

Prospects of Competitiveness of Production of Regions Participating in the Project “New Silk Road” Taking Into Account Concepts “Lean Production” and “Economy of Sustainable Development”

Anna Starodubova

Department of innovation in chemical technology
Kazan National Research Technological University
Kazan, Russia
upfr-nk@list.ru

Nailya Gareeva

Department of finance and credit
Kazan Innovative University named after V.G. Timiryasov
Nizhnekamsk, Russia
gareevana5@mail.ru

Abstract—The authors propose an improved method of assessing the competitiveness of production of regions. The novelty of this method lies in the principles of selection of competitiveness factors based on the concepts: "Lean production", "Economy of sustainable development", "Change Management" (previously these concepts were not taken into account in the methods of other researchers). The study selected and classified (using the method of expert evaluation) influencing factors of competitiveness of production on five criteria: long-term and short-term action factor; financial results production and sales of the product; compliance to norms (standards) in the production and sale of the product; the extensiveness of changes in the production and sale of the product; interaction and integration in the production and sale of the product. Approbation of the methodology for assessing competitiveness was carried out on the example of rubber and plastic products of the Russian regions participating in the project "New Silk Road" (using a score and ranking). Approbation of a technique of an estimation of competitiveness on an example of production from rubber and plastic of the Russian regions - participants of the project "New Silk Road" (by means of point estimation and a ranking) is carried out. As a result, the proposed method allows to classify the regions participating in the project "New Silk Road" by types of competitiveness and on this basis to form a strategy of business cooperation and prospective of economic development.

Keywords: *competitiveness, lean production, sustainable development, “Change Management”, region, innovation, export, integration*

I. INTRODUCTION

Currently, in UN countries the traditional economic model are transforming to a new model of "Sustainable development Economy". Therefore, until 2030, the main goal of these

countries (including their regions) is to improve human well-being and ensure social justice, significantly reducing the risks to the environment and its degradation. Achieving this goal is possible by increasing the level of competitiveness of production of regions in the UN countries. This requires an effective and modern assessment of competitiveness, which determines the factors affecting its level. The second driver of the modern economy is the global investment project initiated by China "New Silk Road" until 2050. Therefore, the countries participating in this project need a methodology for assessing competitiveness to classify the regions participating in the project by types of competitiveness and on its basis the formation of a strategy for business cooperation and the definition of prospects for economic development. The purpose of this research is study the opportunities and threats of competitiveness productive of regions participating in the project "New Silk Road" with the concepts of "Lean production" and "Economy of sustainable development".

The object of the study is method of assessing the competitiveness of production of regions.

The subject of the study is the factors affecting the competitiveness of production of regions.

The hypothesis of the research is the assumption that a more effective and modern methodology for assessing the competitiveness of production of regions is an integrated assessment in the short and long term, while taking into account the concept of "Lean production and "Sustainable development Economy".

II. LITERATURE REVIEW AND RESEARCH METHODS

The most popular among the existing methods of assessing competitiveness is the method of calculating the global

competitiveness index of countries proposed in 2004 at the World economic forum [1]. European regional competitiveness index was developed for calculation the competitiveness of individual European Union countries, on the basis of the global competitiveness index [2]. Such authors as S. Bucher and O. V. Bakhareva, A. I. Romanova, R. S. Safina, I.M. Kursina, A.A. Shindina, A. A. are emphasized of the importance of assessing regional competitiveness [3], [4]. But not all UN countries use the regional competitiveness index, following the example of the European Union. For example, in the Russia for 2019, the regional competitiveness index has not yet been developed by the Federal statistics service. Despite the popularity and a large number of indicators that have the global and European competitiveness regional indices, they do not take into account factors related to environmental. Therefore, the authors A. Bilbao - Teirol, M. Arenas-Parra, V. Onopko - Onopko propose to include in the European regional index environmental indicators (CO2 emissions waste per capita, environmental investment) [5]. A. Bilbao -Teirol, M. Arenas-Parra, V. Onopko - Onopko modified European competitiveness Index and was named it like index regional sustainable competitiveness. Currently, researchers do not have a single approach to the methodology of assessing competitiveness with taking into account the impact factors of the sustainable development. S. N. Bobylev and S. V. Solovyena believe that it is necessary to develop an indicator of regional competitiveness according to the criteria of sustainable development [6], [7]. S. Bucher also notes that regional competitiveness is the ability to offer an attractive and sustainable environment for businesses and citizens to live and work comfortably [3]. Authors D. Gligor, C. N. Jurcut support his view on the need to consider competitiveness in the context of sustainable development [8]. However, there are authors like D. Vrontis, G. Tardivo, S. Bresciani, M. Viassone who do not consider the impact of sustainable development when assessing competitiveness [9]. In assessing the competitiveness of the manufacturing industry of the regions, they propose to use the following factors: the number and size of firms, the characteristics of the entrepreneur, the level of investment, internationalization, the ability to create networks and partnerships, outsource part of their activities, innovation [9]. Other researchers W. Cui, X. Cui, C. Hao assessed the competitiveness manufacturing industry of provinces of China, based on three factors: productivity, innovation, environmental protection and resources [10].

