DOI: 10.15587/978-617-7319-45-9.CH3

3 STATE FINANCIAL SUPPORT FOR BRIDGE CONSTRUCTION OF TERRITORIAL UNITS

Ia. Levchenko, I. Britchenko, I. Khoroshylova, I. Dmytriiev, O. Dmytriieva

ABSTRACT

Financial security has always been, is and will be the most painful topic for those who do not have their own funds. This applies to absolutely all sectors of the economy, all industries, all countries. When it comes to large-scale projects, including bridge construction, for Ukrainian realities it becomes a real test. In the context of the COVID-19 pandemic challenges, the problem of financial security is particularly acute, especially when it comes to poor regions that are unable to self-finance themselves and survive only on state financial support. Therefore, this section considers the problem of distribution of state financial support on the basis of the integrated approach. The answer to the research question is given: «What components should be included in the methodology for determining state financial support.» The comprehensive method for determining the share of public funds, which takes into account the investment attractiveness of the region and its risk, is proposed. Since the problem of financing the construction and reconstruction of bridges is relevant for a number of countries, this technique was tested on the example of bridge construction. According to the results obtained, the state financial support includes territorial units that are not leaders in priority for an investor and have a high level of risk in investing funds. The integrated approach allowed to identify 10 territorial centers for funding, with the areas with the worst priority indicators receiving the largest share of financial state support.

KEYWORDS

State financing, financial support, state support, financing model, bridge construction.

3.1 THE IMPORTANCE OF STATE FINANCIAL SUPPORT IN BRIDGE CONSTRUCTION

Research to address the problem of financing the reconstruction and construction of bridges is relevant for a number of countries [1]. For example, inspections of bridges in Italy have shown disappointing findings: 300 bridges in the country are in disrepair and could collapse at any moment. The traffic on these bridges is partially blocked, and the reason for that is structural damage in their supports. Most bridges and roads in Italy were built between 1950 and 1960 and are in poor condition. The shelf life of the concrete, from which they are made, is the same 50 or 60 years [2]. Seismic activity and climatic collapses only aggravate the situation [3]. The results of research [4] showed a long lack of funding and maintenance of existing structures, which often led to partial or complete closure of a bridge part and the destruction of the material.

The situation is similar in France. Every tenth bridge is in poor condition. Of the 12,000 French bridges, a third needs cosmetic repairs to eliminate structural changes. In 7 % of cases, the damage is quite serious, and some of them are at potential risk of collapse [2], which indicates the presence of the same problems as in Italy.

The results of studies of the condition of German bridges are as follows: 12.4 % of bridges are in very poor condition, and only 12.5 % are in good condition. Many structures were built between the 1960s and 1970s and are not designed for the very busy movement of today. In general, the condition of bridges in eastern Germany has been improved thanks to the state Program to support disappearing cities [6, 7]. In the western part of the country the situation is much worse – on a number of bridges the movement of heavy trucks is already prohibited [2].

According to the Information portal of the Russian community in Latvia [8], almost half of the 969 Latvian state-run bridges are in poor or very poor technical condition. The technical condition of 34.9 % of bridges is assessed as poor, 12.1 % – as very poor. And this indicates insufficient state financing.

For Latin American countries, in particular Brazil, the problem of poor bridges and roads is also relevant [9]. This fact is also recorded in [10], where the emphasis is on the age of bridges. The authors of the study [11] acknowledge the problem and propose to take a set of measures to prevent rapid destruction. At the same time, [12] noted that Brazilian researchers focus on solving «narrow problems». They are engaged in technical developments, related to the construction of new roads, bridges and hydraulic systems, which are considered as a priority on the path to innovative development of the country. At the same time, we are talking not only about buildings in large cities, but also about small ones, in which people also live and which must also follow the path of innovative development [12]. But this requires the maximum «elimination of regional imbalances in the state» and the financing of the most problematic regions and districts [13, 14].

Taking into account the complexity of the situation, the study [5] proposed to carry out the reconstruction, extending the service life of bridges through strengthening measures. Some researchers see the solution to the problem through government intervention, focusing on the need for significant capital expenditures [6, 7]. Financing bridge construction is a difficult task [15]. These questions were raised in the first half of the XX century [16] and are relevant in the XXI century [9, 17–20]. To sum up, on the one hand we have catastrophic wear of bridges, on the other – backward regions, which are not capable to cope with the problem of wear of bridges. This is what provokes the development of new forms of financing the latter [21], which provide for the solution of both problems at once.

