DIVERSIFICATION AS A FACTOR IN THE EFFICIENT ECONOMIC DEVELOPMENT OF THE REPUBLIC OF SAKHA (YAKUTIA), RUSSIA

Anatoliy A. Popov, Tamara A. Karataeva, Elena V. Danilova, Anatoliy N. Myreev, Valentina V. Sergeeva
North-Eastern Federal University named after M.K. Ammosov, Yakutsk, Russia

ABSTRACT

This article empirically substantiates an approach to the diversification of the regional economy of the Republic of Sakha (Yakutia). The authors used data samples for all Russian regions to determine cause-and-effect relationships between the development indicators of the mining, manufacturing, and construction industries. The authors applied regression analysis and the VAR-model to assess the impact of the diversification of the regional economy on the gross regional product regarding the manufacturing, mining, and construction sectors. The obtained results proved the feasibility of diversifying the regional economy for its stable economic development, especially in the long term. This paper presents a universal approach to assessing the region's long-term economic development through the diversification of its economy.

Keywords: Russia, Yakutia, economic diversification, regional economy, gross regional product, construction, manufacturing, mining

DOI: http://dx.doi.org/10.15549/jeecar.v9i2.915

INTRODUCTION

The Republic of Sakha (Yakutia) is one of the largest mineral, raw materials, and mining regions of the Russian Federation, with a total area of 3.1 million square kilometers. Yakutia has one of the best rates of economic development among Siberian regions. It is in the top ten Russian regions regarding fixed-assets investment (Territorial Authority of the Federal State Statistics Service for the Republic of Sakha (Yakutia), 2022). The basis of the socio-economic development of Yakutia is mining, with the emphasis on the extraction of gold, diamonds, antimony, oil, gas, and coal. Over the period from 2016 to 2020, the mining industry generated 47-51% of the region's gross value added (Territorial Authority of the Federal State Statistics Service for the Republic of Sakha (Yakutia), 2022). In Yakutia, the diamond industry accounts for more than half of industrial production, about two-thirds of tax revenues to the state budget, and the largest share of the region's export products (Investment Platform of Russian Regions, 2022). At the end of 2020, Russia accommodated the world's largest producer of natural diamonds (29% of world production) (Kimberley Process, 2022). About 99% of Russia's production takes place in Yakutia (Russian Auction House, 2022). This indicates the great importance of the mining industry in this region, not only for Russia but also for the whole world.

In 2020, during the spreading COVID-19 pandemic and lockdown, the diamond market suffered one of the most substantial shocks, with jewelry sales in some regions reducing by 97% (Oil and Capital, 2021a). This could not but affect the economy of Yakutia: that year was

one of the most challenging periods for the region's economy (Vasiljeva et al., 2020). The leading diamond producer, ALROSA, suspended work at many mines with high production costs and low profitability. In 2021, sales of rough diamonds decreased by more than 26%. However, the profitability of this industry in Yakutia began to decline even before the pandemic due to the trade war between the U.S. and China, and in the first half of 2019, it fell by 38% at an annual rate (Financial Times, 2022). The priority strategy for the development of the mining industry implied increasing prices in the context of declining demand, which remains quite high in all key global markets. Another global problem for the Yakutia's mining industry was the depletion of rough and polished reserves, which, according to experts, will be completely exhausted by 2047 (Financial Times, 2022; Israel Diamond Institute, 2021). This prevents mining companies from increasing production, which will negatively affect Yakutia's economy. Experts believe that only oil and gas production may diversify the region's economy. At present, the Russian Federation possesses 34 deposits in Yakutia with the reserves in C1+C2 categories, of which: natural gas – 2,716 billion cubic meters, and oil – 546 million tons (recoverable) (Oil and Capital, 2021b). The largest Russian companies Surgutneftegaz and Rosneft work in the region, currently producing about 16 million tons of oil with the prospect of increasing production volumes (Oil and Capital, 2021a). Due to the unprecedented collapse of the diamond market in 2020, it could have been catastrophic, but the risks for the regional economy were offset mainly by the oil and gas sector. However, as practice shows, this cannot solve the existing problems of the regional economy. First, experts assume that the geological resources of Yakutia estimate 12 trillion cubic meters of gas and 2.6 billion tons of oil. At present, on average, the development of predictive resources in the republic is about 20% (Territorial Authority of the Federal State Statistics Service for the Republic of Sakha (Yakutia), 2022). Therefore, the significant resource potential of the region, along with low exploration, implies the great potential for geological exploration and discovery of new deposits, including large and unique ones. At the same time, this would require significant expenditures for exploration and development, as well as a great amount of time. In other words, experts do not expect economic returns from potential geological reserves in the near future.

