Macro Environmental Factors in the Development of Public-Private Partnership in Russia

Evgeny A. Kuzmin[1*], Marina V. Vinogradova[2], Elza R. Zinatullina[3]

[1] Department of Regional Economic Policy and Economic Security, Institute of Economics of the Ural Branch of Russian Academy of Sciences, RUSSIA.

[2] Faculty of Economics, Russian State Social University, RUSSIA.

[3] Department of Enterprise Economics, Ural State University of Economics, RUSSIA.

*Corresponding Author (Tel: +7-3433715716, kuzmin.ea@uiec.ru)

Abstract

The transformation of sustainable economic development approaches has created the institution of public-private partnership (PPP) as a form of interaction for the construction and operation of infrastructure facilities. The success of such initiatives creates a supportive environment that meets social needs. In this paper, the authors analyze the dynamics and structure of the distribution of public-private partnership projects in Russia in 2007-2020 to search for significant determinants in the development of this institution. The obtained results of the static and correlation-regression analysis made it possible to establish the presence of a noticeable direct relationship between the level of investment in public-private partnership projects and the size of the gross regional product. A negative impact on the development of public-private partnership projects is exerted by an increase in the tax burden on business, a high cost of loans, and an increase in inflation, which entails an increase in the capital and operating project costs. At the same time, a high level of government spending on the gross domestic product has a positive impact on the implementation of public-private partnership projects. Thus, the activation of the public-private partnership institution in this context should be aimed at improving the macro-state of the economy.

Disciplinary: Macro Economics, State and Regional Administration & Policy, Institutional Economics.

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1 Introduction

Public-private partnership (PPP) is a modern mechanism for attracting private companies to invest/finance the construction, operation, and management of infrastructure facilities. The importance of financing through PPP is due to the high interest of public institutions in creating a favorable environment. A characteristic feature of PPPs, clearly defined in contracts, is the distribution of investment, risk, and responsibility between the parties. The ability to distribute risks between project parties contributes to the success of PPP projects (Fedorova *et al.*, 2013; Lebedeva, & Morozov, 2017; Shvedkova, 2015). When preparing and implementing a PPP project, risks associated with all factors should be taken into account (Krivenok, & Vivchar, 2018).

Under the complicating external economic situation, the issues of the development of internal infrastructure as the basis of competitiveness are of particular relevance for Russia. PPP in Russia is a relatively new instrument. At the same time, the practice of using such mechanisms for the implementation of projects in creating and updating socially significant infrastructure is becoming more common (Khubuluri, & Bagrova, 2019). Despite the obvious benefits of using PPP for economic development, the share of investments in infrastructure under the concluded concession agreements in Russia does not exceed 2% of GDP per year. This is significantly lower than in the UK - 6.6% of GDP, in Australia and New Zealand - 6.9% of GDP, in Canada - 8.1% of GDP (Ministry of Economic Development of the Russian Federation, [2020]). Arguably, infrastructure management remains a barrier to achieving sustainable development goals (Cheng *et al.*, 2021; Derrible, 2018; Di Liddo *et al.*, 2019).

The overwhelming majority of Russian regions already use the mechanism of concession agreements for the creation or reconstruction of infrastructure facilities. However, at the same time, only 10 regions (12%) have concluded more than 100 agreements (including municipal concessions). Over the past five years, there has been a significant reduction in implemented PPP projects in Russia, so in 2020, compared to 2016, the number of implemented PPP projects decreased by 9 times, the volume of budget investments in PPP projects decreased by 44%. In part, the sharp decline in indicators in 2020 can be explained by the COVID-19 pandemic, but the overall trend of previous years is negative. This indicates the undisclosed potential of the PPP mechanism in Russia (Ministry of Economic Development of the Russian Federation, [2020]). In this regard, there is an interest in identifying the reasons and factors that have a negative impact on the development of PPP projects in Russia.

Therefore, the study aims to find determinants that impede the development of PPP in Russia. For this, the tasks were set: to conduct a statistical analysis of the dynamics of implemented PPP projects in 2007-2020 by the federal districts of Russia and sectors of the economy; to identify the statistical relationship between investments in PPP projects and investments in fixed assets, as well as between the gross regional products; to assess the correlation between the influence of various factors on the level of investment in PPP projects.