3.2 WAYS TO DETERMINE THE STATE FINANCIAL SUPPORT OF NON-PRIORITY TERRITORIAL UNITS ON THE EXAMPLE OF BRIDGE CONSTRUCTION

Heads of Europe's world leaders are looking for ways and calling on other countries to help businesses that are global investors and suffering during the 2020–2021 crisis by implementing

government support measures. The road industry in general and bridge construction in particular especially need state support, as it is a guarantee of the country's defense capabilities [22–24]. A clear example is the data [25], where it is recorded, that only about 3 % of bridges do not provide the state's defense capabilities. It is hardly acceptable to talk about the full financing of bridge construction in the conditions of the crisis, but selective and fair regional financing is within the power of each state. Therefore, there is a need to develop a comprehensive methodology for the distribution of public finances and determine their share. It should solve the problem of catastrophic wear of bridges and «eliminate regional imbalances in the state» (support backward regions that are unable to cope with the problem of bridge wear) on the way to innovative development [13, 14].

To solve this problem, it is necessary to answer the research question: «What components need to be taken into account when determining state financial support.» Therefore, the question of the integrated approach [26], for the fair distribution of public funds, remains open and relevant [27].

According to existing methodologies, preference is given to territorial cells (areas) that have a high priority. This approach has raised doubts and questions. Following the experience of India, on the way to eliminating the regional imbalance in the state [13, 14], it is proposed to distribute public funds (state financial support) on the principle of «the largest state support to the weakest», which contradicts the views of researchers-predecessors. Existing funding methods do not provide a clear answer to how to identify weak territorial cells (areas) for funding and in what proportion it is necessary to distribute state financial support among the latter.

In the study [28], the authors discussed in detail some modern financial techniques: intergovernmental financing and credit guarantees. They showed in their article that the financing of large infrastructure projects can be provided not only by the state, but also by regions that are supported by the state. At the same time, the study does not say anything about which regions should be classified as «supported».

In the study [29], the author proposed a methodology that is a standardized structure and mechanisms of financial flows. But this model is specific because it focuses on the management of finances in the municipal housing stock. It also says nothing about the impact of components, such as priority, risk, and the impact of these components on the decision to finance.

The study [30] focuses on the financial security of cities. The authors proposed a financing model based on an indicator of investment attractiveness. This indicator is a key. The method is interesting for the comprehensive approach to assessing the territorial investment attractiveness, based on the rating of which the authors proposed to conduct financing, but did not propose a method of fair distribution of public funds. This part is theoretical in nature, which is a scientific gap of the above study.

The method of state financing is proposed in the study [31]. Here the dependence of financing on territorial attractiveness is proved. Healthy competition of territories for investments is substantiated. The basis of territorial attractiveness is the attractiveness of the land, which will later be able to return on investment.

The results of research [30–32] boil down to the fact that the higher the level of investment attractiveness, the more attractive the region is for financing. If we talk about attractiveness from the

standpoint of «for an investor», then everything is logical and clear. But when it comes to government support, everything should be the other way around. The state is obliged to support less attractive regions, to which an investor may never come and that have no hope of getting into the «top» of investment-attractive regions. Thus, the study [16] proposed a method of financial support of the bridge industry, based on selective regional funding. The authors of [31] consider selective financing as a factor of stabilization and sustainable development of a regional economy, because its main result is not a formal reorganization, but the effect of interaction with the state. At the same time, state support and selective financing of regions is the basis for the development of their economies [33]. In support of point funding the study [34] proposed a method of selecting regions for funding from the standpoint of a set of characteristics. The authors of the study used the approach of quantifying the attractiveness of a region to determine compliance and belonging to specific requirements. The study is indirectly devoted to the method of financing based on the assessment of the investment attractiveness of a region, which was discussed in the study [30]. But the study did not pay attention to the financial component. Namely, it is not indicated how selective state funding is made, how its size is determined. Researchers [33] have also proposed an interesting funding methodology that is based on a combination of private and public funds. But here we are talking about public-private partnership and attention is paid to the method of determining the equity participation of private funds. The issue of fair distribution of public funds on the basis of mathematical calculations is ignored.

To determine the amount of financial support, it is proposed to take into account the strengths and weaknesses of the potential object for funding and clearly identify the public goods and services provided, as well as the positive externalities. This is what is decisive with the support of public funding [35]. But such an approach is unacceptable, because in this case the support of weak regions is completely ignored.

Analyzing the works [16, 28–31, 33–35], it can be argued, that the problem of distribution of state financial support from the standpoint of support for weak regions is not sufficiently considered by other researchers. There is also a lack of a unified approach to determining the share of funding from the standpoint of support for weak regions, which indicates the need for appropriate research and determination of state financial support for non-priority territorial cells.

3.3 THE METHODOLOGICAL BACKGROUND FOR DETERMINING THE STATE FINANCIAL SUPPORT OF NON-PRIORITY TERRITORIAL CELLS

To determine the state financial support of non-priority territorial cells, two most important indicators were needed, namely: the indicator of investment attractiveness of a region (IIA) and the risk indicator.

To determine IIA, the «Methodology for evaluating the work of central and local executive bodies to attract investment, implementation of measures to improve the investment climate in the relevant sectors of the economy, regions and the appropriate form of report» was used [36].

