was restructured into residential and office accommodations. The state launched large-scale projects to advance the development of SMEs, including exports and external investment (UK Trade Investment). As a result, the share of SMEs in the UK's overall exports approached 40%. Local projects were also implemented in South Yorkshire (Kulai 2019).

In Asia, a national feature of Japan is the system of lifelong hiring of employees, according to which permanent employees of the company work for the same company until retirement. Consequently, the problems of single-industry towns are primarily on the shoulders of city-forming enterprises that bear the highest social responsibility. The main criterion for the successful diversification of Japanese single-industry towns was the close cooperation of companies' managers and local authorities. All the measures taken to create jobs, including the establishment of a significant number of innovative industries, technology parks and research centres to create innovative enterprises and the beginning of the production of goods and food exclusively for the employment of the majority of the population, which also attracted new companies. Furthermore, Australia has also successfully restructured single-industry towns specialising in mining. Mines the city of Tennant Creek were closed because of the depletion of coal reserves, leaving about 70% of its residents without work. To address this problem, the state began the construction of a railway to attract tourists and develop logistics, which led to successfully diversifying the structure of the city's economy (Kulai 2019). Finally, in South Korea, the government promoted innovation development to save single-industry towns (Sargidzhyan 2013).

This review demonstrates that each country chose a unique path for the development and protection of single-industry towns and these successful cases have special implications for Kazakhstan.

Theoretical analysis and hypothesis development on growth factors of single-industry town in Kazakhstan

One opportunity in the context of the entrepreneurial potential of single-industry towns in Kazakhstan is the development of SMEs. In regions where one or more industries have a major role in economic development, it can be difficult for many citizens to secure employment (Law 2014); thus, entrepreneurship can be their main source of income. Notably, such trends are extremely crucial for regional development and for the country as a whole, considering all the positive externalities of SME entrepreneurship, including mobility, creativity, increased competitiveness, diversification and other effects (Li et al. 2022). Therefore, we propose our first hypothesis.

H1: The development of small-medium-sized firms in the single-industry town spurs production outputs of the single-industry town.

The next consideration for the development potential of single-industry towns in Kazakhstan is the environmental component. Most of these cities are located in regions with a high risk of environmental degradation. In addition, a key aspect of the specialisations in single-industry towns is connected with heavy pollution. As noted previously, the most frequent industries in such regions include oil and gas, mining and coal. This suggests the relevance of the development of special state programmes to advance monocities' sustainable development and the relevance of factoring environmental pollution into the development of investment projects. However, the impact of environmental pollution on economic growth is rather vague as described in previous research (Kim et al. 2010, Alam et al. 2011, Ahmad−Du 2017). Thus, we offer the following hypothesis.

H2: The relationship between environmental pollution and single-industry towns' production output is uncertain.

Developing technological potential is crucial for Kazakhstan's single-industry towns because the industries in which most main enterprises specialise largely depends on technology, indicating that the state should prioritise the development of innovations to advance efficient functioning in these cities. This effect can be achieved through the organisation and support of research and development (R&D), support for existing projects through direct infusion of funds and the creation of more favourable conditions for the development of such initiatives. It is possible to cite real examples of the existing technological potential of Kazakhstan. For instance, in Temirtau metallurgical plants produce steel, ferrous and non-ferrous metal products and a pipe production plant uses high technological equipment, which allows these industries to successfully compete in the world market to ensure the sustainable economic development of the region (ArcelorMittal 2022, Temirtau Electrometallurgical Plant 2022). In Atyrau oil and gas industries are well-developed, and a significant number of oil refineries are located in the region, which employ the latest technologies to remain competitive on the international market. Notably, that the state authorities have prioritised the development of the innovative component across the country, which is embodied in the framework of the National Development Plan (2018) of the Republic of Kazakhstan until 2025. Pursuing these policies can be expected to achieve truly high-quality results in the long-term. Multiple studies have demonstrated the contribution of innovation to national economic growth and industry through the improvement of production efficiency (Gumus−Celikay 2015, Inekwe 2015, Sokolov-Mladenović et al. 2016, Vaisha et al. 2021). Thus, we propose the next hypothesis.

H3: R&D activities are positively associated with the production output of the single-industry towns.

The infrastructure of single-industry towns in Kazakhstan (i.e. road networks, energy systems and information and communications infrastructure) is at different stages of development depending on the region (Fazylova 2019); however, some common characteristics are shared. In particular, all monocities have a developed energy system, including thermal, hydroelectric and nuclear power plants, ensuring a stable supply of energy. Problems are most often associated with the quality of roads, airports and railway stations (Kongyrbay et al. 2017). Porter (1990) asserted that infrastructure is a crucial basic factor to enhance a nation's competitiveness, and one of the criteria of World Bank's Ease of Doing Business index is the stability of electricity supply. In this sense, basic infrastructure is a pivotal source of productivity, leading to our next proposed hypothesis.