2 Literature Review

Active development of the practice of implementing projects using PPP mechanisms in recent years has attracted an increasing number of researchers. Yescombe (2015) offers a unique comprehensive description of the processes, participants, and established practices of public-private partnership, and speaks in detail about the main financial aspects of the implementation of PPP projects. The tasks that are solved using PPP can be summarized as follows (Kozhurina, 2019): PPPs allow the authorities to focus on the main functional area while the solution of infrastructure issues is delegated to private companies; PPPs contribute to improving the management of state assets (a "life cycle" approach is used in the form of long-term contracts), etc.

The Russian specificity in the light of world practice is considered in Goloborodko *et al.* (2017), where the forms, types, and legal regimes of PPPs are specified and their formation features are analyzed. An important aspect for Russia and many developing economies is the problem of abuse of power. Goloborodko *et al.* assess the legal, economic, and managerial risks in the implementation of PPP projects.

Many researchers note a lack of trust between business and government (Pankratov, 2010). This occurs since companies in Russia are not interested in long-term cooperation. A low time horizon of their operation (Kuzmin, 2018) does not create incentives for long-term investments and innovations (Chernova *et al.*, 2019). This could be neutralized, according to Pankratov, by the acceptance of the role of a guarantor by the state. A similar opinion was expressed by Firsova (2011). Another internal PPP driver specific to Russia is the need to create "growth points" through PPP for regional development (Alpatov et al., 2010; Litau, 2018).

The debate about what factors underlie the development of PPP is generally homogeneous. Kazaryan (2017), among the factors influencing the development of PPP, notes institutional (reflecting the formation of the regulatory framework governing the development of PPP), competence (reflecting the presence of the necessary managerial competencies among public and private sector employees), socio-economic (reflecting the investment attractiveness of regions for the inflow of investments). In addition to these factors, the presence of risks that affect the implementation of PPPs, as well as forms of project financing, are also highlighted (Sidorkin, & Tatarkin, 2010; Sokolov, & Maslova, 2013). Risks affecting the implementation of PPP projects include the risks of planning them, financial risks, including interest rates and inflation, risks of operating the created infrastructure, as well as risks related to the demand for the facilities of the created infrastructure. Hence, one can conclude that the implementation of PPP projects is significantly influenced by financial determinants, including the change in the interest rate on loans, the level of the tax burden, the inflation rate, the level of state budget expenditures to GDP (Han *et al.*, 2020; Wang, & Alvi, 2011). The investment component of PPP projects has an impact on regional economic development. Stable correlations are observed for investment in fixed assets per capita and GRP per capita (Barbysheva, 2020).

Methodological guidelines for evaluating the effectiveness of conventional investment projects are quite complete and well-built (Birman, & Schmidt, 1997; Vilensky *et al.*, 2002). However, PPP projects require a special approach. The multifaceted and complex hierarchical nature of such projects leads to a broad interpretation of the effectiveness of projects, and, consequently, the choice of factors that have a significant impact. Scholars distinguish various components as part of the integrated effectiveness of PPP projects. For example, Prokopovich (2013) proposes to calculate the integral indicator of the effectiveness of PPP projects as the average of public efficiency and that of the balance of interests. At the same time, the efficiency of the balance of interests is understood as the average value of budgetary, economic, and social efficiency. Novikova and Chukhlomin (2010) are guided by the division of efficiency into financial and socio-economic. It is noted that in modern conditions, to assess projects, it is necessary to simultaneously evaluate both these types of efficiency, in two versions - with and without government support. Andreyeva (2013) offers to consider the comprehensive effectiveness of the project from the standpoint of dividing it by stakeholders concerned.

The review made it possible to concretize the pool of determinants that can enhance project activities in PPP. These include the size of the investment, the level of government spending, and the factors of the macroenvironment (cost of borrowing, inflation). It is these parameters that are taken into account when formulating and subsequently testing assumptions in connection with the factors of PPP development.

3 Method

This study finds determinants that impede the development of public-private partnerships in Russia. This work puts forward several assumptions on the relationship of factors and their impact on the development of PPP based on the prevailing view upon a review of references.

1) The development of PPP projects in a region has a significant impact on investments in fixed assets, as well as on economic growth, which is reflected in an increase in the GRP indicator;

2) The high cost of loans, an increase in inflation, which leads to an increase in the cost of capital and operating costs of projects, have a negative impact on the development of PPP projects. At the same time, a high level of government spending in GDP is likely to have a positive impact on the implementation of PPP projects.

