

## **Indication of Competitiveness of the Potential of the Region through Hurwitz and Wald Criteria**

**<sup>1</sup>Ekaterina Vladimirovna Tsenina, <sup>2</sup>Tamara Petrovna Danko,  
<sup>3</sup>Ksenia Valeryevna Ekimova, <sup>4</sup>Vladimir Dmitriyevich Sekerin  
and <sup>5</sup>Anna Evgenevna Gorohova**

*<sup>1-3</sup>Plekhanov Russian University of Economics,  
36, Stremyanny per., Moscow, 117997, Russian Federation.*

*<sup>4,5</sup>Moscow State University of Mechanical Engineering,  
38, Bolshaya Semenovskaya St., Moscow, Russian Federation.*

### **Abstract**

Despite the measures taken by the state for the maintenance and development of the regions, the task of developing a strategy for regional development is a relevant problem of the state economic policy. To implement the developed strategy, priority sectors in the region must be identified, the development of which will be funded through various development programs in the region. Choosing the most efficient directions for realizing the economic potential requires the development of methodical approach to a comprehensive assessment of the components of socio-economic potential of the region. In carrying out a comprehensive assessment of the economic potential of the region to identify the region's specialization and determine the strengths and weaknesses of its development, we propose an approach based on the theory of games with "nature."

To do this, two types of estimates are calculated: comparison of industries by the Hurwitz criterion and identification of parameters that will ensure maximum gain under the worst conditions using the Wald criterion. It creates the following game situation: a part of population (user) acts as Player A, who can act either independently or through an intermediary; the interest of the user is to gain maximum satisfaction at minimum cost; the interest of the intermediary (business entities) is to get the maximum economic benefit while preserving the resource potential of the region. It is necessary to determine the specialization and intensity of the industries in the region.

The article describes the assessment of one of the four main components of the economic potential – production and resource potential – on the example of Leningrad region. Ranking the results of the analysis of statistics on the proposed method, it can be concluded which industries have the greatest production and resource potential. The final conclusions on the investment and development of the industries should be made after a comprehensive study of the characteristics of all four components of the economic potential of the region, which can be extended by analogy with the above example of the analysis of the production and resource potential.

**Keywords:** assessment of the regions, economic potential of the regions, game theory, assessment criteria.

## **Introduction**

Any territorial entity needs to develop and refine the indicators to assess the competitiveness of the regions (Katkalo V.S. 2008) and to promote them to the global market of the territory (Rumelt R.P. 2003). The relevance of the problem of development of integrated indicators of competitive positioning of regions on the basis of the existing statistical reporting is primarily associated with the intensification of globalization processes (Danko T.P. 2015), which are expressed in the free movement of tangible and intangible resources (financial, human, intellectual, etc.) in order to find the most profitable areas of their application. (Parfenova M.J, Babishin V.D., Yurkevich E.V., Dudin M.N., Sekerin V.D.; Vol. 10, No. 17; 2014). In this regard, many regions began to compete with each other to attract resources, including investment, which led to the realization of the need for using marketing philosophy and technologies for the formation of the market attractiveness of the area. (Clark T., Osterwalder A., Pigneur Y. 2012).

The competitiveness of the region is most often considered as the ability to create the conditions in the domestic and foreign markets (Osterwalder A., Pigneur Y. 2010). The assessment of competitiveness of the region can be based on the determination of the level of socio-economic development and investment attractiveness of regions (Norse D. 2012).

Estimation of competitiveness is important (Geroski P., Gugler K.) for developing a strategy for the region (Danko T.P. 2015). Given the specificity of the region, the strategy could be aimed at the solution of problems of interest to both the country as a whole and for the given region: the rational use of natural resources, research and development, etc. (Clark T., Osterwalder A., Pigneur Y.).

Priority sectors (economic activities) must be identified in order to implement the designed strategy (Danko T.P. 2015), the development of which will be funded through various development programs in the region (including direct public investment, government grants and subsidies, etc.) (Sekerin V.D, Avramenko S.A., Veselovsky M.Y., Aleksakhina V.G. 2014).

There are many methods to assess the competitiveness of the territory (Danko T.P., Shemetkova O.L. 2015) and some of its economic performance: method of technical and economic calculations, economic and statistical methods, methods of sociological research, mathematical methods (calculation of the integral index of the regional development and use of econometric models and their characteristics to quantify the level of development) (Danko T.P., Zarova E.V. 2015).