H4: Infrastructure development is positively associated with single-industry towns' production output.

Single-industry towns in Kazakhstan also have a well-developed intellectual potential, based on the impressive number of educational institutions, scientific research centres and talented and qualified specialists. Nevertheless, the state should still pay more attention to improving the education system to advance the effective development of this component by examining foreign experience in more detail and identifying opportunities for its application. Many single-industry towns in Kazakhstan have significant potential in the field of education and science, including large universities and technical and engineering schools that provide a base for innovative projects. Some cities' institutions also have significant historical attractions and cultural and architectural heritage, that can also be useful for attracting tourists. Notably, the single-industry towns of Satpayev, Saran and Zhezkazgan host large research institutions and universities that develop high-quality personnel and can further attract talented scientists and entrepreneurs; however, they contend with certain problems in retaining talent. This results in a 'brain drain', with many highly qualified specialists departing single-industry towns in search of high-paying jobs and improved living conditions, which complicates the processes of achieving sustainable economic development. This calls for more active state initiatives in this area to reduce the occurrence and spread of brain drain, for which a considerable number of methods have been demonstrated in modern economic literature (Arrieta et al. 2017). The outflow of a high-level human capital is a critical factor of economic stagnation (Beine et al. 2003, Mba−Ekeopara 2012). Therefore, we present our final hypothesis.

H5: The reduction of educational institutions is negatively associated with the production output of single-industry towns.

Materials and methods

We construct the panel data for the period 2019–2022 for our empirical study. The list of 26 single-industry towns of Kazakhstan included in this study is presented in Appendix Table A1. The specification of econometric models in our study is as follows:

$$Ln(IP)_{it} = \beta_0 + \beta_1 Ln(SMEs)_{it} + \beta_2 Grw\_Eco_{it} + \beta_3 RnD_{it} + \beta_4 Ln(Infra)_{it} + \beta_5 Ln(Edu)_{it} + \gamma_i + \sigma_t + \varepsilon_{it} \quad (1)$$

$$Ln(IP\_pc)_{it} = \beta_0 + \beta_1 Ln(SMEs)_{it} + \beta_2 Grw\_Eco_{it} + \beta_3 RnD_{it} + \beta_4 Ln(Infra)_{it} + \beta_5 Ln(Edu)_{it} + \gamma_i + \sigma_t + \varepsilon_{it} \quad (2)$$

Table 2 presents detailed descriptions of variables employed in the study. All data are collected from a single source, the Agency for Strategic Planning and reforms of the Republic of Kazakhstan Bureau of National Statistics. To address the issue of non-normal distribution, we applied a logarithm to variables excluding those with negative or zero values in observations. As described in Appendix (Table A2), the variable inflation factor (VIF) of all our variables does not exceed the general threshold of 10 (Menard, 2002); therefore, multicollinearity is not considered to be an issue in our models.

Table 2

Variable definitions

Notation	Definition
i	A single-industry town in Kazakhstan (26)
t	Year (2019–2022)
γ_i	Cross-section effects
σ_t	Period effects
$Ln(IP)_{it}$	A log of volume of industrial production of a single-industry town (in constant, million tenge)
$Ln(IP\_pc)_{it}$	A log of per capital volume of industrial production of a single-industry town (in constant, tenge)
$Ln(SMEs)_{it}$	A log of number of registered small and medium enterprises per 1000 people
Grw_Eco_{it}	The growth rate of expenditure on water supply; collection, processing and disposal of waste and activities to eliminate pollution
RnD_{it}	The number of organisations conducting R&D work per 1000 people
$Ln(Infra)_{it}$	Total area of commissioned residential buildings per 1000 people (in square metres)
$Ln(Edu)_{it}$	A log of the number of educational institutions (schools, colleges, universities) per 1000 people
ε_{jt}	Error term