To test the assumptions, standard statistical methods were used, including multiple linear regression, which involves establishing a relationship between a group of independent variables. To assess the relationship between various factors and the volume of investments in PPP projects, the correlation coefficient was calculated (Ishkhanyan, & Karpenko, 2016):

$$r_{xy} = \frac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{n \cdot \sigma_x \sigma_y} \qquad (1),$$

where n is the size of the studied population (sample size); $\bar{x}$, $\bar{y}$ are average values of parameters; σ_x^2, σ_y^2 are dispersions; σ_x, σ_y are SD of characteristics.

Correlation indices were assessed using the Chaddock scale (Ishkhanyan, & Karpenko, 2016). The multiple correlation coefficient can be found through a matrix of paired correlation coefficients:

$$R = \sqrt{1 - \frac{\Delta_r}{\Delta_{r11}}} \qquad (2),$$

where Δ_r is a determinant of the matrix of paired correlation coefficients; Δ_{r11} is a determinant of the inter-factor correlation matrix.

The information base of the study was data on PPP projects in Russia for 2007-2020, posted on the website of the Rosinfra platform (Rosinfra, 2021). The data structure allows for analysis by region and industry.

4 Result and Discussion

The active development of PPP in Russia was observed in the period from 2010 to 2016. Subsequently, the number of projects has steadily decreased - from a peak of 1,270 projects in 2016 to 116 in 2020, more than 10 times. The dynamics of PPP projects are shown in Figure 1.
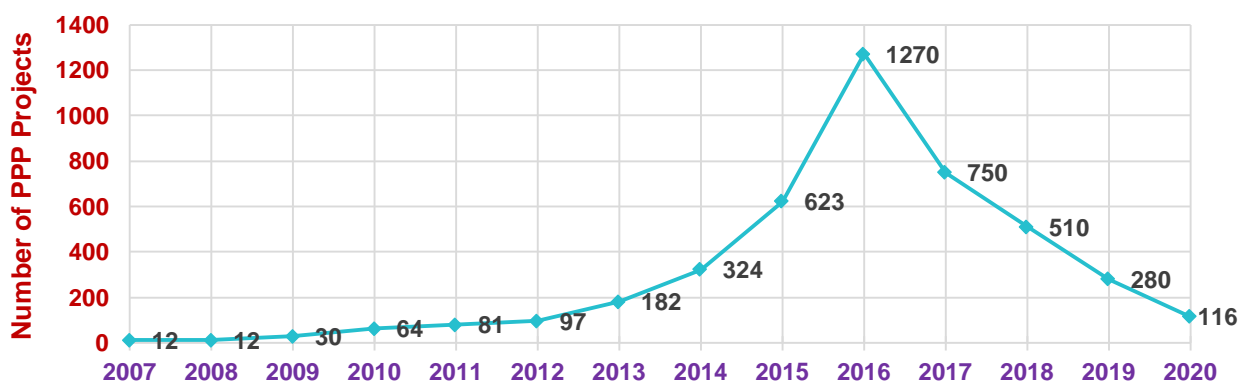

Figure 1: Dynamics of the number of PPP projects implemented in Russia in 2007-2020.
Source: Compiled from (Rosinfra, 2021).

Budget investments in Russia for infrastructure development in 2019 amounted to about 2 trillion rubles. Concerning GDP, the volume of budget investments increased by only 0.1 percentage points to 1.8% at the end of 2019. In 2020, the volume of budget investments directly invested in PPP projects amounted to 327.6 billion rubles. In total for the period of 2007-2018, the volume of budget investments in PPP projects increased from 532 billion rubles up to 851.1 billion rubles, or 60.0%. The volume of investments per PPP project in 2007 amounted to 44.3 billion rubles, and in 2020 it decreased to 2.8 billion rubles. Consequently, PPP projects have become less ambitious over the past 13 years. Low indicators are largely due to the absence of a long-term PPP development plan and clear conditions for the implementation of particular PPP projects.

The distribution of completed PPP projects across federal districts in Russia is uneven. During 2007-2020, the largest number of implemented PPP projects was observed in the Southern

Federal District (3723, or 51%), the Central Federal District (748, or 10%), and the Volga Federal District (954, or 13%). Table 1 presents the dynamics of the implementation of PPP projects.