M. Porter and C. Van der Linde emphasize the relationship between competitiveness and the environment [11]. They believe that competitiveness is manifested in regions where the right environmental standards have been developed, which are a source of implementation and continuous improvement of innovations [11]. W. B. Gray also adheres to this point of view considering that in different regions environmental norms (standards) should be implemented if the benefits to society exceed the costs of their implementation [12]. In those regions where this condition is not met, enterprises tend to move production to regions with less strict regulation [12]. I. P. Glazyrina, I. A. Zabelina suggest that in the project "New silk road" there is a probability of development of such a scenario by China on the territory of Russia [13]. M. Porter and C. Van der Linde believe that in regions where the right

environmental standards are introduced before others, they move to the international market before others (with high added value) [11].

Also, in assessing the competitiveness of production of regions, according to M. Porter and M. R. Kramer, W. E. Deming, it is necessary to take into account the long-term perspective and not only the financial result in the short term [14], [15]. The approach of I. Adizes is interesting from the point of view of the concept of "Change Management" which allows considering the competitiveness of products of each region in the short and long term [16]. For example, the short-term perspective is responsible for meeting the needs of current consumers. A long-term perspective is responsible for meeting the needs of future consumers [16].

Few researchers study the relationship between "Sustainability Economics" and "Lean production" [17], [18], [19], [20], [21], [22], [23]. T. Larson R. Greenwood considers them unrelated [24]. Authors A.A. King and M.J. Lenox believe that "Sustainable development" is a positive side effect of "Lean production" (due to the reduction of waste and pollution and efficient use of energy, resources) [25]. As the popularization of "Lean production" grows, many regions are moving to the "Economy of sustainable development". G. G. Bergmiller and P.R. McCright, Ch.M.Kim, H.T. Ming Lim emphasize that regions that implement the "Economy of sustainable development" in the "Lean production" achieve better results than those that do not [26], [27]. Other authors J. D. Hanson, S. Melnyk, R. J. Calantone believe that the introduction of "Economy of sustainable development" and "Lean production" should be carried out simultaneously [28], [29].

The study consisted of the following five stages. At the first stage, the groups and their factors that affect the competitiveness production of regions taking into account the concepts of "Lean production", "Economy sustainable development", "Change management" were selected and classified using the method of expert evaluation. At the second stage of the study, an integrated assessment of the competitiveness of regional products, including the factors selected at the first stage of the study, is proposed. This assessment is developed using the method of scoring and ranking indicators. At the third stage, the classification of the levels of competitiveness production of regions, based on the threshold values of indicators is developed using the method of calculating the average level in the series of dynamics. At the fourth stage of the study, the methodology competitiveness production of regions was tested (including the calculation of the integrated indicator of competitiveness and the determination of the level of competitiveness production according to the classification). In the sample of the study 27 regions of the Russia were included, which was 32% of the total number of those who made of rubber and plastic products. Among these regions were included those who are participants of the long-term project "New Silk Road" [30]. For example, the region - the Republic of Buryatia participates in the project "Economic corridor China-Mongolia-Russia". The following regions: Smolensk, Moscow, Kurgan, Yekaterinburg, Chelyabinsk, the Republic of Tatarstan participate in the project "New Eurasian Land Bridge".

