The European Proceedings of
Social & Behavioural Sciences
EpSBS

Future Academy

ISSN: 2357-1330

https://dx.doi.org/10.15405/epsbs.2018.12.83

# RPTSS 2018
# International Conference on Research Paradigms Transformation in Social Sciences

# ESTIMATION METHOD OF FAVOR LEVEL OF EXTERNAL BUSINESS CONDITIONS DURING PROJECTS IMPLEMENTATION

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## *Abstract*

The article focuses on the conceptual problem of selecting the place of application and the field of specialization of the projects of public private partnership (PPP projects). Sometimes such selection is made without any reasonable grounds. As one of the variants of solution, the method for estimating the favor level of external conditions is offered that is based upon finding a dynamic criterion of the significance of the values correlation in the group of parameters of the adaptive model. The approach to the selection procedure is based upon ranking the objects according to the value of the model integral function from the point of view of the territorial and branch aspects of the attractiveness of the external conditions. It was revealed that the force of the correlation dependence is determined basing upon the size of sampling and the number of observations. The represented method can serve as a universal tool of building various economic models where the set of parameters (values) is not determined initially and is not fixed.



**Keywords:** External conditions, projects of public private partnership, dynamic criterion of correlation significance, economic differentiation of regions, adaptive model.

https://dx.doi.org/10.15405/epsbs.2018.12.83
Corresponding Author: E. A. Kuzmin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

## 1. Introduction

In the portfolio management of the projects of public private partnership, the most important component of determination of the priority projects for implementation is the selection of the most rational places of their application. To solve the mentioned problem, in our opinion, it is reasonable to use the adaptive approach that combines the procedures into the universal complex of methods and techniques of the changes generation in the management systems depending upon the change of parameters of the management object and also the appearing of exogenous factors.

However, we shall mention that the adaptive management in the selection procedures of the projects of public private partnership shall take into account the availability of the so-called risk-generating elements (Popov, 2005; Xiao-Hua, 2011; Teng, Li, Yuan, & Deng, 2015; Bai, Li, Du, & Xu, 2017). In this context, the obligatory characteristics and at the same time the requirements to the selection procedures of the projects of public private partnership are the following: forecast and analytical character; prevailing of the strategic functions; economic and mathematical modeling; variance; probability and uncertainty. The principal feature of this approach is the perception of the modeled system as a set of the autonomous agents making their independent decisions.

The initial stage of formation of the scientific approaches to the adaptive selection and targeted selection of the fundamental conditions, estimation of their favor for implementation of the projects of public private partnership is the study of reasons that stipulate this selection. The non-system reasons take a special place in this problem with the growth of the uncertainty of the environment when the forecasting of the future state of the organizational and economic system becomes difficult. In this context, we shall mention the point of view of Lösch (1959, p. 48).: “there is no scientifically grounded and doubtless solution of the location selection for an enterprise. There is only a practical approach to this problem: empirical selection excluding the erroneous results”. Nevertheless, Lösch (1959) does not deny the existence of the location theory itself; on the contrary, he emphasizes that the location theory can be used in the practice to determine the location for an enterprise.

That means that the traditional methods of location selection for the project of public private partnership cannot take into account the growing complexity of the processes, their uncertainty and risks. Therefore, the author offers to use the methods of adaptive selection of fundamental conditions via integral estimation of favor level of external conditions.

## 2. Problem Statement

### 2.1.Problematics of social and economic differentiation

The nature of economic differentiation was studied during a long period of time. The evident difference of the living standards of different territories within the same region (country) has become an objective message.

In the works of many scientists, the problem of the leveling of the economic differentiation was solved from the point of view of the levels of development, but the criterial and referential level could be presented in another way. Here we can mention the research of Rosenfeld (1969). In his works, it is emphasized correctly that the content of the notion “leveling shall not be understood more simply as an

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eISSN: 2357-1330

achievement of the same district indexes in all the spheres of production and as a mechanical establishment of the same levels regardless of the economic results" (Rosenfeld, 1969, p. 141).