As is known, the economic potential includes four main complexes. (Suldina G.A. 2012)

1. Production and resource potential. (Osterwalder A., Pigneur Y). For its assessment, the following elements are critical: fixed and working capital, circulating assets and working capital, gross value added, which is calculated at the level of economic sectors in the region (it is defined as the difference between output of goods (services) and intermediate consumption) Dudin M.N., Lyasnikov N.V., Sekerin V.D., Gorohova A.E. 2014). Distribution of assets by industries must be taken into account. It should be remembered that quantitative indicators in the region with a particular monetary value cannot give a complete picture of the state of the region, therefore, the qualitative characteristics should be taken into account: for example, the degree of depreciation of fixed assets and their share by economic activities. In addition, the analysis can take into account dynamic parameters (over several years): for example, growth rate of industry manufacturing, changes in the share of industry production in the total product of the economy of the region, degree of intensification of industries, etc.
2. Natural and environmental potential. It is difficult to assess through quantitative indicators, but components like the quality of the land, climatic conditions and ecological capacity of the region, which indirectly affect the results of operations, may be taken into account. The state of natural resources (minerals, land, water, flora fauna, etc.) may be discussed in detail, which are related to the conduct of economic activity in a particular region and can have quantitative (and sometimes cost) assessments (Sekerin V.D., Gribov V.D. 2014).
3. Labor potential (Tsenina E.V., Panasenko S.V. 2012). It is a combination of available current and anticipated labor opportunities characterized by the number of able-bodied population. It is characterized by a professional educational level and has a certain volume and structure. The qualitative characteristics are especially important: health status, level of education and qualification training, borders of the extent of deviant behavior affecting the scale of unemployment and the degree of involvement (psychological characteristics) of people in employment.
4. Foreign economic relations and fiscal relations in the region (Tsenina E.V., Tsenina T.T. 2014). The former are presented by the regional balance of payments as a ratio of its exports and imports. The latter are presented by a system of intergovernmental relations, the sizes of transfers, subsidies, grants, etc. (Teece D.J. 2002).

## Methodology

In carrying out a comprehensive assessment of the economic potential of the region to identify the region's specialization and determine the strengths and weaknesses of its development, we propose an approach based on the theory of games with "nature."

To do this, two types of estimates are calculated: comparison of industries by the Hurwitz criterion and identification of parameters that will ensure maximum gain under the worst conditions using the Wald criterion. It creates the following game situation: a part of population (user) acts as Player A, who can act either independently or through an intermediary; the interest of the user is to gain maximum satisfaction at minimum cost; the interest of the intermediary (business entities) is to get the maximum economic benefit while preserving the resource potential of the region. Player B is "nature", and it is not necessarily the natural physical and other processes, but also social and other processes that accompany economic activity. The loss of Player B is offset from the outside, for example, through state subsidies or funds for the renewal of resources laid down in the investment. Knowledge of optimal strategies of the "nature" allows to determine the most unfavorable conditions expected by Player A and to estimate the necessary expenses of restoring the resources enabling it to receive a guaranteed income. As a result, it is possible to determine the specialization and intensity of the industries in the region.

To evaluate the intensity of the operation of industries and their investment attractiveness, we should formalize the characteristics shown in the adopted units to a single type of notation. We suggest to take a conventional unit (CU) of measurement as such a unit:

$$X_{ij} = \frac{\Pi_{ij}}{|\Pi_{ij, \text{bas}}|} \quad (1)$$

At  $\Pi_{ij, \text{bas}} \neq 0$ ,

Where  $X_{ij}$  is a conditionally equivalent value of the  $i$ -th index of the  $j$ -th characteristic of the complex of economic potential of the region;  $\Pi_{ij, \text{bas}}$  is a basic value of the  $i$ -th index of the characteristic (in conventional units), minimum or maximum value of the  $i$ -th index of the  $j$ -th characteristic of the complex of economic potential of the region is also offered as basic;  $\Pi_{ij}$  is a value of the  $i$ -th index of the  $j$ -th characteristic of the regional economic potential (in conventional units).

The best option is the one that provides the minimum value of the lost opportunity.

The choice is made using the Hurwitz criterion. The advantage of using this method of decision-making is that it allows to see both optimistic and pessimistic options and determine the weight of each of them depending on the actual state of the regional potential.

Let's introduce a special coefficient  $\lambda$  [0,1], which will denote a quantitative "measure of optimism" of Player A in choosing a strategy. This coefficient is chosen by the

player based on intuition, personal experience, state of the environment, or on the basis of statistical studies of decision-making results (Shapkin A. Shapkin V. 2013).