TABLE I. TABLE INTEGRATED ASSESSMENT OF COMPETITIVENESS PRODUCTION OF REGIONS

Symbol of the group of factors	Name of group of factors	Indicator included in the group	Period	Threshold value in points	
				minimum	maximum
F	financial result	profitability of sales	Short	0	12.5
		costs per 1 monetary unit		0	12.5
S	standards and certification	share of products subject to mandatory certification in the region		0	25
C	extensiveness of the changes	assortment of perspective products	Long	0	5
		market share		0	5
		share of exports		0	5
		share of innovative products		0	5
		share of recycled waste (by recycling)		0	5
I	interaction and integration	number of clusters in the region associated with the production		0	25

Reports of the federal statistics and customs service as of 2018 were used as data for the specified regions of the Russia. Export and import of products between the Russian regions-participants of the project "New Silk Road" and China was analyzed at the fifth stage of the study. The analysis was carried out using the comparative method, based on the data of the federal customs service of the Russia as of 2018. As well as the assessment of the competitiveness of the countries participating in the "New Silk Road" was carried out on the basis of data from the world economic forum "Report of Global competitiveness" [1].

III. RESULTS

The authors propose groups and their factors for assessing the competitiveness production of regions taking into account the concepts of "lean production", "Economics sustainable development" and "Change management". All these concepts are united by the fact that they are based on a principle is the desire to increase value for the customers, society from using the production of regions. On the basis of the concept of "Change Management" by I. Adizes, the factors of competitiveness of products of each region should be classified into two groups: in the short and long term [16]. The first group is named as short-term factors. This group is responsible for meeting the needs of current consumers. And the second group is named as long-term factors. This group is responsible for meeting the needs of future consumers.

Simultaneously with the first classification, the factors of competitiveness of products of each region should be grouped according to the second classification, broken down into four groups. The first group of factors is responsible for the financial result of products in the short term. The second group of factors is the standards and certification for products operating in the short term. The third group of factors should be responsible for the extent of changes in the long term. The fourth group of factors is named as "Interaction and integration of each region in the long term". The author's integrated assessment of the competitiveness production of regions, including the factors listed above is presented in table I.

The criteria for calculating the integrated score assessment of the competitiveness production of regional are presented in table I on the basis of the method of score assessment and ranking of indicators. Table II is proposed to determine the significance in the level of competitiveness of each group of factors in the regions.

The authors developed the classification of regions to determine the level of competitiveness production, consisting of classes. The higher the region's class number is the more competitive the region, and Vice versa.

Results of approbation of the offered technique of competitiveness of production are presented for visibility by six best region on competitiveness among other regions of the

TABLE II. TABLE CRITERIA OF SIGNIFICANCE OF EACH GROUP OF FACTORS IN THE LEVEL OF COMPETITIVENESS PRODUCTION OF REGIONS

Significance of a group of factors	Symbol of factor groups				Threshold value in points	
	financial result	standards and certification	extensiveness of the changes	interaction and integration	minimum	maximum
High level of competitive advantage of the region	F	S	C	I	16.67	25.00
Average level of competitive advantage of the region	f	s	c	i	8.34	16.66
Insufficient level of competitive advantage of the region	-	-	-	-	0.00	8.33

TABLE III. TABLE CALCULATION OF THE INTEGRATED SCORE ASSESSMENT OF COMPETITIVENESS OF RUBBER AND PLASTIC PRODUCTION OF REGIONS OF THE RUSSIAN FEDERATION FOR 2018, IN POINTS

Group or indicator	the regions of the Russian Federation					
	<i>Moscow</i>	<i>Moscow region</i>	<i>Samara region</i>	<i>Leningrad region</i>	<i>Saint Petersburg</i>	<i>Republic of Tatarstan</i>
Financial results, including:	16.39	20.86	17.9	15.39	13.63	14.67
- profitability of sales;	7.8	12.5	9.36	5.54	6.03	6.42
- costs per 1 monetary unit.	8.59	8.36	8.54	9.85	7.60	8.25
Standards, certification, including:	25.00	5.00	10.00	6.25	12.5	12.5
- share of products subject to mandatory certification in the region.	25.00	5.00	10.00	6.25	12.5	12.5
Factors in the short term	41.39	25.86	27.9	21.64	26.13	27.17
The extensiveness of the changes, including:	3.36	7.18	6.99	8.85	3.21	8.81
-assortment of perspective products;	1.00	5.00	5.00	4.00	2.00	4.00
- market share;	0.77	1.03	0.29	3.5	0.28	0.67
- share of exports;	0.57	0.3	0.39	0.41	0.08	1.41
- share of innovative products;	0.17	0.00	0.46	0.09	0.001	1.88
- share of recycled waste (by recycling).	0.85	0.85	0.85	0.85	0.85	0.85
Interaction and integration, including:	16.67	0.00	8.33	0.00	0.00	25.00
- number of clusters in the region associated with the production.	16.67	0.00	8.33	0.00	0.00	25.00
Factors in the long term	20.03	7.18	15.32	8.85	3.21	33.81
Total	61.42	33.04	43.22	30.49	29.34	60.98