To study all nuances, it is necessary to address some earlier publications. In the research of Lavrischev (1964), the processes of the leveling of the development levels are connected to the territorial division of social labor. The possibility for acceleration of the development rates of the whole country is observed only in one case, when the maximal values of the entire set of considered regions are accepted as reference values.

Another approach is described in the work of Nekrasov regarding the determination of factors of location of material production. According to Nekrasov, they include the use of the economic natural resources, rational use of labor resources, optimal sizes of production, etc. (Nekrasov, 1978). Mutalimov (2010) refers this problem to the implementation of the national interests in the field of economic safety and this is not without reason. He mentions that the leveling of the levels of economic development can be considered as a factor of national sustainability and provision of the common economic space.

Basing upon the literature review, it is evident that the estimation model of the favor level of external conditions shall definitely include the set of those factors that can characterize the riskiness of location of the projects of public private partnership. To specify the approach, it is necessary to address the existing estimation methods of the territory potential.

## 3. Research Questions

The results represented in the works of McKim (1960), Blair and Reese (1999), Jaffee (1998), Vermeulen and Sanders (1970), Khan (1986), Garcia (2006) and many others show that the approaches to the building of the territory estimation model are mainly similar but the practice of use of these models gives some specific restrictions. Here it is important to mention that the regional practice of the ranking of regions touches upon the subject of competitiveness estimation that is made in the internal interests.

The solution concerning the location of an enterprise is most often one of the first solutions; its consequences can be rather significant. They will predetermine other managerial decision-making including the enterprise behavior in the market, the efficiency of its activity and its life time. This thought becomes a fundamental postulate that is traced in the work of Estall and Buchanan (1980), who say that "for a new enterprise the location selection shall be one of the earliest decisions and it is extremely important because it is one of the most difficult decisions as it cannot be reversed if the choice was unreasonable".

The comparative approbation of estimation methods of the economic competitiveness of regions performed at the Institute of Social and Economic Development of RAS Uskova, Barabanov, Popova, Yogman, & Ilyin, 2010) led to the conclusion of the imperfection of some offered approaches, such as, for example, the ranking estimation of competitiveness (Pechatkin, Salikhov, & Sablina, 2004) that does not contain the grounding for the selection of the set of values; estimation of the clusterization potential (Ermishina, 2005), where for the practical application of method it is necessary to obtain the data that go beyond the limits of the standard statistic survey; evaluation of the regional market based on demand and proposals (Andreev, 2001), which assesses the role and place of the region in the economic space, as well as the opportunity to provide a high standard of living for the population - the method is based on

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balancing regional demand and regional supply, but the competitiveness function includes, in addition to this assessment of the factors of production, the standard of living of the population of the region and socio-political factors; integral assessment of the competitiveness of regions (Merkushov, 2004, p. 24-38), which assesses the effectiveness of the use of production factors (economic potential); assessment of the competitiveness of regions on the basis of the calculation of the index (Larina & Makaev, 2006), in which the private competitiveness index is duplicated by economic content with a general index calculated on the basis of private indexes, etc.

Finally, the literature review revealed that the problematics of estimation of the favor level of external conditions requires the further development of the theoretical and methodological solutions. For this, the author attempts to describe one of the possible variants in the estimation method on the base of the financial indexes. The possibility of their use in determination of region attractiveness was analyzed by Seeleva (2002), who confirmed the availability of interconnection of the values of the financial indexes and favorable conditions for the execution of commercial operations.

## 4. Purpose of the Study

The adaptive approach to the selection procedure of projects of public private partnership is based upon the formation of dashboard and calculation of the integral index by means of which the places of their application are ranked from the point of view of the territorial and branch aspects of attractiveness (favor of external conditions).

To form the dashboard, it is reasonable to use the indexes that reflect sufficiently the conditions of the projects implementation. The offered method of estimation of the favor level of external conditions excludes the application of the correlation analysis that studies the impact of indexes (correlation). The essence of the approach is to form the list of possible indexes that can characterize the situation and exclude those indexes that show the joint correlation above the design critical level. The other indexes can be included into the model and, at the same time, the duplicating impact of factors will be excluded. In other words, to ground the selection of indexes on the base of the correlation analysis, it is necessary to check the significance of correlation.