Table 1: Dynamics of the implementation of PPP projects in the federal districts of Russia in 2007-2020

Year	Federal district							
	SiFD	FFD	NWFD	SFD	CFD	NCFD	UFD	VFD
2007	3	0	1	7	0	0	0	3
2008	1	0	0	10	3	0	3	3
2009	1	4	4	20	4	0	4	3
2010	5	4	2	57	7	0	3	26
2011	16	5	4	63	10	0	12	10
2012	11	7	4	75	15	2	2	26
2013	20	14	9	143	42	1	16	20
2014	40	41	15	292	25	16	16	112
2015	114	81	33	576	137	3	56	142
2016	164	192	59	1175	322	17	103	261
2017	98	122	30	654	99	14	89	190
2018	77	36	68	403	39	9	58	99
2019	31	20	20	179	26	5	17	46
2020	3	8	9	69	19	3	7	13

Note: SiFD - Siberian Federal District; FFD - Far East Federal District; NWFD - North-West Federal District; SFD - Southern Federal District; CFD - Central Federal District; NCFD - North Caucasian Federal District; UFD - Ural Federal District; VFD - Volga Federal District. (Source: Rosinfra, 2021).

Similar trends can be traced in the distribution of investments for PPP projects in the regions. The largest share of investments falls on the South Federal District (149.16 billion rubles, or 52%). The Volga Federal District ranks second (30.92 billion rubles, or 11%). The third place is occupied by the Ural (26.39 billion rubles, or 9%) and the Central Federal Districts (25.41 billion rubles, or 9%).

The dynamics of the share of investments in PPP projects in total investments in fixed assets by federal districts in 2007-2020 are reflected in Figure 2. It follows from those data that this share is low, in the South Federal District it reached 2.2% in 2016, in other federal districts it did not exceed 0.5%.
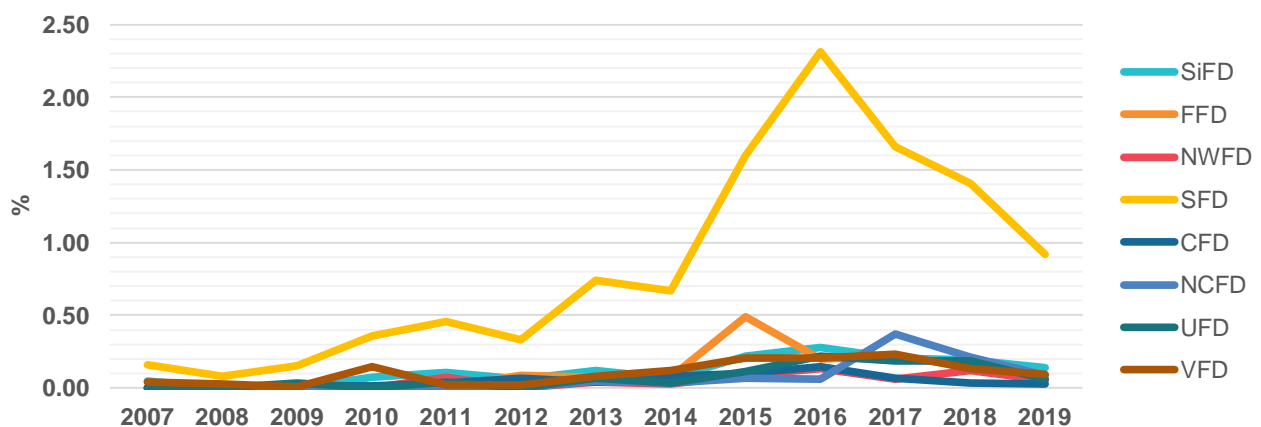

Figure 2: Dynamics of the share of investments in PPP projects in total investments in fixed assets by federal districts of Russia in 2007-2020. (Rosinfra, 2021)

The calculated values of the strength of the relationship between investments in PPP projects and the volume of investments in fixed assets are reflected in Table 2.

Table 2: Correlation-regression dependence between the investments in projects and the volume of investments in fixed assets

Federal district	Model/Relationship	Correlation coefficient R^2	Relationship strength
SiFD	y = 193.21x+908.98	0.5327	direct noticeable
FFD	y = 85.04x+926.82	0.1589	direct weak
NWFD	y = 404.65x+1132	0.6692	direct noticeable
SFD	y = 24.052x+877.59	0.4613	direct moderate
CFD	y = 402.39x+2597.4	0.2561	direct weak
NCFD	y = 131.29x+366.52	0.3318	direct moderate
UFD	y = 26.34x+1697.7	0.6217	direct noticeable
VFD	y = 207.01x+1555.3	0.5455	direct noticeable

It can be seen that the size of investments in PPP projects does not have a significant effect on the volume of investments in fixed assets in most federal districts.

Table 3 shows the relationship between investments in PPP projects and GRP. It can be concluded that in most federal districts of Russia the correlation coefficient exceeds 0.5; therefore, the relationship is direct and noticeable.