Russian Federation as of 2018 (table III).

As a result of the integrated assessment of the competitiveness of rubber and plastic production (table III) Moscow took the 1 place (61.42 points), the 2 place - the Republic of Tatarstan (60.98 points). However, it is not enough to draw final conclusions on the competitiveness of these regions only on the integrated indicator. To eliminate this drawback, table IV, the significance of each group of factors on the level of competitiveness of rubber and plastic products for the subjects of the Russian Federation determined on the basis of table II.

Approbation of the classification of regions (based on table III) to determine the level of competitiveness production and strategies of the region is presented in table V. The higher the region's class number, the more competitive the region is, and vice versa.

Analysis of imports of Chinese products imported into the Russia as of 2018 according to the federal customs service, allowed to determine the volumes (in value terms): 1766 million dollars - plastics and 570 million dollars – rubbers. Analysis of exports of Russian products exported to China as of 2018 according to determine the volume (in value terms):

258 million dollars - plastics and 216 million dollars – rubbers.

Among the regions - participants of "New Silk Road" from the Russian side according to the Federal Customs service, exporters of plastic products to China in 2018 were: Moscow - 33%, the Republic of Tatarstan - 19%, the Moscow region, Sverdlovsk region, the Republic of Buryatia - less than 1% of total exports from Russia. The exporters of rubber products to China in 2018 were: the Republic of Tatarstan - 37%, Moscow - 1%, the Moscow region, the Republic of Buryatia - less than 1% of total exports from Russia. Other regions-participants of "New Silk Road" from the Russian side (Smolensk region, Kurgan and Chelyabinsk regions) were not exporters of rubber and plastic products to China in 2018. On the level of the global competitiveness index based China ranked 28th in the world (5.0 units), Russia - 43 place (4.5 units) on data from the world economic forum "Global competitiveness Report" for 2016 - 2018. For 2017 - 2018, China ranked 27th (5.0 units), Russia - 38th place (4.64 units) in the world.

Thus, the hypothesis put forward by the authors that a more effective and modern assessment of the competitiveness of regions, which should be integrated, based on the concepts of "Lean production" and "Economy sustainable

TABLE IV. TABLE THE IMPORTANCE OF EACH GROUP OF FACTORS ON THE LEVEL OF COMPETITIVENESS OF RUBBER AND PLASTIC PRODUCTION OF REGIONS

Regions	Symbol of the significance of a group of factors			
	<i>financial result</i>	<i>standards and certification</i>	<i>extensiveness of the changes</i>	<i>interaction and integration</i>
Moscow	f	S	—	I
Moscow region	F	—	—	—
Samara region	F	s	—	—
Leningrad region	f	—	c	—
Saint Petersburg	f	s	—	—
Republic of Tatarstan	f	s	c	I

TABLE V. TABLE THE CLASS AND THE IMPLEMENTED STRATEGY ON THE LEVEL OF COMPETITIVENESS OF RUBBER AND PLASTIC PRODUCTION OF REGIONS OF THE RUSSIA FOR 2018

The class of the region	Integrated level of competitiveness, point	Strategy of the region	Region
0 class	0 - 33.33	Insufficient level of competitiveness in the short and long term	-
1 class	16.67 - 50.00	Insufficient level of competitiveness in the short term and average level of competitiveness in the long term	-
		Average level of competitiveness in the short term and the insufficient level of competitiveness in the long term	Moscow region, Samara region, Leningrad region, Saint Petersburg
2 class	33.33 - 66.66	Average level of competitiveness in the short and long term	-
		Insufficient level of competitiveness in the short term and high level in the long term.	-
		High level of competitiveness in the short term and insufficient level of competitiveness in the long term	-
3 class	50.00 - 83.33	High level of competitiveness in the short term and average level of competitiveness in the long term	Moscow
		Average level of competitiveness in the short term and high level of competitiveness in the long term	Republic of Tatarstan
4 class	66.66 - 100.00	High level of competitiveness in the short and long term	-

development", take into account the short and long term, was confirmed.