## 5. Research Methods

### 5.1.Dynamic significance criterion of indexes (factors)

Contrary to the widely used opinion about the existence of the constant levels of correlation dependence, we would like to pay attention to the fact that the *force of correlation dependence is determined according to the sampling size or the number of observations.* An example of the typification of the correlation relationship is its division into 5 types using the two criteria (directionality and force) offered in the work of Glass and Stanley (1976, p. 110). Such correlation relationship can be strong direct, weak direct, weak reverse, strong reverse or absent (no relationship). But the types of correlation without the calculation of the acceptable values do not allow concluding about the dependence of the indexes or factors for use in the model. The necessity of testing of correlation significance taking into account the reliability of estimation (error) and the sampling size is mentioned in the works of Nimenia (2003), Pagano (2012), Downie and Heath (1970) et al. Basing upon the results of their studies of testing the

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correlation significance, we offer to determine the dynamic critical level of correlation when the relationship becomes significant. The possibility of calculation of such critical level is described in the work of Kramer (1975), where the Student's distribution function and probability are described at which the parameter of t-statistics will be higher or lower than its average value:

$$S_n(t) = \frac{1}{\sqrt{n \times \pi}} \times \frac{G(\frac{n+1}{2})}{G(\frac{n}{2})} \times (1 + \frac{t^2}{n})^{-\frac{n+1}{2}} \quad (1)$$

,

where $n$ is the number of freedom degrees; $G$ is Euler's gamma-function.

The Student's distribution (Gosset, 1908) allows estimating initially the hypothesis and calculating the confidential intervals for indexes. However, the Students' inverse distribution function at the set significance level (error) and the number of tests (sampling size) gives the possibility to determine the critical level of correlation by several transformations.

Quantiles of the Student's distribution function at inverse use become the starting point of the calculation of correlation critical value between the indexes. Conditionally, when the probability (significance) is determined according to the formula (1) at the set number of the freedom degrees, the value of the quantile can be determined in the following way:

(2)

$$X = S^{-1}(P \mid n) = \{X : S(X \mid n) = P\},$$

at

$$P = S(X \mid n) = \int_{-\infty}^{X} \frac{G(\frac{n+1}{2})}{G(\frac{n}{2})} \times \frac{1}{\sqrt{n \times \pi}} \times \frac{1}{\left(1 + \frac{t^2}{n}\right)^{\frac{n+1}{2}}} dt$$

,

where $X$ – t-statistics.

There are table values of t-statistics as well as for the critical values of Pearson's correlation – for particular cases they are shown in the work of Fisher and Yates (1963, p. 63). But the necessity of determination of the critical value of correlation at the individual correlation of probability of significance (reliability) and the number of freedom degrees leads to the solution of the problem of formula derivation of its determination. The mathematical expression of t-statistics for mutual estimation shall contain the value of Pearson's correlation, the value of which shall be determined as a critical value:

$$X = r_{ij} \times \sqrt{\frac{v-2}{1-r_{ij}^2}} \quad (3)$$

,

where $r_{ij}$ is a value of correlation between the i-index (factor) and the j-index (factor); $v$ is a sampling size (number of observations).

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By some transformations, we can obtain the following solution:

$$r_{ij}^2 \times (X^2 + v - 2) = X^2 ,$$
$$r_{ij} = \sqrt{\frac{X^2}{X^2 + v - 2}} . \quad (4)$$

The derived formula of the correlation critical value (4), when using the formula (1) of determination of t-statistics directly, can be applied for determination of the indexes that meet the requirement of absence of correlation relationship (up to the level of significance) to include it into the model of estimation of the favor level of external conditions.