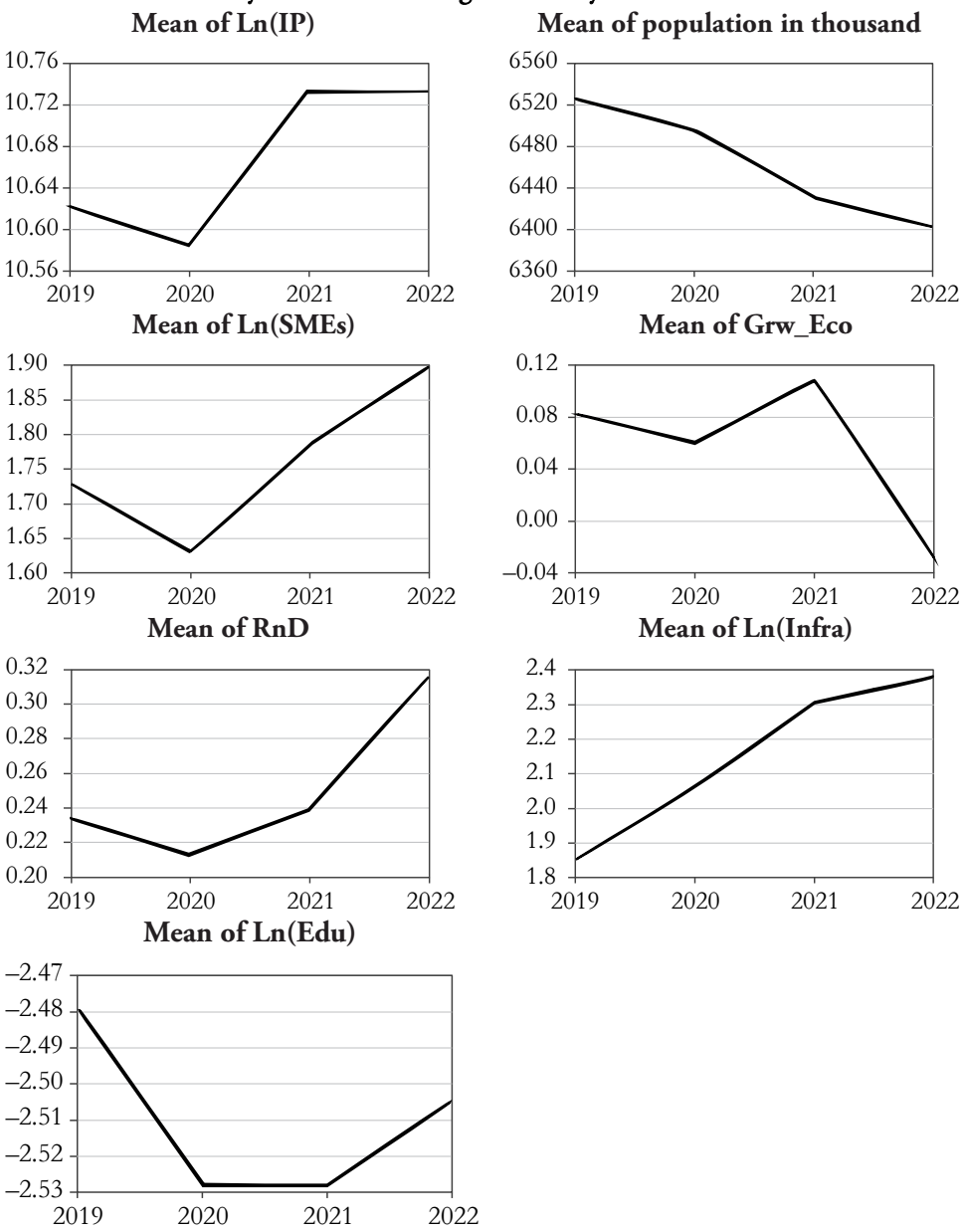
Note: nominal values are converted to real values by applying the deflator (2015 = 100).

Figure 1 illustrates the dynamics of variables from 2019 to 2022. The mean of Ln(IP) dropped in 2020 but recovered afterwards. The population (in 1000) mean shows a continuous decreasing slope during the period. The Ln(SMEs) mean demonstrated decreasing tendencies from 2019 to 2020 but began climbing again afterwards. The trajectory of Grw_Eco fluctuates, confirming H2. The mean of RnD

decreased slightly in 2020 but recovered a growing tendency thereafter, validating H3. The mean of Ln(Infra) showed a growing tendency that peaked in 2022. The mean of Ln(Edu) fluctuates, peaking in 2019, severely decreasing in 2020 and showing a recovering tendency thereafter but still not achieving the 2019 level.

Figure 1

Variable dynamics in 26 single-industry cities in Kazakhstan



We adopt fixed effects (FE) and random effects (RE) as a baseline model, and our model showed better fitness for FE considering the R-squared value. For heteroskedasticity, which is an unequal distribution of the residuals, we apply an ordinary least squares (OLS) estimator without FE. For a more accurate estimation, we further apply the cross-section fixed effects with a cross-section GLS weights (FE–GLS) estimator. In addition, although independent variables are transformed to be exogenous to the dependent variable, potential endogeneity remains. A common approach for resolving endogeneity is to use instrumental variables, in which a third variable is introduced. We apply a two-stage least squares (2SLS) estimator, introducing lagged independent variables as instrument variables.