Table 3: Correlation-regression dependence between investments in PPP projects and GRP

Federal district	Model/Relationship	Correlation coefficient R^2	Relationship strength
SiFD	y = 0.0005x-1.2198	$R^2 = 0.7244$	direct high
FFD	y = 0.0006x-0.8778	$R^2 = 0.3145$	direct moderate
NWFD	y = 0.0003x-0.9161	$R^2 = 0.6457$	direct noticeable
SFD	y = 0.0046x-6.8555	$R^2 = 0.6834$	direct noticeable
CFD	y = 0.0001x-0.7629	$R^2 = 0.3444$	direct moderate
NCFD	y = 0.0007x-0.5573	$R^2 = 0.4351$	direct moderate
UFD	y = 0.0005x-2.3937	$R^2 = 0.5546$	direct noticeable
VFD	y = 0.0004x-1.3916	$R^2 = 0.4671$	direct moderate

Thus, when checking the first assumption, it has been found that at present, public-private investments occupy a small share in the total investments of regions; however, there is a positive relationship between attracted investments in PPP projects and the size of GRP.

In the sectoral context, PPP projects are also not equally attractive to investors. In 2020, 7 PPP projects were implemented in the field of transport, while in the field of agricultural infrastructure they amounted to 9.9 times more. The dynamics of the number of PPP projects by sectors are presented in Table 4.

In the number of PPP projects by sectors, the largest share in 2007-2020 was taken by the projects aimed at modernizing agricultural infrastructure (4008, or 47%), as well as the projects in the field of housing and communal infrastructure (3723, or 44%). The smallest shares of PPP projects were observed in the field of industrial infrastructure, defense, and security.

Next, let us consider what factors influence the size of investments attracted in PPP projects.

It is known that both the state budget and private individuals, including debt financing, are used to finance PPP projects. The rise in the cost of loans reduces the opportunity to participate in

the implementation of investments, including PPP projects. An additional factor is the level of the tax burden, which in Russia amounted to 33.47% in 2019 (Ministry of Finance of the Russian Federation, 2021a, 2021b). This significantly exceeds the level of some OECD countries. The inflation rate also has a significant impact on the implementation of PPP projects, as it increases the cost of capital and operating costs, and, ultimately, increases the final cost of creating infrastructure facilities. These factors include the level of government spending. The budget financing of PPP projects in Russia is about 22% (Rosinfra, 2021).

Table 4: Dynamics of the number of PPP projects by sectors of the economy in Russia in 2007-2020 (Rosinfra, 2021).

| Year | Sector | | | | | | | |
	Social sphere	Transport	Agriculture	Defense and security	House building	Redevelopment	ICT	Manufacturing
2007	1	0	10	0	7	0	0	0
2008	6	0	20	0	10	0	0	0
2009	5	1	57	0	20	1	0	0
2010	14	3	75	0	57	0	1	0
2011	19	4	63	0	63	1	1	2
2012	12	2	292	0	75	2	1	1
2013	32	1	143	0	143	4	0	0
2014	44	4	292	0	292	7	2	0
2015	79	10	576	1	576	10	7	5
2016	54	7	1175	0	1175	16	2	11
2017	89	11	654	0	654	26	4	18
2018	69	10	403	0	403	18	4	22
2019	45	11	179	0	179	14	2	4
2020	24	7	69	0	69	7	2	1

Now, coming to correlation analysis of the influence of factors on the level of investments in PPP projects (Y): tax burden (X_1); interest rate on loans to non-financial organizations (X_2); inflation (X_3); share of budget expenditures in GDP (X_4). The matrix of paired correlation coefficients R is presented in Table 5.

Table 5: Matrix of paired correlation coefficients

-	Y	X_1	X_2	X_3	X_4
Y	1				
X_1	-0.318	1			
X_2	-0.746	0.203	1		
X_3	-0.519	0.368	0.593	1	
X_4	-0.586	-0.284	0.580	0.287	1

Thus, the correlation coefficient between the tax burden and the size of investments in PPP projects is -0.318 (moderate inverse relationship), between the size of investments in PPP projects and the interest rate on loans to non-financial organizations, is -0.746 (high inverse relationship), between the investments amount in PPP projects and the inflation rate, is -0.519 (noticeable inverse relationship), between the size of investments in PPP projects and the share of budget expenditures in GDP -0.586 (noticeable inverse relationship). Based on the pairwise correlation

coefficients, it was found that all the selected factors had an impact on attracting investments in PPP projects, which confirms the author's assumption. The constructed system of linear equations, when solved by the Gauss method, allows one to obtain the following values: $\beta_1 = -0.357$, $\beta_2 = -0.4$, $\beta_3 = -0.021$, $\beta_4 = -0.449$. According to the maximum coefficient $\beta_3 = -0.021$, it can be concluded that the inflation factor has the greatest influence on the size of investments in PPP. Thus, it was found that interest rates on loans for businesses did not have the greatest impact on the amount of the attracted investments.