As the correlation matrix includes the paired correlation value, to perform the sampling procedure, it is necessary to determine some average correlation value for every index (factor) to all the others. For this, the authors offer to calculate the cumulative impact by adding the values of correlation:

$$\sum R_i R_j = \sum_{j=1}^{kl} R_j(R_i) - 1 , \quad (5)$$

where $\sum R_i R_j$ is the cumulative correlation impact of the i-factor (index) on the set of factors (indexes) R; $kl$ is the number of combination of factors (indexes).

Taking into account the fact that the value of factor correlation on its own is 1, the formula (5) gives the pure cumulative impact for the number of factors kl-1. Thus, when calculating the average correlation value it should be taken into account that the number of indexes shall be less by 1. In other words, the mathematical expression can be represented as follows:

$$\overline{R}_i(R_j) = \frac{\sum R_i R_j}{kl - 1} , \quad (6)$$

where $\overline{R}_i(R_j)$ is the average cumulative correlation impact of the i-factor (index) on the combination of factors (indexes).

The calculation of critical value of correlation at the set level of estimation reliability of 99.9% and the sampling volume (observations) allowed filtering the indexes that met the condition that:

$$| \overline{R}_i(R_j) | \leq | r_{ij} | . \quad (7)$$

**5.2.Integrated function of adaptive model**

The application of the selected indexes for the formation of a model is closely connected to the development of the integral function. As a complex index, we can offer a function that is represented as a sum of product of indexes and their standardized value (standardized coefficients).

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To determine the standardized coefficients, we follow the method of relative differences. However, taking into account all disadvantages and advantages of the method of relative differences, it is not suitable and efficient for making comparative or contrastive estimations and it is shown in the work of Savitskaya (2002). Thus, the author's opinion regarding the problem of calculation of the integration index of the favor level realizes the unification principle where by transforming the only maximal level for all indexes of the model is formed.

In such case, the determination of the standardized coefficient can be done by the following calculations:

$$N_i = \frac{1}{\max\{F_i\} - \min\{F_i\}}, \tag{8}$$

where $N_i$ is the standardized coefficient of the i-index (factor), $\max\{F_i\}$ is the maximal value of the i-index (factor); $\min\{F_i\}$ is the minimal value of the i-index (factor).

The preliminary stage of calculation of the standardized coefficient is to establish the directionality of the indexes dynamics. In other words, all selected values shall meet one of the requirements depending upon the purposes of estimation where, on one hand, the growth of indexes shall witness the improvement of the situation and, on the other hand, the contrary is possible when the growth of index characterizes the deterioration of the situation. Therefore, the multidirectionality of the dynamics of indexes shall be leveled by the reverse data format ('$a^{-1}$' or '1-a' for specific values).

The essence of application of the standardized coefficients in the estimation model of the favor level comes to the determination of the location of the object under analysis in the relative comparison with other objects. Finally, the mathematical expression of the standardized coefficients allows saying that they represent a "step" or "cost" of the index change at which the minimal value of the private integral index is zero and its maximal value is equal to one.

The partial integral estimations do not contain a special analytic content except that they define the level of the considered observation in comparison with other observations. Finally, it is the generalized integral index that can serve as the means of determination of some favorable external conditions for the production activity of enterprises or location of the projects of public private partnership.

The integral value for the cumulative impact of all selected indexes can be calculated using the formula (8) as a sum of products of standardized coefficient and actual values:

$$M_{j-estimation\_level} = \sum_{i=1}^{kv} F_i \times N_i, \tag{9}$$

where $M_{j-estimation\_level}$ is an integrated index, j – estimation level, $F_i$ is an actual value of the i-index, $kv$ is the number of indexes (factors) selected for the model.

The offered approach can serve as a universal tool of building of economic models where the set of parameters is not determined initially. The adaptivity of the approach is expressed by its ability to determine the indexes (factors) for the model by individual calculation of the critical correlation value

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eISSN: 2357-1330

provided that the general list of indexes (factors) can completely characterize the studied phenomena and processes.