Results

Table 3 presents the regression results, revealing that Ln(Infra) is positively correlated with Ln(IP) and its statistical significance (1% level) remains consistent in all eight models, supporting H4. If the total area of commissioned residential buildings per 1000 people is increased, it will raise the volume of industrial production of a single-industry town. Ln(Edu) is also positively associated with Ln(IP) and its statistical significance (1% level) is consistent across all eight models, supporting H5, implying that building more educational institutions (schools, colleges, universities) will have a positive impact on the volume of industrial production of a single-industry town. Conversely, the impact of other variables is found to be insignificant.

Table 3

Regression results of baseline estimations

Dependent variable models	Ln(IP)				Ln(IP_pc)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FE	FE	RE	RE	FE	FE	RE	RE
Ln(SMEs)	−0.03	−0.04	−0.04	−0.04	−0.02	−0.02	−0.02	−0.02
	(0.07)	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)	(0.06)
Grw_Eco	−0.09	−0.10	−0.11	−0.11	−0.10	−0.11	−0.11	−0.11
	(0.10)	(0.11)	(0.10)	(0.10)	(0.11)	(0.11)	(0.30)	(0.10)
RnD	−1.03	−1.20	−0.69	−0.69	−0.47	−0.63	−0.43	−0.45
	(1.81)	(1.88)	(1.75)	(1.64)	(1.84)	(1.92)	(1.70)	(1.65)
Ln(Infra)	0.24***	0.21***	0.21***	0.21***	0.25***	0.23***	0.21***	0.21***
	(0.07)	(0.08)	(0.07)	(0.06)	(0.07)	(0.08)	(0.06)	(0.06)
Ln(Edu)	1.12***	1.14***	0.42***	0.42***	1.32***	1.35***	0.94***	0.94***
	(0.32)	(0.33)	(0.20)	(0.19)	(0.33)	(0.34)	(0.14)	(0.13)
Constant	13.04***	13.18***	11.38***	11.36***	15.30***	15.45***	14.44***	14.44***
	(0.84)	(0.88)	(0.91)	(0.84)	(0.85)	(0.90)	(0.59)	(0.56)
Obs.	104	104	104	104	104	104	104	104
Cross-section effect	yes	yes	yes	yes	yes	yes	yes	yes
Period effect	no	yes	no	yes	no	yes	no	yes
r2_a	0.97	0.97	0.15	0.15	0.99	0.99	0.48	0.48

Note: standard errors are in parentheses; * p < 0.1, ** p < 0.05 and *** p < 0.01.

Table 4 presents the results of FE–GLS and 2SLS, which are almost the same as the baseline models. The positive impacts of Ln(Infra) and Ln(Edu) are quite clear, although Ln(infra) lost its statistical significance exclusively in model (4). Other variables, Ln(SMEs), Grw_Eco and RnD present inconsistent statistical significance in some models, indicating uncertain the relationships with the dependent variable.

Table 4

Regression results of FE–GLS and 2SLS estimations

Dependent variable models	Ln(IP)		Ln(IP_pc)	
	(1)	(2)	(3)	(4)
	FE–GLS	2SLS	FE–GLS	2SLS
Ln(SMEs)	−0.03	−0.29***	−0.02	−0.10
	(0.03)	(0.11)	(0.03)	(0.11)
Grw_Eco	−0.10***	0.12	−0.10***	−0.83
	(0.04)	(1.97)	(0.05)	(2.02)
RnD	0.24	−9.90***	0.33	−4.92***
	(0.67)	(2.42)	(0.74)	(2.47)
Ln(Infra)	0.19***	0.13***	0.23***	0.05
	(0.04)	(0.07)	(0.04)	(0.08)
Ln(Edu)	0.61***	0.36***	0.99***	1.10***
	(0.23)	(0.13)	(0.22)	(0.13)
Constant	11.84***	12.09***	14.50***	15.53***
	(0.61)	(0.58)	(0.61)	(0.60)
Obs.	104	78	104	78
r2_a	0.99	0.28	1.00	0.79

Note: standard errors are in parentheses; * $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.

Discussion

We next discuss the important factors for promoting the productivity of single-industry towns in Kazakhstan drawn from the regression analysis. Infrastructure development is found to be a crucial factor for increasing productivity, supporting the argument of the Porter (1990) hypothesis that infrastructure is an essential basic factor for enhancing competitiveness of a nation. One of the critical methods to develop infrastructure is to attract foreign direct investment (FDI) (Sader 2000). In reality, multiple Russian firms relocated to Kazakhstan following the sanctions on Russia, while many foreign companies in Russia also seriously considered moving their headquarters to Kazakhstan from Russia. Thus, the government should develop and implement FDI-conducive policies such as tax cuts, administrative services and other attractive benefits. In addition, securing high-quality local human resource is an important task to diversify single-industry towns in Kazakhstan, which is aligned with previous studies by Beine et al. (2003) and Mba–Ekeopara (2012). To prevent brain drain, the government should collaborate with the private sector to revise and restructure the nation's entire employment system in an efficient way; for instance,

targeting tax incentives, creating high-wage jobs, introducing policies to prevent women's mid-career breaks and improving the overall education system.