Second, during the pandemic, the high volatility of prices for energy resources seriously hinders the stable economic development of Yakutia. What is more, the world is transferring to the concept of a low-carbon economy, so reliance on the oil and gas sector may be a wrong strategy. Still, most of the exports in the region accrue to raw materials (about 95% of the total volume of regional exports) (Russian Export Center, 2020), while the current prevailing trends require urgent diversification of Yakutia's economy.

In this research, we assessed the prospects for the economic development of Yakutia within the existing economic structure (that is, we analyzed the threats of the resource curse for the economy of the region). In addition, we studied how the diversification of the economy might affect the region's development. We believe that the alternative sectors for diversifying the region's economy are manufacturing and construction. We assessed the effectiveness of investments in these industries compared to mining and its impact on the growth of the regional gross product in the short, medium, and long term.

LITERATURE REVIEW

Scientists often addressed the problem of the resource curse or, as it is sometimes called, the paradox of resource abundance. It is usually considered within the theory of the destructive impact of significant mineral reserves on the economic growth of countries (Li et al., 2021; Yang et al., 2021; Oduyemi et al., 2021). Most papers examined the impact of oil reserves, other non-renewable hydrocarbons, and their processing on the economic development of these countries (Yang et al., 2021). Recently, more and more experts focused on the ability of countries with resource economies to achieve sustainable development goals (Oduyemi et al., 2021).

Most studies examined the impact of resource abundance on economic growth and the causes of the resource curse. Using the example of various countries, scientists concluded that natural resources affect the economy in three different ways: current abundance has a positive effect on economic growth, for instance, in Saudi Arabia, Angola, and Nigeria (Arshad & Tahir, 2021). The situation is the opposite in Australia, Canada, and Botswana, where resource endowment has

a dampening effect on economic development (Jakob, 2010; Li et al., 2021). In the third group of countries, the availability of resources does not affect their economic growth (Ibrahim, 2017). Here one can mention such countries as Singapore, Korea, Taiwan, and Hong Kong, which achieved economic growth, although they do not possess large mineral reserves (Sharif et al., 2021).

There are two types of economic diversification of a region: related and unrelated (Edwards, 2019). Definitely, from the perspective of evolution, related diversification is the most characteristic phenomenon for regions. It implies using the local potential of resources, technologies, and territories while expanding the focus of economic activity (Martínez-Campillo, 2016). Unrelated diversification involves creating an entirely new type of economic activity that implies new opportunities, and it is not connected with regional activities. Unrelated diversification is a more complex form of increasing the economic specialization of a region and is less common in modern conditions (Tatarkin, 2013). It requires the development of innovative technologies, a new highly qualified workforce, significant financial resources, and a progressive institutional basis that can ensure the development of a new specialization of the region (Edwards, 2019; Degtyareva et al., 2013; Ng, 2017).

There is no definite answer which of the models is the most effective for ensuring the economic growth and achieving the stability of the region's economy. As experts note, more knowledge intensive regions with liberal market institutions opt for unrelated diversification, while regions with coordinated market institutions based on cooperation and smaller role of direct competition tend to choose related diversification of the economy (Edwards, 2019; Martínez-Campillo, 2016). At the same time, there has been no comprehensive research into the impact of their effects on the economic growth in the region and the comparative advantages of related and unrelated diversification. The lack of studies is the most obvious in the regions with a resource economy, one of which is the Republic of Sakha (Yakutia).

Having analyzed the conceptual approaches to assessing the impact of resource abundance and the possible types of diversification of the region's economy, we assumed that in modern conditions when an economy focuses on minerals, underdevelopment of knowledge-intensive economy and innovation, narrowly specialized labor resources, and harsh climatic conditions, related diversifications are the best option for Yakutia. It will contribute to the fastest expansion of the region's advantages and increase specialization. Our study used empirical methods to justify the most appropriate ways to diversify Yakutia's economy and considered the mining and construction industries as unrelated and related economic diversification options.

METHODOLOGY

We considered manufacturing and construction as alternative sectors capable of diversifying the region's economy. After mining, construction has the largest share in the gross regional product of Yakutia (8-10% over the period from 2016 to 2020). This means that now, this sector has the greatest development potential for the region. Manufacturing is the most promising economic sector globally in terms of Industry 4.0 and 5.0.

We built models for assessing the prospects for the economic development of Yakutia through mining, construction, and manufacturing, using annual values of indicators (Table 1) for all Russian regions for the period from 2010 to 2020 (Territorial Authority of the Federal State Statistics Service for the Republic of Sakha (Yakutia), 2022; Federal State Statistics Service, 2022). We included the data for other regions (not only Yakutia), namely, comparable indicators for such sectors of the economy as mining, construction, and manufacturing, as we had to consider different options in the economic structure and provide a representative sample. This is why we did not use data from other countries. We forecasted the possible development of the region for the next 20 years. This time range was chosen because, during this period, the proven reserves of natural resources on the territory of Yakutia will provide sufficient mining resources (Israel Diamond Institute, 2021). Further prospects for mining development will depend on the intensity of exploration.