The list of indicators, developed by the Ministry of Economy, is used for calculation – 4 groups, including 36 indicators, characterizing the level of development of a region (**Table 3.1**).

● **Table 3.1** The list of indicators for IIA assessment [36]

Group	Indicator
Economic indicators	Gross regional product per 1 person, million USD Profit from ordinary activities before tax, received by enterprises, million USD Volume of agricultural products (in comparable prices), million USD Share of innovation-active enterprises, % Gross agricultural output per 100 hectares of agricultural land, million USD Area of agricultural land per farm, ha Retail turnover of enterprises on average per month per 1 person, million USD The volume of realized market non-financial services of consumers per 1 person, USD Absorbed investments in fixed assets per 1 person, USD Absorbed investments in fixed assets at the expense of foreign investors, million USD Share of unprofitable enterprises to the total number of enterprises, % Volume of construction works, million USD Growth rate (decrease) of overdue accounts payable, % Growth rate (decrease) of overdue receivables, % Total exports per 1 person, million USD Increase in foreign direct investment per 1 person in the period, million USD Foreign direct investment per capita at the end of the period, million USD Volume of investments from regions to the economy of other countries per 1 person, million USD
Infrastructure development	Total volume of freight traffic, thousand tons Total volume of passenger traffic, thousand persons Provision of the population with home telephones per 100 families, units Total innovation costs for technological innovations, million USD Applications for inventions were submitted to legal entities, units Number of Internet users (contract), thousand persons
Human resources	Commissioning of housing by developers of all forms of ownership, thousand m^2 Wage arrears on average per 1 employee, USD The level of economic activity of the population aged 15–70 years, % Average monthly nominal salary of 1 full-time employee, USD Unemployment rate (according to the methodology of the International Labor Organization), % Level of employment of the unemployed registered population, % Graduation by higher educational institutions of I–II levels of accreditation, thousand persons Graduation by higher educational institutions of III–IV levels of accreditation, thousand persons
Enterpreneur-ship	The average annual number of employees of small enterprises with the number of employees in general at enterprises – business entities, thousand persons Volume of sold products (works, services) of small enterprises, %

The indicators, presented in **Table 3.1**, are open data of the State Statistics Committee of Ukraine. The calculation of IIA was carried out in three stages.

At the first stage, the assessment of IIA is carried out by summing the relative deviations of the indicators, characterizing the relevant activities of a region, to the best values of these indicators of the regions by the formula:

$$S_j = \sum((B_{max} - B_{ij})/(B_{max} - B_{min})) + \sum = \sum((B_{ij} - B_{min})/(B_{max} - B_{min})), \quad (3.1)$$

where S_j – rating of the investment attractiveness of the j-th region for each indicator; B_{ij} – value of the i-th indicator of the j-th region, $1 \le i \le n$; B_{max}, B_{min} – maximum and minimum values of the indicators; n – number of indicators, on which the calculation is made [36].

The first part of the formula is used to assess indicators, whose growth has a positive value (stimulants), the second part – to assess indicators, whose growth has a negative effect (disincentives).

In the second stage, the arithmetic mean value of the sum of rating estimates of IIA for each indicator is determined by the formula:

$$S_{mean} = S_j/n, \quad (3.2)$$

where S_{mean} – arithmetic mean of the sum of rating assessments of the activities of a particular region on the n-th indicators; n – number of indicators, on which the calculation is made [36].

At the third stage, the integrated rating IIA is determined by the following formula:

$$S_{ij} = \sum S_{cp} \times g_n, \quad (3.3)$$

where S_{ij} – integrated rating value of IIA; g_n – weight of the n-th group of indicators [36].

Next, the calculation of the risk indicator – the most important indicator in financing [37–39], which is taken into account when determining the state financial support of non-priority territorial cells. In contrast to the neoclassical approach, where a coefficient of variation is used to assess risk [40], a coefficient of semivariation was used, which allows a better assessment of the degree of risk [19]. Its use is expedient, in particular, when the external economic environment, the risk factors, characteristic of the considered project, is marked by dynamism.

Semivariation is calculated as follows:

$$SV = \frac{1}{P^-} \sum_{i=1}^{n} d_i^2 p_i, \quad (3.4)$$

where p_i – probability of the i-th result; d_i – negative deviations of actual results from the average expected:

$$d_i = \begin{cases} 0, & x_i \ge \overline{x}, \\ x_i - \overline{x}, & x_i < \overline{x}, \end{cases}$$

P – sum of the probabilities, for which d_i are negative.

In case of necessity of distribution of the state financial resources and determination of a share of financing, the corresponding technique, constructed on the basis of the received IIA and risk values, is offered. Its use will allow to make the optimum administrative decision, which will be useful both for the state budget, and for regional ones.