The effectiveness of pure Strategy A in terms of the Hurwitz criterion [(Hur)( $\lambda$ )] is characterized by the following index:

$$(\text{Hur})(\lambda) = (1 - \lambda)W_{ij} + \lambda M_{ij},$$

at  $i = 1, 2, \dots, m$ ;  $j = 1, 2, \dots, n$

where  $W_{ij}$  and  $M_{ij}$  are performance indicators for Strategy A, respectively according to the maximin rule (named the Wald criterion), maximizing the minimum of possible outcomes and according to the maximax rule (named the Savage criterion) maximizing the maximum of possible outcomes.

The coefficient of optimism  $\lambda$  is chosen between 0 and 1, and if the coefficient is 1, the Hurwitz criterion is transformed into Wald criterion (by pessimism of the result), while if the coefficient is 0, it is transformed into the Savage criterion.

The number  $(1-\lambda)$  will characterize the extent of pessimism of Player A, and thus the coefficients of optimism and pessimism sum to one. With increasing measure of responsibility, coefficient  $\lambda$  tends to zero: the more serious the consequences of wrong decisions, the greater the desire of the player to avoid them. The closer  $\lambda$  to zero, the closer  $(1-\lambda)$  to one, i.e. the greater the pessimism, and vice versa. Note that the coefficient of  $\lambda=0.5$  reflects the neutrality of the player in the assessment of the situation in the choice of strategy.

Let's consider the example of assessment of one of the four major complexes – production and resource potential – in Leningrad region.

The following characteristics of the region by economic activities were used for its assessment:

- Distribution of the number of enterprises and organizations;
- Investments in fixed capital;
- Sectoral structure of gross value added;
- Cost of fixed assets;
- Commissioning of fixed assets;
- Structure of fixed assets;
- Structure of the commissioning of fixed assets;
- Degree of depreciation of fixed assets;
- Proportion of fully depreciated fixed assets;
- Amount of loss for organizations.

Summary table of the listed characteristics in absolute units of measurement is given in Table 1.

The choice is made using the Hurwitz criterion. The advantage of using this method of decision-making is that it allows to see both optimistic and pessimistic options and to determine the weight of each of them depending on the actual state of the regional potential.

The results of decisions (industries) are ranked in descending order (Tables 4 and 5). The development strategy should firstly address the industries for which the objective function has adopted the highest values.

## Results

The result of formalization of the absolute values of characteristics (in CU) is based on absolute indicators of economic activities of the production and resource potential of Leningrad region (absolute indicators of economic activities of production and resource potential of Leningrad region (<http://www.gks.ru/>) for 2013. The calculation is made according to formula (1). Thus, for the characteristic "Distribution of the number of enterprises and organizations by economic activities", a basic indicator value of  $P_{i,t,as}$  was chosen as minimum, corresponding to the economic activity "mining." Accordingly,  $X_{t,i}$  for the economic activity "Agriculture, hunting and forestry" in CU will be 24.4 (4910/201).

According to the analysis, various types of economic activity are distributed (from maximum to minimum) as follows: manufacturing, transportation and communication, production and distribution of electricity, gas and water, etc.

Let's assign values to the coefficient  $\lambda$  (Table 2). Recall that the coefficient of optimism  $\lambda$  is selected between 0 and 1, and if the ratio is 1, the Hurwitz criterion is transformed into the Wald criterion (by pessimism of the result). Thus, the selected values  $\lambda=0.2$  and  $1-\lambda=0.8$  reflect a cautious attitude to risk of the consequences of decisions made, quite a pessimistic mood. We take the maximum and minimum values for each industry from Table 1 and fill in Table 3.

**Table 2:** Weights for calculation according to the Hurwitz criterion

	$\lambda$	$-\lambda$
probability pessimist	0.2	,8
probability optimist	0.8	,2

**Table 3:** Calculation results for the considered economic activities (industries) according to Hurwitz (pessimistic version)

Economic activity	Minimum	Maximum	$\lambda \times (\text{maximum value})$ = 0.2 x (maximum value)	$(1-\lambda) \times (\text{minimum value})$ = 0.8 x (minimum value)	sum	ranking
agriculture, hunting and forestry	2.4	24.4	4.9	1.9	6.8	5
mining	1.0	2.5	0.5	0.8	1.3	7
manufacturing	2.0	147.7	29.5	1.6	31.2	1
production and distribution of electricity, gas and water	1.8	95.3	19.1	1.4	20.5	3
construction	1.0	15.5	3.1	0.8	3.9	6
wholesale and retail trade; repair of motor vehicles, motorcycles, household goods and personal items	1.0	35.8	7.2	0.8	8.0	4
transportation and communication	1.7	109.4	21.9	1.4	23.2	2

The selected values of  $\lambda=0.8$  and  $1-\lambda=0.2$  reflect the risk-averse attitude, quite an optimistic mood. We take maximum and minimum values for each industry from Table 2 and fill in Table 4.