Table 1: Indicators of the models for predicting the region's economic development through mining, construction, and manufacturing

Notation			Indicator
Mining	**Manufacturing**	**Construction**	
GRPmin	*GRPman*	*GRPb*	Cost of gross regional product per capita generated in the sector, USD
Imin	*Iman*	*Ib*	The volume of the investments in fixed assets, USD
EImin	*EIman*	*EIb*	Investment efficiency calculated as the ratio of the value of the gross regional product generated in the sector to the investments in fixed capital
FAmin	*FAman*	*FAb*	Cost of fixed assets, USD
Fmin	*Fman*	*Fb*	Capital productivity calculated as the ratio of the value of the gross regional product generated in the sector to the value of fixed assets
EMPmin	*EMPman*	*EMPb*	Number of the employed, thousand people
LPmin	*LPman*	*LPb*	Labor productivity calculated as the ratio of the value of the gross regional product generated in the sector to the number of the employed in the sector
EXPmin	*EXPman*	*EXPb*	Export of sector products per capita, USD
IMPmin	*IMPman*	*IMPb*	Import of sector products per capita, USD
W*min*	W*man*	W*b*	Average nominal wage in the sector, USD

Building the model, we used standardized values of indicators obtained by dividing the difference between the actual value of the indicator and the minimum value for the sample by the difference between the maximum and minimum value of the indicator for the sample.

To assess the possibility of using these variables for modeling, we applied the augmented Dickey-Fuller test (to test variables for stationarity) and the Granger causality test (to test cause-and-effect relationships between variables) in EViews 10 software.

We constructed three groups of models representing the prospects for the economic development of Yakutia through mining, construction, and manufacturing. We took the value of the gross regional product per capita as an indicator of the economic development in the region for each sector under study (Yukhanaev et al., 2014). We calculated the indicators affecting the gross regional product generated in the sector with Leontief and Cobb-Douglas production function (Shikhman et al., 2018; Lopes & Neder, 2017). According to these functions, the volume of production depends on:

1) The availability of fixed assets (F.A.) and their efficiency (capital productivity – *F*) determines the sector's production capacity. The degree of suitability and depreciation of fixed assets also affect the production capacity, but we did not use these indicators separately. They reveal themselves in capital productivity, which is calculated by dividing the gross regional product by the initial cost of fixed assets. For the same reason, we did not use the indicators of manufacturability and digitalization of the economic sectors;

2) The volume of the investments in fixed assets (*I*) and their effectiveness (*E.I.*), determines the financial capabilities of the sector. The efficiency of investment is its ability to have a multiplier effect on the economy (Yukhanaev et al., 2014);

3) Availability of labor resources: the number of employed in the sector (*E.M.P.*) and their productivity (*L.P.*), depends on education, qualifications, and intellectual development;

4) Availability of natural resources and raw materials for the economic sectors calculated for during the assessment period (20 years) and Yakutia will have enough natural resources (Israel Diamond Institute, 2021). Therefore, we did not introduce any constraints.

Considering the interdependencies described above, the dependence function of the volumes of the gross regional product generated by

mining, construction, and manufacturing has the following form:

$$GRP = f(GRP(-I); FA; F; I; EI; EMP; LP) \quad (1)$$

where *I* is the lag value (number of years).

The value of the fixed assets in the sector depends on the volume of investment in the fixed capital of the sector, its effectiveness, and the available fixed assets (Cho et al., 2021):

$$FA = f(FA(-I); I; EI) \quad (2)$$

The volume of investment in fixed capital depends on the level of the region's development and investment in alternative sectors (Yukhanaev et al., 2014; Vasiljeva et al., 2013):

$$I = f(GRP; GRP(-I); I(-I)) \quad (3)$$

The availability of labor resources is mainly determined by the size of wages in the industry (*W*) (Formula 4). The number of employed also depends on the availability of jobs, which stems from the development of the economic sector (gross regional product) as well as worker mobility (Liu et al., 2021). Mobility denotes their desire/unwillingness to change jobs. We expressed mobility through the dynamics of the number of employed in previous periods.

$$EMP = f(EMP(-I); W; GRP; GRP(-I)) \quad (4)$$

Wage levels depend on the development of the economic sector (G.R.P.) and the region. Suppose we use the variable of the aggregate gross regional product. In that case, we cannot estimate the specifics of wage formation in the studied sectors of the economy since it is the same for mining, construction, and manufacturing. Therefore, in model (5), we used only the indicator of the gross regional product generated in the studied sector of the economy (Liu et al., 2021):

$$W = f(W(-I); GRP; GRP(-I)) \quad (5)$$

To determine the coefficients of independent variables in models (1)-(5) and prove the theoretically described nature of the relationship between the variables, we used V.A.R. models and linear regression models built in EViews 10 software. We chose this method as it was necessary to assess the influence of independent variables on the dependent one, so we applied regression analysis. We selected regression models based on the nature of the relationships between the variables.