3.4 THE CHOICE OF CONDITIONS FOR CLASSIFYING REGIONS AS NON-PRIORITY IN TERMS OF STATE FINANCIAL SUPPORT

Suppose that a regional program (region development program) consists of n number of projects or regions (within the state) that need support. The index of the project that participates in investment processes will be indicated $i = \overline{1,n}$. Let the impact of the project per unit of investment spent be for the state a_i ($a_i < 1$, $i = \overline{1,n}$).

Since regional economic resources are limited, the most effective way to increase production is to attract additional capital resources [38], namely public funds. Regions are also interested in receiving budget funds. The idea of region's interaction with the state is that budget funds are provided on condition that the region participates in the financing of the project and undertakes to provide its own, regional, resources for financing.

A model for ensuring effective interaction between the state and the region is proposed, which takes into account the amount of public funding (support). The economic interest of the i-th project can be described by the expression:

$$Z_i(S_i x_i) = \varphi_i(S_i) - y_i = \varphi_i(S_i) - (S_i - x_i),\ i = \overline{1,n}, \tag{3.5}$$

where S_i – total amount of funding; $\varphi_i(S_i)$ – income of the i-th project; $y_i = (S_i - x_i)$ – lack of funds for project implementation; Z_i – net profit of the i-th project.

Also for calculation the artificial indicator q_i, which is calculated on (3.6), is necessary:

$$(1 - a_i)/l_i = q_i, \tag{3.6}$$

where a_i – efficiency; l_i – priority.

Substituting in formula (3.6) risk indicator (3.4) instead of the efficiency indicator and IIA indicator (3.3) instead of the priority indicator, the calculation of the artificial indicator q_i is performed:

$$(1 - SV)/S_{rj} = q_i, \tag{3.7}$$

where SV – risk (semivariation); S_{rj} – IIA.

To determine the number of regions to participate in regional development programs in general, we found the maximum value of n that would satisfy the inequality:

$$q_i < Q_n/(n-1), \tag{3.8}$$

where Q_n – sum of artificial indicators q_i corresponding to n.

When condition (3.8) is not met, the relevant regions are excluded from the list of candidates.

3.5 IDENTIFICATION OF TERRITORIAL CELLS FOR THE DISTRIBUTION OF STATE FINANCIAL SUPPORT

Based on the statistical data on the indicators, presented in **Table 3.1**, which are in the public domain, using formulas (3.1)–(3.3), IIA was calculated. As this study is conducted on the example of Ukraine, the values of IIA are presented by region of Ukraine (**Table 3.2**).

Table 3.2 IIA of Ukraine (2018)

Region	S_{rj}
Vinnytsia	0.408514
Volyn	0.355415
Dnipropetrovsk	0.422116
Donetsk*	0.458794
Zhytomyr	0.369553
Zakarpattia	0.374684
Zaporizhzhia	0.405340
Ivano-Frankivsk	0.373391
Kiyv	0.406496
Kropyvnytskyi	0.383469
Luhansk*	0.403544
Lviv	0.356200
Mykolaiv	0.398673
Odesa	0.396466
Poltava	0.410794
Rivne	0.361749
Sumy	0.376327
Ternopil	0.352696
Kharkiv	0.395974
Kherson	0.377155
Khmelnytskyi	0.363777
Cherkasy	0.398636
Chernivtsi	0.431203
Chernihiv	0.363765
Kyiv City	0.569373

*Note: * – data on the area, controlled by the territory of Ukraine; generalized by the authors on the basis of research [19, 28]*

It should also be noted, that during the anti-terrorist operation in the Donetsk and Luhansk regions of Ukraine, the data for evaluation were taken exclusively from the controlled areas of these regions.

The results of the calculation of risk (semivariation) are made according to formula (3.4) and are presented in **Table 3.3**.

Table 3.3 Risk calculation by regions of Ukraine [19]

Region	***SV*, %**
Ternopil	0.81
Kyiv City	0.96
Luhansk*	1.28
Khmelnytskyi	1.42
Lviv	1.69
Kropivnitsky	2.03
Chernihiv	2.31
Poltava	2.71
Zaporizhzhia	2.85
Volyn	2.93
Ivano-Frankivsk	3.05
Odesa	3.06
Kiyv	3.65
Kherson	3.70
Rivne	3.74
Zakarpattia	4.07
Kharkiv	4.21
Dnipropetrovsk	4.49
Donetsk*	5.50
Cherkasy	5.58
Vinnytsia	5.58
Sumy	8.78
Mykolaiv	9.65
Chernivtsi	11.37
Zhytomyr	20.03

*Note: * – data on the area, controlled by the territory of Ukraine*

Based on the calculations, the regions are grouped by level of risk, namely:

1. 0–3 % – low-risk regions (Kyiv City, Ternopil, Luhansk, Khmelnytskyi, Lviv, Kropyvnytskyi, Chernihiv, Poltava, Zaporizhzhia and Volyn regions);

2. 3–6 % – regions with an average level of risk (Ivano-Frankivsk, Odesa, Kyiv, Kherson, Rivne, Zakarpattia, Kharkiv, Dnipropetrovsk, Donetsk, Cherkasy and Vinnytsia regions);

3. >6 % – regions with a high level of risk (Sumy, Mykolaiv, Chernivtsi and Zhytomyr regions).