While the role of entrepreneurship in the industrial growth of single-industry towns in Kazakhstan is found to be insignificant at the current time, this finding contradicts previous studies, i.e. Audretsch et al. (2015), Law (2014) and Li et al. (2022). The impact of R&D activities on single-industry towns' industrial growth is also difficult to define in our study, unlike the previous research findings, including Gumus–Celikay (2015), Inekwe (2015) and Sokolov-Mladenović et al. (2016). The results can be partially explained by the power of entrepreneurial potential and R&D activities differing depending on some factors such as population density, which indicates the increasing influence of economic agglomeration. It seems that the impact of entrepreneurship and R&D should be examined in a follow-up study in interaction with other variables. In addition, the impact of entrepreneurship can differ depending on state support for business (Taneo et al. 2022), the level of internationalisation and technology-absorption capabilities (Aguilar 2022). This suggests that the establishment of SMEs alone may not produce results for the economy; however, continuous government financing and enhancement of regional competitiveness is required until SMEs can contribute to the local and national economy by creating enough jobs, spill-over effects and other benefits.

In contrast, as indicated in H1, the main component of the specialisation of single-industry towns in Republic of Kazakhstan is connected with high pollution and our results show no clear relationship between the ecology expenditure and industrial output. However, the environmentally friendly policy becomes generally supported, as such policies should be strengthened with a long-term aspect for the economic development (Jaber 2022). Some European countries impose an obligation on producers to collect waste and restrict trades with environmentally unfriendly enterprises (e.g. While swan in the Northern Europe). In this sense, environmentally unfriendly policies might reduce economic opportunities with other countries in the long-term.

Conclusion

This study explored main factors to develop productivity of single-industry towns in Kazakhstan based on panel data for the period 2019–2022. We constructed our econometric model, including entrepreneurial, environmental, technological, infrastructural and intellectual factors based on a literature review to examine 26 monocities. The findings revealed that improving infrastructure and securing quality local human resources are main factors to promote productivity in Kazakhstan's single-industry towns. In contrast, entrepreneurship, environmental expenditure and R&D activities were not found to significantly influence the productivity of the single-industry towns in Kazakhstan.

In general, single-industry towns in Kazakhstan have a significant potential to improve economic and social conditions; however, this will require the effort of local managers of the primary main enterprises in these regions and the state, whose policies should promote the development of single-industry towns. Collaborative public–private efforts should be focused primarily on improving infrastructure and securing quality local human resources. Such actions could prevent the single-industry towns of the country from experiencing the trajectory of those in modern developed countries. Some cities will require significant investment to modernise infrastructure and improve citizens' quality of life, and although the state has implemented a few initiatives to address some infrastructural challenges, more must be done before such policies can be considered successful. These efforts will have a positive impact on the economic development of single-industry towns and significantly improve social development. It is highly recommended to implement policies to attract FDI to advance infrastructure development. In addition, the government should develop policies to enhance the working environments in single-industry towns in Kazakhstan to prevent brain drain. Many highly qualified specialists currently depart single-industry towns in search of high-paying jobs and improved living conditions, which complicates the processes of achieving sustainable economic development. More active state activities in this area are extremely necessary to reduce the spread of brain drain. Once again, the government can collaborate with the private sector to efficiently restructure the employment system.

Notably, the variables R&D, SMEs and ecology were found to be insignificant; however, we cannot easily disregard these variables, as they are central components of economic growth. As noted in the discussion above, we posit that these variables do not directly contribute on productivity growth of monocities in Kazakhstan due to their development stage. To elaborate, the power of entrepreneurial potential and R&D activities may differ depending on such factors as population density, suggesting the influential role of economic agglomeration. Furthermore, the positive impact of entrepreneurship could be realised through state support for business development; thereby, the establishment of SMEs alone may not produce results for the economy, but strategic governmental financing is required until SMEs contribute to the local economy by creating enough jobs, spill-over effects and other benefits. Also, multiple industries in monocities in Kazakhstan directly pollute the environments; however, the environmental Kuznets curve (EKC) explains that the environment is degraded in the initial stage of economic growth, and when economic growth reaches a certain threshold, pollution decreases (Kuznets 2019). Consequently, the results can be attributed to the economic development stage of the monocities in Kazakhstan, and it can be expected that securing the environment will become a significant consideration as productivity advances.