RESULTS

We examined the indicators of the economic development of mining, construction, and manufacturing in Russian regions for stationarity and presented the results in Table 2. For this purpose, we used the augmented Dickey-Fuller test.

Table 2: Stationarity test results for the economic development indicators in mining, construction, and manufacturing using the augmented Dickey-Fuller test

Indicator	Integration level	*P*	Indicator	Integration level	*P*	Indicator	Integration level	*P*
GRPmin	1	0.02	*GRPman*	1	0.00	*GRPb*	1	0.01
Imin	0	0.00	*Iman*	1	0.00	*Ib*	1	0.04
Elmin	0	0.03	*Elman*	0	0.00	*Elb*	1	0.00
FAmin	0	0.04	*FAman*	0	0.00	*FAb*	0	0.00
Fmin	1	0.00	*Fman*	1	0.00	*Fb*	1	0.01
EMPmin	1	0.00	*EMPman*	0	0.03	*EMPb*	0	0.00
LPmin	0	0.00	*LPman*	0	0.02	*LPb*	0	0.04
EXPmin	1	0.04	*EXPman*	1	0.04	*EXPb*	0	0.04
IMPmin	1	0.00	*IMPman*	1	0.04	*IMPb*	1	0.00
Wmin	1	0.03	*Wman*	1	0.00	*Wb*	0	0.01

Note: *P* – The probability of non-stationarity of the variables.

Probability values below 0.05 indicate the stationarity of the indicators of the economic development in mining, construction, and manufacturing at the 0th and 1st integration levels. The stationarity of the variables allowed us to use them for modeling. In this study, we used the 0th level of integration variables without transformations. The 1st level of integration variables was reduced to the standard form by differentiation of the 1st order.

Table 3 presents the directions of cause-and-effect relationships between indicators established using the Granger causality test.

The table shows statistically significant cause-and-effect relationships with a probability of 95% between the indicators of economic development in mining, construction, and manufacturing.

Table 3: Cause-and-effect relationships between the indicators of the economic development in mining, construction, and manufacturing by Russian regions

In	*Dep*	*P*	*In*	*Dep*	*P*	*In*	*Dep*	*P*
FAmin	GRPmin	0.00	*GRPman*	Wman	0.03	*GRPmin*	EMPmin	0.01
FAman	GRPman	0.04	*EMPmin*	GRPmin	0.01	*Wman*	EMPman	0.04
Fmin	GRPmin	0.01	*LPmin*	GRPmin	0.00	*GRPman*	EMPman	0.01
Fman	GRPman	0.01	*EMPman*	GRPman	0.00	*GRPmin*	Imin	0.00
Imin	GRPmin	0.00	*LPman*	GRPman	0.00	*GRPman*	Imin	0.02
EImin	GRPmin	0.01	*Imin*	FAmin	0.00	*GRPb*	Imin	0.02
Iman	GRPman	0.01	*EImin*	FAmin	0.00	*GRPmin*	Iman	0.00
EIman	GRPman	0.02	*Iman*	FAman	0.02	*GRPman*	Iman	0.02
EIman	FAman	0.04	*Wmin*	EMPmin	0.00	*GRPb*	Iman	0.01
GRPmin	Wmin	0.02	*Fb*	GRPb	0.03	*GRPb*	Ib	0.04
FAb	GRPb	0.00	*EMPb*	GRPb	0.01	*Iman*	Imin	0.00
GRPb	Wb	0.03	*Ib*	FAb	0.00	*Imin*	Iman	0.01
EIb	FAb	0.03	*Wb*	EMPb	0.00	*Iman*	Ib	0.01
Ib	GRPb	0.00	*LPb*	GRPb	0.02	*Imin*	Ib	0.04
EIb	GRPb	0.00	*GRPb*	EMPb	0.01	*Ib*	Imin	0.00
GRPmin	Ib	0.00	*GRPman*	Ib	0.02	*Ib*	Iman	0.00

Notes: *In* is an independent indicator that affects *Dep; Dep* is a dependent indicator*; P* is the probability that the influence of indicator *In* on *Dep* is not statistically significant.

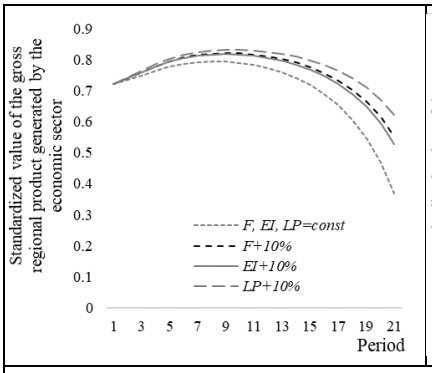
The probability of no cause-and-effect relationships between the indicators given in Table 3 was less than 5%. This confirms the statistical significance of these relationships. The results of the Granger causality test statistically proved the theoretically described possible relationships between the development indicators of mining, construction, and manufacturing.