Thus, we get a list of regions – applicants for state financial support, namely: Ivano-Frankivsk, Odesa, Kyiv, Kherson, Rivne, Zakarpattia, Kharkiv, Dnipropetrovsk, Donetsk (controlled territory of Ukraine), Cherkasy, Vinnytsia, Sumy, Mykolaiv, Chernivtsi and Zhytomyr regions.

For the implementation of the program of state financial support, the emphasis was placed on financing the least priority areas. In conditions of a shortage of funds and provided that such regions have less chances to attract an investor than others, it is they who need state financial support.

3.6 DETERMINING THE FUNDING SHARE

To determine the share of funding, it is necessary to calculate q_i. The initial data for the calculation are presented in **Tables 3.2, 3.3**.

The calculation of q_i is carried out according to formula (3.7). When determining state financial support for non-priority territorial cells, according to the proposed methodology, it is necessary to line up applicants in ascending order of q_i value. The calculation results are presented in ascending order in **Table 3.4**.

According to the calculation results, presented in **Table 3.4**, it is possible to conditionally distinguish three groups of areas, applying for funding. Moreover, group 1 is the weakest area. The distribution into groups is as follows:

1) group – Zhytomyr, Donetsk, Chernivtsi, Dnipropetrovsk and Vinnytsia regions;

2) group – Cherkasy, Mykolaiv, Kiyv, Odesa and Kharkiv regions;

3) group – Sumy, Kherson, Zakarpattia, Ivano-Frankivsk and Rivne regions.

The algorithm of the procedure for determining the number of candidate regions for participation in the distribution of state financial support can be represented by inequality (3.8).

Let us check the fulfillment of the given condition for the set of obtained values of q_i. The check is performed as long as condition (3.8) is satisfied.

The calculation results are presented in **Table 3.5**.

Since condition (3.8) is not met for $n=11$, the calculations are terminated. 10 regions for state financial support were identified, namely: Zhytomyr, Donetsk, Chernivtsi, Dnipropetrovsk, Vinnytsia, Cherkasy, Mykolaiv, Kiyv, Odesa, Kharkiv regions.

Further, the values of the share of financing are calculated in proportion to the obtained $Q_n/(n-1)$ and the results are presented in **Table 3.6**.

Table 3.4 The value of q_i in ascending order

Region	q_i value
Zhytomyr	1.62683
Donetsk*	2.09440
Chernivtsi	2.13310
Dnipropetrovsk	2.23895
Vinnytsia	2.29833
Cherkasy	2.33897
Mykolaiv	2.34252
Kiyv	2.35721
Odesa	2.38860
Kharkiv	2.44940
Sumy	2.50048
Kherson	2.53609
Zakarpattia	2.54801
Ivano-Frankivsk	2.58040
Rivne	2.64686

*Note: * – data on the area, controlled by the territory of Ukraine*

Table 3.5 Checking the fulfillment of condition (3.8)

Regions number, n	q_i	$\sum q_i$ corresponding to n, Q_n	$Q_n/(n-1)$	Checking the fulfillment of condition (3.8)
2	2.09440	3.72123	3.721234	$3.721234 > q_2$
3	2.13310	5.85433	2.927168	$2.927168 > q_3$
4	2.23895	8.09328	2.697765	$2.697765 > q_4$
5	2.29833	10.39161	2.597906	$2.597906 > q_5$
6	2.33897	12.73058	2.546120	$2.546120 > q_6$
7	2.34252	15.07310	2.512187	$2.512187 > q_7$
8	2.35721	17.43031	2.490049	$2.490049 > q_8$
9	2.38860	19.81891	2.477368	$2.477368 > q_9$
10	2.44940	22.26831	2.474261	$2.474261 > q_{10}$
11	2.50048	24.76879	2.476883	$2.476883 < q_{11}$

● **Table 3.6** The results of calculating the share of financing at $K=1$

Region	Share of financing at $K=1$
Zhytomyr	0.1382
Donetsk*	0.1087
Chernivtsi	0.1002
Dnipropetrovsk	0.0965
Vinnytsia	0.0946
Cherkasy	0.0933
Mykolaiv	0.0925
Kiyv	0.0920
Odesa	0.0919
Kharkiv	0.0920

*Note: * – data on the area, controlled by the territory of Ukraine*

Thus, state financial support will be distributed according to the principle of «the greatest state support to the weakest», which corresponds to the goal of the study – to eliminate the regional imbalance in the state on the way of its innovative development.