## 6. Findings

To approve the described approach, the regional and branch conditions for the implementation (location) of the projects of public private partnership are considered. The formation of the dashboard is performed by compiling a combination of the specific financial and economic indexes that characterize the general conditions. The sampling was made in several stages; the correlation dependence of indexes was analyzed to make a list of the indexes of the model. The results of calculations are shown in Table 1-2.

**Table 01**. Correlation matrix of indexes of estimation model of favor level

| | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | R11 | R12 | R13 | R14 | R15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R1 | 1 | | | | | | | | | | | | | | |
| R2 | .59 | 1 | | | | | | | | | | | | | |
| R3 | -.14 | -.20 | 1 | | | | | | | | | | | | |
| R4 | .53 | .72 | -.44 | 1 | | | | | | | | | | | |
| R5 | .00 | -.27 | -.23 | .10 | 1 | | | | | | | | | | |
| R6 | .23 | .37 | -.42 | .49 | .06 | 1 | | | | | | | | | |
| R7 | .29 | .30 | -.43 | .39 | .24 | .80 | 1 | | | | | | | | |
| R8 | .32 | .35 | -.44 | .45 | .26 | .77 | .92 | 1 | | | | | | | |
| R9 | .25 | .35 | -.46 | .45 | .02 | .87 | .92 | .82 | 1 | | | | | | |
| R10 | .28 | .35 | -.46 | .42 | -.04 | .78 | .88 | .75 | .95 | 1 | | | | | |
| R11 | .13 | .22 | -.44 | .34 | .31 | .70 | .92 | .86 | .87 | .80 | 1 | | | | |
| R12 | -.23 | -.08 | .02 | -.07 | -.23 | -.36 | -.44 | -.45 | -.37 | -.27 | -.41 | 1 | | | |
| R13 | .55 | .92 | -.21 | .85 | -.22 | .43 | .28 | .36 | .36 | .37 | .18 | -.05 | 1 | | |
| R14 | .48 | .36 | -.42 | .49 | .23 | .53 | .65 | .67 | .56 | .59 | .44 | -.41 | .41 | 1 | |
| R15 | .20 | -.13 | -.15 | .16 | .80 | .01 | .16 | .31 | -.04 | -.12 | .17 | -.26 | -.09 | .21 | 1 |

*Note:* R1 – absolute (immediate, instant) liquidity; R2 – quick liquidity (intermediate coverage); R3 – profitability of sales; R4 – security of working capital; R5 – total assets turnover; R6 – interests coverage (EBIT interest coverage); R7 – return on assets; R8 – return on fixed assets; R9 – return on profit before tax (accounting period profit); R10 – share of overdue payments in the total volume of accounts payable to the budgets of all levels; R11 – return on equity; R12 – ration of owned and borrowed capital; R13 – day-to-day liquidity (total coverage); R14 – specific weight of owned capital in total capital (Equity Ratio); R15 – yield of capital investment (fixed asset turnover).

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**Table 02.** Model parameters

| Index | | $\sum RR$ | $\overline{R}\overline{R}$ | *RRc* [1)] | Use [2)] |
|---|---|---|---|---|---|
| R1 | Absolute (immediate, instant) liquidity | 3.48 | .25 | .37 | + |
| R2 | Quick liquidity (intermediate coverage) | 3.84 | .27 | .37 | + |
| R3 | Profitability of sales | 4.43 | .32 | .37 | + |
| R4 | Security of working capital | 4.88 | .35 | .37 | + |
| R5 | Total assets turnover | 1.04 | .07 | .37 | + |
| R6 | Interests coverage (EBIT interest coverage) | 5.26 | .38 | .37 | – |
| R7 | Return on assets | 5.87 | .42 | .37 | – |
| R8 | Return on fixed assets | 5.94 | .42 | .37 | – |
| R9 | Return on profit before tax (accounting period profit) | 5.54 | .40 | .37 | – |
| R10 | Share of overdue payments in the total volume of Accounts payable to the budgets of all levels | 5.27 | .38 | .37 | – |
| R11 | Return on equity | 5.08 | .36 | .37 | + |
| R12 | Ration of owned and borrowed capital | 3.60 | .26 | .37 | + |
| R13 | Day-to-day liquidity (total coverage) | 4.15 | .30 | .37 | + |
| R14 | Specific weight of owned capital in total capital (Equity Ratio) | 4.79 | .34 | .37 | + |
| R15 | Yield of capital investment (fixed asset turnover) | 1.24 | .09 | .37 | + |