IV. DISCUSSION

The practical significance of the study is as follows. The proposed author's method of assessing the competitiveness production of regions can be used as a monitoring of regions of different countries (for example, for the Russia). And also, in the author's methodology, all indicators are based on accessible, open, official information of statistics and customs service. The factors that have been included in the methodology are based on the experience of previous researchers: M. Porter and C. Van der Linde, M. Kramer, I. Adizes, A. Bilbao-Terol, G. Bergmiller and P. McCright [5], [11], [14], [16], [26]. The proposed monitoring makes it possible to accurately determine the bottlenecks in the competitiveness production of regions and their cause. In time to take measures to improve the competitiveness production of the region, to change the competitive strategy. For example, the insufficient level of competitive advantage production of rubber and plastic for certain groups of factors was in most regions of Russia in 2018 (table VI). Only the Republic of Tatarstan had a high level of competitive advantage production of rubbers and plastics for certain groups of factors in 2018. The insufficient level of competitiveness due to low indicators (of the share of recycled waste, share of products subject to mandatory certification) is a signal to the society living in the region about the insufficient level of sustainable development. Conversely, the high integrated level of competitiveness production of regions testifies to the correct chosen competitive strategy, increasing the value for customers, society from the standpoint of "Lean production" and "Economy sustainable development".

The author's methodology allows classifying regions according to the level of competitiveness and on this basis to form a strategy of business cooperation. For example, a business cooperation strategy is proposed regions participating in the "New Silk Road" project for the Russian and China for

rubber and plastic products. In general from the project "New Silk Road" benefits more for China, as its global competitiveness index is higher than that of Russia. Participation for Russia is not profitable for a separate "Economic corridor China - Mongolia - Russia" project in the field of products of rubber and plastics. Since the region participating in this project it is the Republic of Buryatia practically does not carry out foreign economic activities for these products. However, the "Economic corridor China - Mongolia - Russia" project is beneficial for China. Since imports from China for plastic products in 2018 exceeds 6.8 times an export from Russia. Also imports of rubber products from China in 2018 2.6 times exports from Russia. In the framework of a separate "New Eurasian Land Bridge" project in the field of plastic products, the benefit is observed only for two Russian regions - Moscow, the Republic of Tatarstan. Because in these regions of the Russian Federation exports to China in large volumes. In addition, the competitive advantages of these regions (Moscow and the Republic of Tatarstan) have a high level of competitiveness of the 3rd class (table 5), which will allow them to be successful in the Chinese market. On a separate project "New Eurasian Land Bridge" in the field of rubber products is a benefit only for the Republic of Tatarstan, due to significant exports to China.

V. CONCLUSION

Prospects for research to test the method of assessing the competitiveness of rubber and plastic production of Russia regions: have to need to identify the nature of the dynamics of the integrated assessment of the competitiveness production of regions over a longer period, expand the sample (from 32% to 100%).

Thus, assessment of the competitiveness production of regions, integrated, based on the concepts of "Lean production" and "Economy sustainable development", to take into account the short and long term it allows to define: precisely bottlenecks of competitiveness of production of regions and their reason; take timely measures to improve the

competitiveness of the region's products and to change the competitive strategy. For development of entrepreneurial skills among engineering students of Technological University in regions need include information about assessment competitiveness production of regions [31], [32]. This will allow future engineers-innovators to direct their knowledge and skills to improve the production, which will be of competitiveness in the future, taking into account the concepts of "Lean production" and "Economy sustainable development". The author's methodology allows classifying regions according to the level of competitiveness and on this basis to form a strategy of business cooperation and prospects of economic development. Therefore, the business cooperation strategy proposed to the regions (Russia and China) participating in the "New silk road" project can be developed for other products, not just rubber and plastics.

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