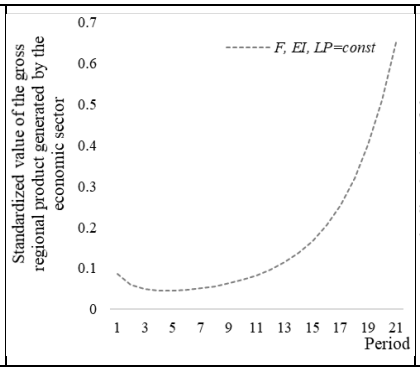
In addition, we established the interdependence between the indicators of the volume of investments in the fixed capital of mining, construction, and manufacturing. This dependence is inverse and is due to limited financial resources. When investment in one economic sector increases, the investment in another decreases, while the level of investment in the region remains the same.

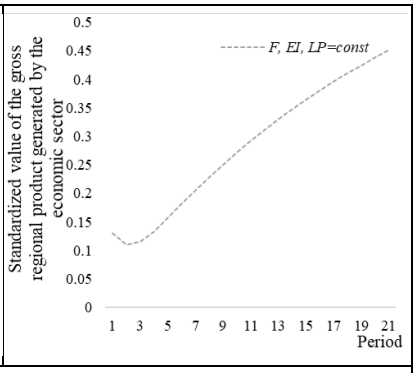
Table 4 presents an analytical and graphical interpretation of the constructed models for assessing the possible economic development of Yakutia through mining, construction, and manufacturing.

Table 4: Models for predicting Yakutia's economic development through mining, construction, and manufacturing

Mining		Manufacturing		Construction	
GRPmin = 0.75×GRPmin(-1)+ 0.07×FAmin+0.11×Fmin+0.39×Imin+0.25×EImin+0.03×EMPmin+0.17×LPmin-0.23;	(6)	*GRPman = 0.43×GRPman(-1)+ 0.15×FAman+0.45×Fman+0.37×Iman+ 0.43×EIman+ 0.07×EMPman+ 0.32×LPman-0.65;*	(7)	*GRPb = 0.61×GRPb(-1)+ 0.12×FAb+0.33×Fb+0.32×Ib+0.46×EIb+ 0.05×EMPb+ 0.28×LPb-0.90;*	(8)
FAmin = 0.11×FAmin(-1)+0.07×Imin+ 0.15×EImin;		*FAman = 0.62×FAman(-1)+0.62×Iman+ 1.01×EIman-0.38;*		*FAb = 0.52×FAb(-1)+ 0.54×Ib+0.87×EIb-0.41;*	
Imin = 0.05×GRPmin(-1)-0.92×GRPman(-1)-0.04×GRPb(-1)+0.55;		*Iman = 1.24×GRPman(-1)-0.07×GRPmin(-1)-0.03×GRPb(-1)+0.05;*		*Ib = 0.68×GRPman (-1)-0.04×GRPmin(-1)- 0.02×GRPb(-1)+0.08;*	
EMPmin = 0.08×EMPmin(-1)+ 0.21×Wmin+0.15×GRPmin(-1)+ 0.27;		*EMPman=0.33×EMPman(-1)+0.44×Wman+0.83×GRPman(-1);*		*EMPb =0.26×EMPb(-1)+ 0.49×Wb+0.15×GRPb(-1);*	
Wmin=0.37×GRPmin(-1)+ 0.51		*Wman=0.58×GRPman(-1)+ 0.19*		*Wb=0.41×GRPb(-1)+0.26*	







F,EI, LP=const is G.R.P. dynamics at the actual level of capital productivity, investment efficiency, and labor productivity; *F+10%* is G.R.P. dynamics with a 10% increase in capital productivity compared to the value for 2020; *EI+10%* is G.R.P. dynamics with a 10% increase in investment efficiency compared to the value for 2020; *LP+10%* is G.R.P. dynamics with a 10% increase in labor productivity compared to the value for 2020.

Figure 1: The dynamics of the economic development of Yakutia through mining

Figure 2: The dynamics of the economic development of Yakutia through manufacturing

Figure 3: The dynamics of the economic development of Yakutia through construction

For variables whose influence manifests itself with a time lag, we calculated the lags by testing the maximum lag length according to the criteria developed by Akaike, Schwartz, Hann-Quinn (Kim et al., 2022).

In the constructed systems of models for predicting the economic development of Yakutia through mining, construction, and manufacturing (formulas 6-8), in addition to the variables affected by other variables, some do not depend on others. They are the efficiency of investments in fixed assets, capital productivity, and labor productivity. For these variables, we used standardized values of the corresponding indicators for 2020 when constructing graphical models for predicting the economic development of Yakutia (Figures 1-3). We set the indicator representing the availability of resources for the economic value of sectors at Level 1 to demonstrate its potential when resources are not limited.