**Table 4:** Calculation results for the considered economic activities (industries) according to Hurwitz (optimistic version)

Economic activity	Minimum	Maximum	$\lambda \times (\text{maximum value})$ = 0.8 x (maximum value)	$(1-\lambda) \times (\text{minimum value})$ = 0.2 x (minimum value)	sum	ranking
agriculture, hunting and forestry	2.4	24.4	19.5	0.5	20.0	5
mining	1.0	2.5	2.0	0.2	2.2	7
manufacturing	2.0	147.7	118.1	0.4	118.5	1
production and distribution of electricity, gas and water	1.8	95.3	76.2	0.4	76.6	3
construction	1.0	15.5	12.4	0.2	12.6	6

wholesale and retail trade; repair of motor vehicles, motorcycles, household goods and personal items	1.0	35.8	28.6	0.2	28.8	4
transportation and communication	1.7	109.4	87.5	0.3	87.9	2

After ranking the results, we can conclude that manufacturing, transport and communication, production and distribution of electricity, gas and water have the largest production and resource potential. An interesting fact is that in this case the choice of priority industries for the development is the same, regardless of the relationship to the risks of the chosen decision. However, when analyzing a larger number of industries or with a wider range of the analyzed characteristics, the priority of the industries may change in ranking. This provides additional flexibility of the proposed method, since it takes into account not only the completely different characteristics of industries development, but also the attitude of a researcher to the analyzed situation. In addition, this approach allows to make decisions and to choose the future development strategies for the priority industries without the use of the numerical values of the probabilities of outcomes, based on the existing statistics.

## Discussion

Thus, the proposed model of the integrated indication of the competitiveness of the region using the methods of the Hurwitz and Wald criteria allows to offer another tool for integrated assessment of the priority and lower rationality of industries in the region. A positive feature of this method is the initial focus on the situation of crisis. The latter allows to make a judgment on the complex and the best use of resources. However, it should be noted that the above calculation example illustrates the architecture of obtaining the research result, while in practice the final conclusions on investment and development of industries in the region should be made after a comprehensive study of the characteristics of all four components of the economic potential: natural, environmental and labor potential, as well as taking into account the development of foreign economic relations and fiscal relations in the region. Using this method allows to build a system of priorities for competitiveness of the regions based on real calculations and estimates. In addition, it is possible to trace the dynamics of the regional development (perhaps even taking into account the chosen strategy) when comparing the marked indicators over several years. The originality of the author's position is the attempt to develop a new system of indicators to measure the competitiveness of regions based on the game theory. The bottleneck of this method is focus on the existing structure of the regional market segments and the



resource base of the region. It seems appropriate to further elaborate inter-regional cooperation and vectors of development of innovative sectors of the region.

## **Conclusions**

The method under consideration allows to expand the indicative base of assessment of regional competitiveness based on the game theory. The method requires testing of its development with the inclusion of evaluation of the component of the innovation potential of the region, the vector of opportunities of the market of intangible assets.

This study was conducted as part of the situational analysis center of Plekhanov RUE, marketing of the regions.

Depending on the position of research, various components of the economic potential can be used (this study involved the natural, environmental and employment potential, as well as took into account the development of foreign economic relations and fiscal relations in the region and production resources). In the real economic situation, the market situation requires clarification of behavior of different segments of the market, which would respectively require not only to expand statistical and analytical base and methodological tools. We assume that the limitations of the study chosen by us are the first step of indication of competitiveness of the potential of the region through Hurwitz and Wald criteria. The bottleneck of this method is focus on the existing structure of the regional market segments and the resource base of the region. It seems appropriate to further elaborate inter-regional cooperation and vectors of development of innovative sectors of the region. Consideration of a competitive research field by regions will provide an opportunity to clarify the system of interconnection of priorities and clarify the balance of resources usage through the correlation coefficients, including on inter-regional level, in order to achieve the development goals of the region in a chosen strategy for each individual region.

## **References**

- [1] Katkalo, V.S., 2008. Evolution of the strategic management theory. St. Petersburg: PH SPbSU, pp: 548.
- [2] Danko, T.P., 2015. Estimation of the potential of development of the regions and architecture of their competitiveness. (On an example of the Sakha Republic, Primorsky Krai and Khabarovsk Krai). Bulletin of Belgorod University of Cooperation, Economics and Law, 2(54).
- [3] Clark, T., A. Osterwalder and Y. Pigneur, 2012. Business Model You: A One-Page Method For Reinventing Your Career Paperback. John Wiley and Sons, pp: 264.
- [4] Osterwalder, A. and Y. Pigneur, 2010. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers Paperback. John Wiley and Sons, pp: 288.
- [5] Norse, D., 2012. Low carbon agriculture: Objectives and Policy path ways. Environmental Development, 1: 25-39.