As a result of the calculations, the multiple regression equation was obtained,

$$Y = 3491.8388 - 44.0246X_1 - 34.6048X_2 - 1.5613X_3 - 54.3634X_4 \tag{3}.$$

The multiple correlation coefficient $R = 0.8284$. The relationship between the Y sign and X_i factors is strong. Let us check the overall significance of the equation using the F-statistic (right-sided check). The tabular value for the degrees of freedom $k_1 = 4$ and $k_2 = 8$, $F_{kp}(4;8) = 3.84$. The estimated F is 4.374. Since the actual value is $F > F_{kp}$, the coefficient of determination is statistically significant and the regression equation is statistically reliable (i.e., the b_i coefficients are jointly significant).

The parameters of the model can be interpreted as follows: an increase in the tax burden by 1% leads to a decrease in the size of investments in PPP by an average of 44.025 billion rubles; an increase in the interest rate on loans to legal entities by 1% leads to a decrease in the size of investments in PPP by an average of 34.605 billion rubles; an increase in the inflation rate by 1% leads to a decrease in the size of investments in PPP by an average of 1.561 billion rubles; an increase in the share of budget expenditures in GDP by 1% leads to a decrease in the size of investments in PPP by an average of 54.363 billion rubles.

5 Conclusion

The number of implemented PPP projects in Russia has been steadily decreasing since 2016, from a peak of 1,270 projects to 116 in 2020. Over the past 13 years, the projects have become smaller in scale; the volume of investments per one PPP project in 2007 was 44.3 billion rubles, and in 2020, it decreased to 2.8 billion rubles. Low indicators are largely due to the absence of a long-term PPP development plan and clear conditions for the implementation of particular PPP projects. The distribution of PPP projects by sectors and regions is uneven. Similar trends can be traced in the distribution of investments. The study found that the size of investments in PPP projects did not have a significant impact on the volume of total investments in fixed assets. However, there is a positive relationship between the attracted investments in PPP projects and the size of the GRP. The author made sure that all the selected factors (the tax burden, the interest rate on loans to non-financial organizations, the inflation rate, the share of budget expenditures in GDP) have a significant impact on attracting investments in PPP projects. Therefore, the activation of the PPP institution in this context should be aimed at improving the macro-state of the economy. The creation of conditions for the functioning of an efficient infrastructure investment market will

allow attracting additional financing for PPP projects in sufficient volumes to overcome the accumulated lag of infrastructure from the needs of the economy and society.

6 Availability of Data And Material

Data can be made available by contacting the corresponding authors.

7 Acknowledgement

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Evgeny A. Kuzmin is a Researcher of Department of Regional Economic Policy and Economic Security of the Institute of Economics of the Ural Branch of Russian Academy of Sciences (Ekaterinburg, Russian Federation). His research interests include Risk, Uncertainty, Economic Crises, Sustainability, Public-Private Partnerships, Economic and Food Security, Investments, Business Planning, Industrialization, Industrial Policy, Industry Markets, Modeling, Economic Growth and Development, Entrepreneurship, Business Activity.
ORCID ID: orcid.org/0000-0002-8805-135X

Dr.Marina V. Vinogradova.is Professor of the Faculty of Economics of the Russian State Social University (Moscow, Russian Federation). She received a Dr.Sci. from the Russian State University of Tourism and Service. His research interests encompass Economic Development of Macro- and Microsystems, Socio-cultural Problems, Forecasting, Planning and Monitoring the Development of Socio-economic Systems, Regional Clusters, Public-Private Partnership, Economic and Information Security.
ORCID ID: orcid.org/0000-0002-5051-9404

Elza R. Zinatullina is a Post-graduate student of the Ural State University of Economics (Ekaterinburg, Russia). She is also Head of the Financial Department of Greif Russia, LLC (Perm, Russia). She holds a MEcon. His research interests: Digital Transformation of Industrial Enterprises; Impact of the Industry 4.0 on Changes in Business Processes of Enterprises; Monitoring the Effectiveness of Digitalization Implementation.
ORCID ID: orcid.org/0000-0002-0202-1054