The statistical significance of the constructed models for predicting the economic development of the region through mining, construction, and manufacturing is due to:

1) Sufficient size of the sample (674 observations);

2) The law of normal distribution of variables;

3) Stationarity of variables proven with the augmented Dickey-Fuller test;

4) The influence of independent variables on dependent ones at a significance level of 0.05 confirmed with the Granger causality test;

5) The results of the F-statistic, according to which the empirical values of the criterion 19.52–44.75 exceed the critical values 2.11–3.86 at a significance level of 0.05 (Cunningham et al., 2013);

6) The results of t-statistics, according to which the empirical values of the criterion |2.97|–|4.58| exceed the critical value of 1.96 at a significance level of 0.05 (Cunningham et al., 2013);

7) The deviation of the values of dependent variables calculated in the constructed functions for the retrospective period from the actual values of these variables by no more than 4.3%.

DISCUSSION

The research results demonstrate that with the current capital and labor productivity indicators in the mining sector, investment efficiency, and abundant reserves of natural resources, the indicator of the gross regional product generated in this sector has a downward trend in the long term. The growing performance indicators in the industry moderate the decline in the gross regional product developed in the industry. Nevertheless, they do not ensure a sustainable dynamic of economic development. We can see this in the example

of a 10% increase in capital productivity, investment efficiency, and labor productivity. The results obtained indicate that the technological development of the mining sector, the renewal of fixed assets, and material incentives for workers lead to a short and medium-term increase in the gross regional product (within 7–10 years). But it does not ensure the stable economic growth of Yakutia in the long run. The downward dynamics of the mining sector development in the long term is due to lower investment efficiency compared to the manufacturing and construction industries.

The value of the investment efficiency ratio in mining for the year 2020 estimated 2.64, in manufacturing – 6.84, and in construction – 8.41. The efficiency of investments use in mining is 2.6 times lower than in manufacturing and 3.2 times lower than in construction (Territorial Authority of the Federal State Statistics Service for the Republic of Sakha (Yakutia), 2022). This means that if in the future the economy remains focused on the development of the mining sector, this will not allow providing alternative sectors of the economy with the required production potential due to limited investment resources. This will prevent the region from obtaining the maximum economic effect through the implementation of more efficient investment options and its diversification, which could ensure the stability of the regional economy.

The development of manufacturing over the next five years will reduce the gross regional product generated in the industry due to the need to invest in the acquisition of fixed assets and the development of human capital. In the future, upward dynamics will replace the downward one. Further development of manufacturing leads to an increase in the gross regional product generated in this economic sector. We may observe a similar situation regarding the development of construction. Investment in this industry within three years leads to a decrease in the gross regional product generated in this sector, after which there is growth. Yakutia has more developed construction than manufacturing. Therefore, it will not require such large investments in the industry to allocate production assets and workers. As a result, the initial decline in the gross regional product after investing in the industry will not be as lasting as in manufacturing. However, in the long run (over the simulated 20 years), the pace of construction development is lower than that of manufacturing.

The results obtained indicate the potential for the economic development of Yakutia through diversification of its economy, namely, a shift in priorities from the development of mining to the development of manufacturing and construction. What is more, in the long term, manufacturing has more significant development potential. Therefore, the unrelated diversification of the regional economy, despite requiring a substantial amount of investment for both technological processes and labor resources training, should become a priority to ensure the sustainability of Yakutia's economy.

CONCLUSION

Having tested the proposed approach to predicting economic development through economic diversification on the example of Yakutia, we proved the impact of the resource curse, which manifests itself not only in the country's economy but also at the regional level. Even with unlimited natural resources, maintaining the existing structure of the region's economy will lead to a decrease in the volume of gross regional product per capita. This is due to an increase in alternative costs. It is impossible to develop more efficient high-tech industries that might bring greater economic benefits under lower costs and in the shortest possible time. The absolute superiority of the extractive industry hinders the development of other sectors of the economy, reducing the competitiveness and attractiveness of products created in them. This has even a stronger detrimental effect for a region with weak administration and institutions where insufficient economic diversification is one of the obstacles to economic and social development.

The resource economy of the region requires expanding and increasing specialization. According to the research results, this outcome may be achieved through related and unrelated diversification of the regional economy. In this regard, the most suitable sectors are manufacturing and construction, which will ensure the comparative advantages of Yakutia's economy in the long term.

In this study, we did not consider agriculture as an alternative specialization of Yakutia's economy as this industry has low surplus value. In addition, the agricultural

sector is conservative and strongly depends on natural and climatic conditions. Yakutia has a severe climate. More than a third of municipal settlements are hard-to-reach and sparsely populated. It is unprofitable to breed cattle due to the lack of grazing. Therefore, Yakutia has a low potential for developing agriculture due to economic diversification. However, considering the importance of this industry for ensuring the food supply in the region, self-employment of the population, food security in the future, we are planning to examine the economic efficiency of agriculture in Yakutia.