- [6] Rumelt, R.P., 2003. What in the World Competitive Advantage? Policy Working Paper, 1: 25- 34.
- [7] Parfenova, M.J, V.D. Babishin, E.V. Yurkevich, M.N. Dudin and V.D. Sekerin, 2014. Methodology Making Management Decisions Based on a Modified Ramsey Model. *Asian Social Science*, Vol. 10, 17: 292-301. ISSN 1911-2017 E-ISSN 1911-2025 Published by Canadian Center of Science and Education
- [8] Danko, T.P., 2015. Textbook "Marketing management" 4th ed. revised and enlarged. Tutorials and workshops for bachelors and masters. Moscow: Publ. Uright M. 42.3, pp: 1. ISBN 978-5-9916-4482-2 BBK 65.290ya73
- [9] Clark, T., A. Osterwalder and Y. Pigneur, 2012. *Business Model You: A One-Page Method For Reinventing Your Career* Paperback. John Wiley and Sons, pp: 264.
- [10] Geroski, P. and K. Gugler, 2004. Corporate growth convergence in Europe. *Oxford Economic Papers*, 56(4): 597–620.
- [11] Danko, T.P., 2015. Estimation of the potential of regional development and architecture of their competitiveness. (On an example of the Sakha Republic, Primorsky Krai and Khabarovsk Krai). *Bulletin of Belgorod University of Cooperation, Economics and Law*, 2(54).
- [12] Sekerin, V.D, S.A. Avramenko, M.Y. Veselovsky and V.G. Aleksakhina, 2014. B2G Market: The Essence and Statistical Analysis. *World Applied Sciences Journal*, Vol. 31, 6: 1104-1108. ISSN 1818-4952 <http://www.idosi.org/mejsr/mejsr17%2810%2913/8.pdf>
- [13] Danko, T.P. and O.L. Shemetkova, 2015. Using the correlation coefficients to clarify the filling of SWOT and PEST-analysis of regional marketing (on an example of Penza, Orenburg and Perm regions). *J. "Economy and entrepreneurship"*, 6-3(Part 3): 1066-1074.
- [14] Danko, T.P. and E.V. Zarova, 2015. Methods of assessing the competitiveness of the region on the basis of the ratio of business positioning. *J Economics Sciences*, 5.
- [15] Osterwalder, A. and Y. Pigneur, 2010. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers* Paperback. John Wiley and Sons, pp: 288.
- [16] Suldina, G.A., 2012. Actual problems of modernization of the regional economy. Eds., Suldina, G.A. Kazan. Date Views: 12.11.15 [http://repository.kpfu.ru/?p\\_id=44401](http://repository.kpfu.ru/?p_id=44401).
- [17] Dudin, M.N., N.V. Lyasnikov, V.D. Sekerin and A.E. Gorohova, 2014. Historical aspects of global transformation of engineering thought in industry and agriculture in the context of changing the technological modes. *American-Eurasian Journal of Sustainable Agriculture*, Vol. 8, 6: 17-22.
- [18] Sekerin, V.D. and V.D. Gribov, 2014. The Miles Stones of Logistics Management Development. *World Applied Sciences Journal*, Vol. 30, 4: 454-459. (ISSN 1814952). Date Views: 12.11.15 [http://www.idosi.org/wasj/wasj30\(4\)14/11.pdf](http://www.idosi.org/wasj/wasj30(4)14/11.pdf).
- [19] Tsenina, E.V. and S.V. Panasenko, 2012. Classification and management of operational risks in marketing. *Practical Marketing*, 11(189): 13-17.

- [20] Teece, D.J., 2002. Dynamic capabilities. The International Encyclopedia of Business and Management. London: Thomas Learning Publisher, pp: 149-151.
- [21] Tsenina, E.V. and T.T. Tsenina, 2014. Approaches to management of uncertainty in volatile markets. Logistics and trade policy: coll. of sc. w., Vol. 1(12). Eds., Shcherbakov, V.V. and E.A. Smirnova. St. Petersburg: PH SPbSU, pp.109-111.
- [22] Shapkin, A. and V. Shapkin, 2013. Economic and financial risks. Assessment, management, investment portfolio. Publ.: Dashkov & Co. ISBN 978-5-394-02150-3
- [23] Federal State Statistics Service. Date Views: 12.15.15 <http://www.gks.ru>