Considering the limited number of studies regarding productivity in single-industry towns in Kazakhstan, the results in this study can be used as a stepping stone to further develop this line of research. Once enough empirical evidence is

accumulated, researchers will be able to investigate various new arising factors in the society. For instance how firms' digitalisation or environmentally friendly activities (measured by corporate social responsibility, environment information disclosure and related indicators) influence the productivity of single-industry towns. In addition, some effects can be re-estimated in various ways, upon the availability of new datasets. For instance, we measured R&D effects using the number of organisations; however, this variable can be estimated using different proxies in follow-up studies such as R&D expenditure ratio, the number of patent applications or awarded patents and other common measures. Moreover, as categories of datasets are diversified, measuring the interaction of the variables used in this study with other new variables can be expected to provide meaningful insights. The effect of environmental variables should also be re-estimated after the productivity of monocities in Kazakhstan reaches viable growth to investigate the feasible application of the EKC hypothesis.

To conclude, despite the above limitations, our study has relevant policy and managerial implications. To achieve direct productivity growth in the short-term, the government should focus on improving infrastructure and preventing brain drain as the first priority. After reaching a certain level of productivity, the government can expand policies to include the promotion of R&D, entrepreneurship and environmental protection measures with long-term aspects as it remains unclear whether the effects of these variables will be significant for productivity development since it depends on the development level of productivity and other related factors. The effects of these variables must be re-examined in follow-up studies as more time-series are accumulated and categories of datasets are expanded.

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Appendix

Table A1

List of the single-industry towns in Kazakhstan included in this study

1.Abay; 2. Aksai; 3. Aksu; 4. Altai; 5. Arkalyk; 6. Ekibastuz; 7. Karajal; 8. Karatau; 9. Kentau; 10. Khromtau; 11. Kulsary; 12. Kurchatov; 13. Lisakovsk; 14. Ridder; 15. Rudny; 16. Saran; 17. Satpaev; 18. Serebryansk; 19. Shakhtinsk; 20. Stepnogorsk; 21. Tekeli; 22. Temirtau; 23. Zhanaozen; 24. Zhanatas; 25. Zhezkazgan; 26. Zhitikara

Note: Balkhash is excluded in our study as some of its data are not available.

Table A2

VIF tests applying OLS

Ln(SMEs)	Grw_Eco	RnD	Ln(Infra)	Ln(Edu)
2.458196	1.092881	1.200976	2.007606	3.622259

REFERENCES

AGUILAR, E. C. (2022): Regional systems of entrepreneurship in 2017–2018: An empirical study in selected regions of South America *Regional Statistics* 12 (1): 51−76. https://doi.org/10.15196/RS120103

AHMAD, N.−DU, L. (2017): Effects of energy production and CO_2 emissions on economic growth in Iran: ARDL approach *Energy* 123: 521−537. https://doi.org/10.1016/j.energy.2017.01.144

ALAM, M. J.−BEGUM, I. A.−BUYSSE, J.−RAHMAN, S.−VAN HUYLENBROECK, G. (2011): Dynamic modeling of causal relationship between energy consumption, CO_2 emissions and economic growth in India *Renewable and Sustainable Energy Reviews* 15 (6): 3243−3251. https://doi.org/10.1016/j.rser.2011.04.029

AUDRETSCH, D. B.−BELITSKI, M.−DESAI, S. (2015): Entrepreneurship and economic development in cities *The Annals of Regional Science* 55 (1): 1−31. https://doi.org/10.1007/s00168-015-0685-x

BEINE, M. A.−DOCQUIER, F.−RAPOPORT, H. (2003): Brain drain and LDCs' growth: winners and losers *Economic Journal* 118 (528): 515−843.

BOLTER, K.−ROBEY, J. (2020): *Agglomeration economies: a literature review* The Fund for our Economic Future (FFEF), Cleveland.

BOZHKO, L. L. (2017): Government support for monotowns in the Republic of Kazakhstan *R-Economy* 3 (1): 1-11. http://dx.doi.org/10.15826/recon.2017.3.1.001

FAZYLOVA, Z. (2019): Problems and prospects of infrastructure and innovative development of Kazakhstan *International Journal of Engineering and Management Research* 9 (3): 7−10. http://dx.doi.org/10.31033/ijemr.9.3.2

GUMUS, E.−CELIKAY, F. (2015): R&D expenditure and economic growth: new empirical evidence *Margin: The Journal of Applied Economic Research* 9 (3): 205−217. http://dx.doi.org/10.1177/0973801015579753

GUSEV, V. V. (2014): *Monoprofile settlements (monocities): foreign experience solving social problems* (No. gus3).