REFERENCES

Arshad, H., & Tahir, M. (2021). Natural resources volatility and economic growth: Evidence from the resource rich region. *Journal of Risk and Financial Management*, *14*(2), 84. https://doi.org/10.3390/jrfm14020084

Cho, H., Chung, J.R., & Kim, Y.J. (2021). Fixed asset revaluation and external financing during the financial crisis: Evidence from Korea. *Pacific-Basin Finance Journal*, *67*, 101517. https://doi.org/10.1016/j.pacfin.2021.101517

Cunningham, C.J.L., Weathington, B.L., & Pittenger, D.J. (2013). *Understanding and conducting research in the health sciences*. London: John Wiley & Sons.

Degtyareva, I., Marjina, A., & Shalina, O. (2013). The influence of state on the innovative processes. *Journal of Contemporary Economics Issues, 1*. https://doi.org/10.24194/11313.

Edwards, J. (2019). Mastering strategic management – 1st Canadian edition. https://opentextbc.ca/strategicmanagement/

Federal State Statistics Service. (2022). https://eng.rosstat.gov.ru/

Financial Times. (2022). World's biggest diamond producer Alrosa hit by Sino-US trade war. https://www.ft.com/content/0b727e52-9f36-11e9-9c06-a4640c9feebb

Ibrahim, M.J. (2017). Introductory chapter: Economics, natural resources and sustainable development. In M. J. Ibrahim (Ed.), *Emerging issues in economics and development.* London: IntechOpen. https://doi.org/10.5772/intechopen.70399.

Investment Platform of Russian Regions. (2022). The Republic of Sakha (Yakutia). https://www.investinregions.ru/en/regions/14/

Israel Diamond Institute. (2021). Alrosa's diamond production up 22% in Q2 2021. https://en.israelidiamond.co.il/news/mining/alrosas-diamond-production-2021/

Jakob, M. (2010). Dutch disease or Botswana's blessing? Natural resources and economic growth – A channel approach. https://resec.ethz.ch/content/dam/ethz/special-interest/mtec/cer-eth/resource-econ-dam/documents/research/sured/sured-2010/SURED-10_079_Jakob.pdf

Kim, S., Shim, S., & Park, D. (2022). Dynamic interactions between trade globalization and financial globalization: A heterogeneous panel V.A.R. approach. *Journal of International Money and Finance*, *122*, 102547. https://doi.org/10.1016/j.jimonfin.2021.102547

Kimberley Process. (2022). Public statistics area. https://kimberleyprocessstatistics.org/public_statistics

Li, Z., Rizvi, S.K.A., Rubbaniy, G., & Umar, M. (2021). Understanding the dynamics of the resource curse in G7 countries: The role of natural resource rents and the three facets of financial development. *Resources Policy*, *73*, 102141. https://doi.org/10.1016/j.resourpol.2021.102141

Liu, Y., Nanda, V., Onal, B., & Silveri, S. (2021). Employment mobility and pay for sector performance. *Journal of Corporate Finance*, *70*, 102069. https://doi.org/10.1016/j.jcorpfin.2021.102069

Lopes, T.C., & Neder, H.D. (2017). Sraffa, Leontief, Lange: The political economy of input-output economics. *EconomiA*, *18*(2), 192–211. https://doi.org/10.1016/j.econ.2016.08.001

Martínez-Campillo, A. (2016). The benefits of related and unrelated diversification strategies in the Spanish context: What is the difference that executive leadership style can make? *Leadership*, *12*(1), 86–119.

https://doi.org/10.1177/1742715014543580

Ng, M.C.H. (2017). Competitive advantage of Hong Kong economy structural transformation after 1997 [research note]. *Hong Kong Journal of Social Sciences, 49*, 107–130. http://hkjoss.com/index.php/journal/article/view/368

Oduyemi, G.O., Owoeye, T., & Adekoya, O.B. (2021). Health outcomes and the resource curse paradox: The experience of African oil-rich countries. *Resources Policy*, *73*, 102201. https://doi.org/10.1016/j.resourpol.2021.102201

Oil and Capital. (2021a). It is not diamonds: Yakutia is making money off. https://oilcapital.ru/news/markets/01-02-2022/uchastniki-opek-ne-vypolnili-plan-po-dobyche-v-yanvare-2022

Oil and Capital. (2021b). Yakutia discovers oil and gas resources. https://oilcapital.ru/news/upstream/10-12-2021/yakutiya-otkryvaet-neftegazovye-resursy

Russian Auction House. (2022). The world diamond market. https://www.auction-house.ru/en/news_analytics/rynok-almazov-mira/