*Note:* [1)] critical correlation value in modulus (the value is determined at the level of significance 0.001 (reliability 99.9%), at 80 observations and the inclusion of right and left Student's distribution tail areas); [2)] indexes, the values of which do not exceed the critical level, are marked.

Index correlation values are composed as of 2012/16 in the context of the entities of the Russian according to the data of the First Independent Rating Agency (FIRA).

15 indexes most widely used in the economic analysis refer to the widely distributed indexes. On their base, the groups of liquidity indexes (absolute, quick and day-today), profitability (profitability of sales, return on assets, return on fixed assets, profit before tax), turnover (turnover of assets, yield on capital investment), indexes of debt service (interests coverage, a share of overdue payments in the total volume of accounts payable to the budgets of all levels), indexes of capital structure (ratio of borrowed and owned capital, specific weight of owned capital in the total capital) can be formed.

For the studied situation, using the formulas of the approach (2), (4) provided that the significance is 0.001, and the number of observations is 80 (selected by entities of the Russian Federation), the expression (7) can be represented as:

$$|\bar{R}_i(R_j)| \leq 0.37. \quad (10)$$

In such case, among 15 considered financial indexes that fulfil the conditions (8), only 10 correspond to the model. All selected indexes demonstrate the low correlation relationship and this allows using them in the model with the sufficient grounding of likelihood. The index of total asset turnover showed the smallest correlation value, that is, 0.07. The second according to the level of correlation is the yield on capital investments or the fixed assets turnover where the correlation value does not exceed 0.09. For other indexes included into the model, in the average the correlation varies in the range of 0.29-0.33.

Taking into account the standardization of indexes by means of (9), we can conclude about their dynamics independently in every group – by regions and types of economic activity (international

economic activity). Considering the regions as the objects under analysis we can reveal that during the considered period the territorial differentiation decreased. This shows an increase in the amplitude of indexes changes and it leads to a decrease in the values of standardized coefficients.

The author connects the analysis of the standardized coefficients with the analysis of soundness and steadiness. These parameters play an important role in the determination of risk and uncertainty (Kuzmin, 2015). Such connection is stipulated by the amplitude fluctuations of indexes that a priori demonstrated the uncertainty of the economic development and the presence of risk when selecting one or another region or type of economic activity.

Thus, the described approach of the estimation model of the favor level of external conditions allows obtaining a relatively independent estimation, from the point of view that the weight coefficients for the indexes are not set, and each of them is estimated separately from the others. However, the integral index is not the end index on the base of which the final decision of the location of projects of public private partnership is made. For this it seems necessary to analyze also the impact of transaction capacity (Dubrovsky & Kuzmin, 2013), to determine the connection of transaction costs with the measures of uncertainty and risk that is the field of the further perspective researches.

## 7. Conclusion

The obtained results allow concluding that the hypothesis of the possible estimation of the favor level of external conditions has already found its confirmation. The used financial and economic indexes in the model reflect the level of the efficiency of the company's activity. In this regard, the problem of selection and compilation of the set of indexes for including into the model is extremely important. The author's approach presupposes that the favor estimation can be formed according to several directions: "region-branch", "branch-region" and the parallel analysis "region-region" and "branch-branch". The location of the projects of public private partnership regardless of the field of specialization with various potentials influences definitely the level of the development of regions. The main consequence of this is an economic differentiation of regions. The traditional selection methods of the project location of public private partnership cannot take into account the growing complexity of the processes, their uncertainty and risks. The described approach of the estimation model of the favor level of external conditions allows solving this problem partially and obtaining a relatively independent estimation.

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