INEKWE, J. N. (2015): The contribution of R&D expenditure to economic growth in developing economies *Social Indicators Research* 124 (3): 727−745. http://dx.doi.org/10.1007/s11205-014-0807-3

JABER, M. M. (2022): Analysis of selected economic factor impacts on CO_2 emissions intensity: A case study from Jordan, 1990–2015 *Regional Statistics* 12 (1): 193−208. https://doi.org/10.15196/RS120101

JUNUSSOVA, M.−BEIMISHEVA, A. (2020): Monotowns of Kazakhstan: Development challenges and opportunities. In: KOULOURI, A.−MOURAVIEV, N. (eds.): *Kazakhstan's developmental journey: Entrenched paradigms, achievements, and the challenge of global competitiveness* pp. 211−247., Springer Nature.

KIM, S. W.−LEE, K.−NAM, K. (2010): The relationship between CO_2 emissions and economic growth: The case of Korea with nonlinear evidence *Energy Policy* 38 (10): 5938−5946. https://doi.org/10.1016/j.enpol.2010.05.047

KIREYEVA, A. A.−NURLANOVA, N. K.−KREDINA, A. (2022): Assessment of the socio-economic performance of vulnerable and depressed territories in Kazakhstan *R-ECONOMY* 8 (1): 21−31. https://doi.org/10.15826/recon.2022.8.1.002

KONGYRBAY, A. R.–DUISEN, G. M.–SPANKULOVA, L. (2017): Analysis of Kazakhstan's transport infrastructure in the context of the silk road economic belt development *Journal of Applied Economic Sciences* 12 (7): 2050–2060.

KOZBAGAROVA, N. Z.–TAMARA, B. Y. (2022): Role of architectural and landscape means in increasing the artistic potential of the urban environment of monocities in Kazakhstan *Urban construction and architecture* 12 (3): 143–148. https://doi.org/10.17673/Vestnik.2022.03.20

KULAI, S. V. (2019): Foreign experience of modernization and restructuring of the economy of single-industry towns *Public administration. Electronic Bulletin* (73): 224–248.

KUZNETS, S. (2019): Economic growth and income inequality. In: SELIGSON, M. A.: *The gap between rich and poor* pp. 25–37., Routledge.

LAW, K. (2014): *Unemployment and the creation of micro and small enterprises* University of Malaysia, Kota Samarahan.

LI, W.–LIU, Z.–XIA, S.–YAN, J.–XIONG, Y.–SAKKA, G.–LI, R. Y. (2022): How can emerging-market SMEs domestically benefit from their performance in developed countries? Empirical evidence from China *Journal of Business Research* 142: 200–210. https://doi.org/10.1016/j.jbusres.2021.12.058

Li, X.–ZHUANG, X. (2022): Eco-city problems: industry–city–ecology, urbanization development assessment in resource-exhausted cities *Sustainability* 15 (166): 1–22. https://doi.org/10.3390/su15010166

MAIMURUNOVA, A.–KAZBEKOV, T.–MYRZABEK, Z.–SHUGAIPOVA, Z.–SAPAROVA, B.–ZHUGUNISSOVA, Z. (2022): Problems of sustainable development of single-industry towns. Example of Karaganda region *Journal of Environmental Management & Tourism* 13 (3): 707–720.

MBA, P. N.–EKEOPARA, C. (2012): Brain drain: implication for economic growth in Nigeria *American Journal of Social Issues and Humanities* 2 (2): 41–47.

MCDONALD, J. F. (2013): What happened to and in Detroit? *Urban Studies* 51 (16): 1–21. https://doi.org/10.1177/0042098013519505

MENARD, S. (2002). *Applied logistic regression analysis* (No. 106). Sage Publications.

MIKRYUKOV, N. YU. (2016): *Факторы, проблемы и модели развития моногородов России* [PhD dissertation].

NAJKAR, N.–KOHANSAL, M. R.–GHORBANI, M. (2020): Impact of industrial agglomeration on productivity: evidence from Iran's food industry *Chinese Geographical Science* 30: 309–323. https://doi.org/10.1007/s11769-019-1087-2

NURGALIEVA, A.–KARIMBERGENOVA, M.–MOLDASHBAYEVA, L.–KASHUK, L.–SOLTAN-GAZINOV, A.–JRAUOVA, K. (2019): Sustainable development of single-industry towns as a factor of economic stabilization *Reports of the National Academy of sciences of the Republic of Kazakhstan* 5 (327): 162–170.

PORTER, M. E. (1990): *The competitive advantage of nations* Palgrave Macmillan, London.

RAKHMETOVA, R.–ZHAKENOVA, K.–ISSABEKOV, N.–ANDEKINA, R.–TAZABEKOVA, A. (2018): The development potential of the cities in the Republic of Kazakhstan *Theoretical and Empirical Researches in Urban Management* 13 (4): 56–72.

ROHNER, T. (2021): The second life of the Monotown: questioning narratives of failed Soviet urban modernity in contemporary Kazakhstan. In: SCHMIDT, M.–STEENBERG,

R.–SPIES, M.–ALF, H. (eds): *Beyond post-soviet: layered legacies and transformations in Central Asia* Vol. 1., pp. 64–74., Institut für Geographie, Universität Augsburg.