3.7 DISCUSSION OF THE RESULTS OF DETERMINING STATE FINANCIAL SUPPORT FOR NON-PRIORITY TERRITORIAL CELLS

A large number of funding methods was proposed by researchers [19, 26–28, 31, 33–35]. In contrast to them, where preference for financing is given to objects that have high investment attractiveness and, accordingly, high priority, the proposed author's methodology is focused on determining financial support for non-priority territorial cells (regions). This became possible by applying the integrated approach to determining state financial support for the latter, which are not leaders in priority for an investor and have a high level of riskiness of investing funds. Comprehensiveness is ensured by the use of IIA and risk. Based on statistical data on the indicators, presented in **Table 3.1**, which are in the public domain, with the help of formulas (3.1)–(3.3), the calculation of IIA has been carried out. The results of calculating the risk have been made according to formula (3.4), based on the results of which the regions are grouped by the level of risk. The results of calculating IIA and risk have been summarized. The list of regions – applicants for state financial support has been received. Further, the values of the share of financing have been calculated in proportion to those, obtained in **Table 3.5** results.

Unlike existing methods, the author's methodology allows providing financial state support for regions that have the worst values of IIA and risk, which makes it possible to eliminate the regional

imbalance in the state on the way of its innovative development. Funding is carried out according to the principle of «the greatest state support to the weakest».

The results of the author's study are a laconic continuation of studies, carried out both at the local level [19, 41, 42] and in Africa [43] and Asia [44–46].

This study is practically interesting for public authorities in determining and allocating public funds, and theoretically – for researchers, involved in the financial support of the components of the road transport complex and public administration. The general provisions of the section are covered in [47].

REFERENCES

1. Del Grosso, A., Inaudi, D., Pardi, L. (2002, July). Overview of European activities in the health monitoring of bridges. First International Conference on Bridge Maintenance, Safety and Management. Bercelona. Available at: https://www.researchgate.net/publication/229004961
2. Manukov S. (2018). Sotni evropeiskikh mostov nakhodiatsia v avariinom sostoianii. Available at: https://expert.ru/2018/08/17/sotni-evropejskih-mostov-nahodyatsya-v-avarijnom-sostoyanii/
3. Pucci, A., Sousa, H. S., Puppio, M. L., Giresini, L., Matos, J. C., Sassu M. (2019). Method for sustainable large-scale bridges survey. IABSE Symposium Guimarães 2019, Towards a resilient built environment, risk and asset management. Guimarães, 1034–1041. Available at: https://repositorium.sdum.uminho.pt/handle/1822/64363
4. Di Sarno, L., da Porto, F., Guerrini, G., Calvi, P. M., Camata, G., Prota, A. (2018). Seismic performance of bridges during the 2016 Central Italy earthquakes. Bulletin of Earthquake Engineering, 17 (10), 5729–5761. doi: http://doi.org/10.1007/s10518-018-0419-4
5. Pipinato, A. (2018). Extending the lifetime of steel truss bridges by cost-efficient strengthening interventions. Structure and Infrastructure Engineering, 14 (12), 1611–1627. doi: http://doi.org/10.1080/15732479.2018.1465103
6. Pelke, E. (2020). The main directions taken by road bridges in Germany in the twentieth century. Proceedings of the Institution of Civil Engineers – Engineering History and Heritage, 173 (1), 14–25. doi: http://doi.org/10.1680/jenhh.19.00002
7. Hendricks, A., Volovich, N. V. (2018). Renovatsiia v Vostochnoi Germanii: programma podderzhki «ischezaiuschikh» gorodov. Imuschestvennye otnosheniia v Rossiiskoi Federatsii, 5 (200), 26–42. doi: http://doi.org/10.24411/2072-4098-2018-15002
8. Ivanov, A. (2018). Pochti polovina latviyskih mostov – v plachevnom sostoyanii. Available at: https://mixnews.lv/transport/2018/08/16/po4ti-polovina-latvijskix-mostov-naxoditsya-v-pla4evnom-sostoyanii/
9. Prato, C. A., Gerbaudo, C. F., Ceballos, M. A. (2002). Case Studies of Failure, Damage Assessment, and Repair of Multispan Bridges in Argentina. Rehabilitating and Repairing the Buildings and Bridges of Americas. doi: http://doi.org/10.1061/40613(272)14