Russian Export Center. (2020). The Republic of Sakha (Yakutia). Export data. https://yakutiaexport.com/tinybrowser/images/eksportnaya-spravka-po-regionufo-rossii-dekabr-2020-respublika-saha-yakutiya.pdf

Sharif, N., Chandra, K., Mansoor, A., & Sinha, K.B. (2021). A comparative analysis of research and development spending and total factor productivity growth in Hong Kong, Shenzhen, Singapore. *Structural Change and Economic Dynamics*, *57*, 108–120. https://doi.org/10.1016/j.strueco.2021.02.004

Shikhman, V., Nesterov, Yu., & Ginsburgh, V. (2018). Power method tâtonnements for Cobb–Douglas economies. *Journal of Mathematical Economics*, *75*, 84–92. https://doi.org/10.1016/j.jmateco.2017.12.010

Tatarkin, A. (2013). Innovation direction of the average region development in the modernization of the Russian Federation. *Journal of Contemporary Economics Issues, 3*. https://doi.org/10.24194/31311.

Territorial Authority of the Federal State Statistics Service for the Republic of Sakha (Yakutia). (2022). https://sakha.gks.ru/

Vasiljeva, M., Neskorodieva, I., Ponkratov, V., Kuznetsov, N., Ivlev, V., Ivleva, M., Maramygin, M., & Zekiy, A. (2020). A predictive model for assessing the impact of the COVID-19 pandemic on the economies of some Eastern European countries. *Journal of Open Innovation: Technology, Market, and Complexity, 6*(3), 92. https://doi.org/10.3390/joitmc6030092.

Vasiljeva, M.V., Vladimirova, T.V., Romanenko, E.V., & Chasovskiy, V.P. (2013). *The new paradigm of management of socio-economic development of regions of Russia.* Moscow: Planeta. https://elibrary.ru/item.asp?id=21329191.

Yang, J., Rizvi, S.K.A., Tan, Z., Umar, M., & Koondhar, M.A. (2021). The competing role of natural gas and oil as fossil fuels and the non-linear dynamics of the resource curse in Russia. *Resources Policy*, *72*, 102100. https://doi.org/10.1016/j.resourpol.2021.102100

Yukhanaev, A., Sharma, S., & Nevidimova, A. (2014). Subnational determinants of foreign direct investments in the Russian Federation. *Journal of Eastern European and Central Asian Research*, *1*(2), 10. https://doi.org/10.15549/jeecar.v1i2.62

ABOUT THE AUTHORS

Tamara A. Karataeva, email: t.karatayeva@list.ru

Anatoliy A. Popov is a Professor, Doctor of Economic Sciences, Full Member of the Academy of Sciences of the Republic of Sakha (Yakutia), Academician of the Russian Academy of Social Sciences, International Academy of Scientology, Head of the Economic Theory Department of the North-Eastern Federal University named after M.K. Ammosov, Deputy Editor-in-Chief of the scientific and practical journal "Economy of Eastern Russia", Honored Worker of Higher Professional Education of the Russian Federation, the National Economy of the Republic of Sakha (Yakutia), Honored Citizen of Suntarsky District of the Republic of Sakha (Yakutia).

Tamara A. Karataeva is a PhD in Economic Sciences, Associate Professor of the Department of Economic Theory of the North-Eastern Federal University named after M.K. Ammosov. She lectures in the following disciplines: statistics, economics, mathematical statistics, mathematical methods in economics, qualimetry, econometrics. Scientific interests: shadow economy, economic security.

Elena V. Danilova is a PhD in Economic Sciences. Since 1993, she has been working at the Economic Theory Department of the North-Eastern Federal University named after M.K. Ammosov. Research interests: economic theory, regional economy and development, spatial development, economics of the Far East and the Arctic, demography, labor market and employment issues.

Anatoliy N. Myreev is the First Deputy Chairman of the Board of JSCB "Almazergienbank" J.S.C. In 2011, he obtained a PhD degree. Since 2012, he has taught part-time at the North-Eastern Federal University named after M.K. Ammosov. In 2019, he graduated from a 2-year acceleration program at the Massachusetts Institute of Technology Sloan School of Management in the direction of the "Regional Entrepreneurship Acceleration Program". At present, he heads the direction for the implementation of JSCB "Almazergienbank" J.S.C.'s digital transformation.

Valentina V. Sergeeva defended her PhD thesis on the theme "Development of social and economic security of the population of the Arctic zone on the example of the Russian Far East" in 2018 on the basis of the North-Eastern Federal University named after M.K. Ammosov. Currently, she works at J.S.C. "R.I.C. Plus." She is the chief specialist of the Economics and Finance Department. She also teaches at the Economics and Finance Department of the North-Eastern Federal University named after M.K. Ammosov. Her research interests are economic security and the Arctic zone.