SADER, F. (2000): *Attracting foreign direct investment into infrastructure: why is it so difficult?* (Vol. 12). World Bank Publications, Washington.

SARGIDZHYAN, M. S. (2013): Analysis of foreign experience of modernization economy of monoprofile city *Audit and Financial Analysis* (2): 404–406.

SCOTT, R.–BENNETT, E. (2015): Branding resources: extractive communities, industrial brandscapes and themed environments *Work, employment and society* 29 (2): 278–294.

SOKOLOV-MLADENOVIĆ, S.–CVETANOVIĆ, S.–MLADENOVIĆ, I. (2016): R&D expenditure and economic growth: EU28 evidence for the period 2002–2012 *Economic research-Ekonomskaistraživanja* 29 (1): 1005–1020.

STAROVOITOV, V. G. (2005): *Формирование современной стратегии развития малых городов* [PhD dissertation].

STOREY, K.–HALL, H. (2018): Dependence at a distance: labour mobility and the evolution of the single industry town *The Canadian Geographer/Le Géographe canadien* 62 (2): 225–237. https://doi.org/10.1111/cag.12390

TANEO, S. Y. M.–NOYA, S.–MELANY, M.–SETIYATI, E. A. (2022): The role of local government in improving resilience and performance of small and medium-sized enterprises in Indonesia *Journal of Asian Finance, Economics and Business* 9 (3): 245–256. https://doi.org/10.13106/jafeb.2022.vol9.no3.0245

TAYLOR, A. (2020): Disasters and demographic change of 'single-industry' towns – Decline and resilience in Morwell, Australia. In: KARÁCSONYI, D.–TAYLOR, A.–BIRD, D. (eds.): *The demography of disasters: impacts for population and place* pp. 125–151., Springer, Cham. https://doi.org/10.1007/978-3-030-49920-4_7

TOMLINSON, J. (2021): Deindustrialisation and 'Thatcherism': moral economy and unintended consequences *Contemporary British History* 35 (4): 620–642. https://doi.org/10.1080/13619462.2021.1972416

TURGEL, I. D.–BOZHKO, L. L.–XU, L. (2016): Government support of single-industry towns in Russia and Kazakhstan *Finance: Theory and Practice* 20 (2): 22–32.

TURGEL, I. D.–ULYANOVA, E. A. (2023): Comparative analysis of the role of second-tier cities in the development of European countries and Russia *Regional Studies, Regional Science* 10 (1): 604–624. https://doi.org/10.1080/09654313.2022.2110377

VAISHA, A.–STASTNA, M.–ZAPLETALOVA, J. (2021): Small industrial towns in Moravia: a comparison of the production and post-productive eras *European Planning Studies* 31 (8): 1776–1796.

VASYAN, R. I. (2013): *Совершенствование политики занятости населения в моногородах Российской Федерации* [PhD dissertation].

INTERNET SOURCES

AGENCY FOR STRATEGIC PLANNING AND REFORMS OF THE REPUBLIC OF KAZAKHSTAN BUREAU OF NATIONAL STATISTICS (2023): https://old.stat.gov.kz/region/247783/dynamic (downloaded: May 2023)

ARCELORMITTAL (2022): https://www.arcelormittal.kz/index.php?id=10&pr=19 (downloaded: March 2023)
TEMIRTAU ELECTROMETALLURGICAL PLANT (2022): https://temk.kz/ (downloaded: May 2023)
WORLD BANK: https://archive.doingbusiness.org/en/doingbusiness (downloaded: April 2022)

LAWS/LEGAL RULES

Law of the Republic of Kazakhstan "On architectural, urban planning and construction activities in the Republic of Kazakhstan". (2001): https://adilet.zan.kz/rus/docs/Z010000242 (downloaded: March 2023)
Law of the Republic of Kazakhstan "On environmental protection". (2006): https://online.zakon.kz/Document/?doc_id=1008107 (downloaded: March 2023)
Law of the Republic of Kazakhstan "On local government and self-government in the Republic of Kazakhstan". (2001): https://adilet.zan.kz/rus/docs/Z010000148 (downloaded: March 2023)
On approval of the Action Plan for the implementation of the State Program for Industrial and Innovative Development of the Republic of Kazakhstan for 2015–2019. (2014): https://adilet.zan.kz/rus/docs/P1400001159 (downloaded: March 2023)
On approval of the National Development Plan of the Republic of Kazakhstan until 2025 and invalidation of some decrees of the President of the Republic of Kazakhstan (2018): https://adilet.zan.kz/rus/docs/U1800000636 (downloaded: March 2023)