10. Milani, C. J., Kripka, M. (2012). Diagnosis of pathologies in bridges of the road system in Brazil. Constructii, 13 (1), 26–34. Available at: https://www.researchgate.net/profile/Moacir_Kripka/publication/237101774_Diagnosis_of_pathologies_in_bridges_of_the_road_system_in_Brazil/links/0046351b88c3b4f50d000000.pdf
11. Esteves, I. C. A., Medeiros-Junior, R. A., Medeiros, M. H. F. (2018). NDT for bridges durability assessment on urban-industrial environment in Brazil. International Journal of Building Pathology and Adaptation, 36 (5), 500–515. doi: http://doi.org/10.1108/ijbpa-04-2018-0032
12. Khozhempo, V. V., Chernova, V. A. (2010). Brazil: current situation, problems and tendencies of innovative development. RUDN Bulletin, 4, 53–58. Available at: http://journals.rudn.ru/economics/article/view/11886
13. Backward Regions Grant Fund. Available at: https://www.indiastat.com/social-and-welfare-schemes-data/27/backward-classes-schemes/27905/backward-regions-grant-fund-brgf/411976/stats.aspx
14. Backward Region Grant Fund for all Arunachal districts (2013). Available at: https://timesofindia.indiatimes.com/city/guwahati/Backward-Region-Grant-Fund-for-all-Arunachal-districts/articleshow/27236041.cms
15. Gil, N., Beckman, S. (2009). Introduction: Infrastructure Meets Business: Building New Bridges, Mending Old Ones. California Management Review, 51 (2), 6–29. doi: http://doi.org/10.2307/41166478
16. Parker, F. (1931). Constructing and Financing Toll Bridges. The Journal of Land & Public Utility Economics, 7 (2), 127. doi: http://doi.org/10.2307/3139049
17. Danette Bonano-Rodríguez, V. (2017). La colaboración público-privada para la provisión de autopistas, carreteras y puentes. Madrid. Available at: https://eprints.ucm.es/40889/
18. Hemming, R., Anderson, B., Alier, M., Petrie, M., Cangiano, M. (2006). Public-Private Partnerships, Government Guarantees, and Fiscal Risk. International Monetary Fund, 100. doi: http://doi.org/10.5089/9781589064935.058
19. Levchenko, Y. (2020). Teoretiko-metodologicheskie osnovy finansovogo obespecheniia mostostroeniia ukrainy v ramkakh gosudarstvenno- chastnogo partnerstva. Sofia, 272. Available at: https://www.academia.edu/41818798/ТЕОРЕТИКО_МЕТОДОЛОГИЧЕСКИЕ_ОСНОВЫ_ФИНАНСОВОГО_ОБЕСПЕЧЕНИЯ_МОСТОСТРОЕНИЯ_УКРАИНЫ_В_РАМКАХ_ГОСУДАРСТВЕННО_ЧАСТНОГО_ПАРТНЕРСТВА
20. Guo, S., Shi, Y. (2018). Infrastructure investment in China: A model of local government choice under land financing. Journal of Asian Economics, 56, 24–35. doi: http://doi.org/10.1016/j.asieco.2018.04.001
21. Kukacka, J., Kristoufek, L. (2020). Do «complex» financial models really lead to complex dynamics? Agent-based models and multifractality. Journal of Economic Dynamics and Control, 113, 103855. doi: http://doi.org/10.1016/j.jedc.2020.103855
22. Kukla, W. (2018). The infrastructure of road transport in poland in shaping the state security. Transport Economics and Logistics, 80, 139–148. doi: http://doi.org/10.26881/etil.2018.80.15

23. Britchenko, I. G., Cherniavska, T. A. (2017). Transport security as a factor of transport and communication system of Ukraine self-sustaining development. Scientific Bulletin of Polissia, 1 (1 (9)), 16–24. doi: http://doi.org/10.25140/2410-9576-2017-1-1(9)-16-24
24. Mattar Nasser, R., de Moraes, R. F. (2014). O Brasil e a segurança no seu entorno estratégico: América do Sul e Atlântico Sul. Brasília: Ipea.
25. Pashinsky M. (2020). Krupnye i dlinnye: v kakom regione strany bolshe vsego mostov. Available at: https://gmk.center/infographic/krupnye-i-dlinnye-v-kakom-regione-strany-bolshe-vsego-mostov/
26. Snieska, V., Zykiene, I. (2015). City Attractiveness for Investment: Characteristics and Underlying Factors. Procedia – Social and Behavioral Sciences, 213, 48–54. doi: http://doi.org/10.1016/j.sbspro.2015.11.402
27. Muczyński, A. (2020). Financial flow models in municipal housing stock management in Poland. Land Use Policy, 91, 104429. doi: http://doi.org/10.1016/j.landusepol.2019.104429
28. Terlikowski, P., Paska, J., Pawlak, K., Kaliński, J., Urbanek, D. (2019). Modern financial models of nuclear power plants. Progress in Nuclear Energy, 110, 30–33. doi: http://doi.org/10.1016/j.pnucene.2018.09.010
29. Smyrnov, O., Borysenko, A., Trynova, I., Levchenko, I., Marchenko, A. (2020). Determining the technical and economic parameters for designing hybrid power units for the budget segment. Eastern-European Journal of Enterprise Technologies, 1 (8 (103)), 43–49. doi: http://doi.org/10.15587/1729-4061.2020.194642
30. Sardak, S., Samoilenko, A. (2014). National Economies Intellectualization Evaluating in the World Economy. SSRN Electronic Journal. doi: http://doi.org/10.2139/ssrn.3508400
31. Akbulaev, N., Aliyev, Y., Ahmadov, T. (2019). Research models for financing social business: theory and practice. Heliyon, 5 (5), e01599. doi: http://doi.org/10.1016/j.heliyon.2019.e01599
32. Mindlin, Yu., Stolyarov, N., Novikova, N., Smolentsev, V., Tikhomirov, E. (2018). Evaluation of competitive advantages of regional economic clusters. Revista Espacios, 39 (31). Available at: https://www.revistaespacios.com/a18v39n31/a18v39n31p14.pdf
33. Urbancikova, N., Burger, P. (2014). Financing Clusters from Public Funds in the European Countries. Journal of Applied Economic Sciences, 9 (1 (27)), 148–157. Available at: https://www.researchgate.net/publication/262791406_Financing_Clusters_from_Public_Funds_in_the_European_Countries
34. Angelis-Dimakis, A., Dimaki, K. (2016). Identifying Clusters of Regions in the European South, based on their Economic, Social and Environmental Characteristics. REGION, 3 (2), 71. doi: http://doi.org/10.18335/region.v3i2.81
35. Coletti, M., Maria, E. D. (2015). The rush for cluster initiatives: cluster organization and management in Central Europe. International Journal of Entrepreneurship and Innovation Management, 19 (5–6), 327–342. Available at: https://www.deepdyve.com/lp/inderscience-publishers/the-rush-for-cluster-initiatives-cluster-organisation-and-management-0sfcKSigpR

36. Pro zatverdzhennia Metodyky otsiniuvannia roboty tsentralnykh i mistsevykh orhaniv vykonavchoi vlady shchodo zaluchennia investytsii, zdiisnennia zakhodiv z polipshennia investytsiinoho klimatu u vidpovidnykh haluziakh ekonomiky ta rehionakh i vidpovidnoi formy zvitu (2006). Nakaz Ministerstva ekonomiky Ukrainy No 245. 12.08.2006. Available at: https://zakon.rada.gov.ua/laws/show/z0459-04#Text
37. Vorkut, T., Volynets, L., Bilonog, O., Sopotsko, O., Levchenko, I. (2019). The model to optimize deliveries of perishable food products in supply chains. Eastern-European Journal of Enterprise Technologies, 5 (3 (101)), 43–50. doi: http://doi.org/10.15587/1729-4061.2019.177903
38. Orlowski, L. T. (2012). Financial crisis and extreme market risks: Evidence from Europe. Review of Financial Economics, 21 (3), 120–130. doi: http://doi.org/10.1016/j.rfe.2012.06.006
39. Kraus, K., Kraus, N., Pochenchuk, G. (2021). Principles, assessment and methods of risk management of investment activities of the enterprise. VUZF Review, 6 (3), 45–58. doi: http://doi.org/10.38188/2534-9228.21.3.06
40. Variation coefficient. Available at: https://wiki.loginom.ru/articles/variation-coefficient.html
41. Mustafakulov, S. (2017). Investment Attractiveness of Regions: Methodic Aspects of the Definition and Classification of Impacting Factors. European Scientific Journal, 13(10), 433. doi: http://doi.org/10.19044/esj.2017.v13n10p433
42. Levchenko, Y. (2019). On the way to European integration: How and who can invest in construction and reconstruction of Ukrainian bridges? Eastern Europe: Economy, Business and Management, 6 (23). doi: http://doi.org/10.32782/easterneurope.23-22
43. Collier, P., Pattillo, C. (2000). Investment and Risk in Africa. Investment and Risk in Africa. London: Palgrave Macmillan, 3–30. doi: http://doi.org/10.1007/978-1-349-15068-7_1
44. Abuzayed, B., Al-Fayoumi, N., Arabiyat, T. S. (2018). Does Investors' Fear Gauge in a Mature Market Matter? Evidence from the MENA Region. The Journal of Wealth Management, 21 (1), 71–87. doi: http://doi.org/10.3905/jwm.2018.21.1.071
45. Lee, S. (2001). The risks of investing in the real estate markets of the Asian region. Working Papers in Land Management & Development, 6 (1), 30. Available at: http://centaur.reading.ac.uk/27114/1/0601.pdf
46. Singh, R., Bhattacharjee, J. (2019). Measuring Equity Share Related Risk Perception of Investors in Economically Backward Regions. Risks, 7 (1), 12. doi: http://doi.org/10.3390/risks7010012
47. Levchenko, I., Britchenko, I. (2021). Estimation of state financial support for non-priority territorial units using the example of bridge construction. Eastern-European Journal of Enterprise Technologies, 1 (13 (109)), 26–34. doi: http://doi.org/10.15587/1729-4061.2021.225524