

Quantitative Assessment of Primorsky Krai Fishery Cluster Competitiveness Factors on the Basis of the Porter Model Transformation

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Abstract

The goals of Russian Federation state program "The development of fishery complex" # 314 approved by RF Government Decree on April 15, 2014 # 314, include the transition to an innovative type of industrial production the provision of global competitiveness for goods and services produced by the Russian fishery complex. However, a number of problems that exist in the fishing industry of Russian Federation hinder the achievement of the set tasks: the deterioration of the basic production assets, the shortage of efficient cooling capacities for storage, a high level of raw and shadow exports, an unfavorable financial situation for industrial organizations, and an imperfect regulatory and legislative base. These circumstances necessitate the resumption of integration processes, the search for new interaction forms and methods in the fishing industry. The aim of the study, the results of which are reflected in the article, is a quantitative assessment of the factors which contribute to and impede the development of the fishing industry cluster in Primorsky Krai on the basis of the technique application previously developed by the authors. The theoretical basis of the study is the model of M. Porter's national competitive advantages "rhombus", the critical analysis of which allowed the authors to propose the division of production factors into basic resource and infrastructural ones, which is especially important for the Russian business environment. This transformation served as the basis for the developed methodology, which includes an integral indicator of clustering factor development. The analysis of each of its components on the developed scale allows to identify the degree of cluster initiative implementation, as well as to determine the most effective support measures based on the competitive advantages of the fishing cluster. The determination of the competitive advantages of clusters is carried out by the method of focus group conduct among the experts, and their quantitative assessment is carried out using the questionnaire method, which gives the assessment of the implementation and importance. The developed methodology can be used to develop normative and strategic programs for the creation and the functioning of industrial clusters, the development of which corresponds to the implementation of import substitution processes and the transition of Russia to an innovative type of development.

Keywords: Industrial cluster; National competitiveness; Fishing industry complex; Competitive advantages; Cluster policy.



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1. Introduction

The current stage of the economy development is characterized by the fact that the increase of state, industrial and enterprise competitiveness is put forward as the national idea of many world powers. The achievement of this goal requires the transition to an innovative way of economic development in many ways. International practice shows that the use of the cluster approach to gain competitive advantages facilitates the increase of innovation activity, the increase of population well-being and the economy efficiency, and the provision of national competitiveness.

In Russian Federation, the fishing industry is a priority sector, the development of which is of strategic importance for the embodiment of the country national interests and its strengthening as the leading maritime power. Fishery organizations in a number of subjects of the Far Eastern Federal District provide 80% of the population employment, form a significant part of GDP. Nowadays, we have to state the fact that fishery organizations carry out their activities in the context of domestic and international competition toughening. Economic reforms which took place in the 90-ies of the last century in Russia led to the fact that the fishery complex disintegrated into separate structures after privatization, each of which was engaged in fish product extraction, processing and marketing. This

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resulted in a twofold decline of fish and seafood production in Russian Federation from 7.9 million tons in 1990 to 4.4 million tons in 2015.

The solution of fishery organization competitiveness increase requires the improvement of existing management mechanisms and the use of organizational innovations.

Fishery business structures are not able to find a way out of the current situation and solve the tasks set at the state level independently. It is necessary to integrate fishermen and the representatives of economic activities who ensure the production cycle continuity. Possible options for the development of integration processes in the fishing industry require a detailed processing. One of the rational integration options is the creation of fishing cluster (Korneyko and Latkin, 2015).

Primorsky Krai initiated the creation of a cluster structure in the fishery sector, which is directly related to the President's instruction on the development of the Far East economy. However, despite the clearly defined vector of regional clusterization development, the works in this direction are very slow or they are not performed at all. This is related to the influence of a number of factors that negatively affect this area of work both from the authorities and from the economic entities.

The purpose of this article is to generalize and quantify the factors of competitiveness that influence the development of fishing complex cluster at Primorsky Krai. The quantifying of the factors that stand in the way of creation process initiated by RF Government, the implementation and the development of the cluster approach in fishery enterprise economics of the Far Eastern region is particularly important.

2. Methods

Earlier, the authors carried out the generalization of existing methods to assess the factors of clustering. The theoretical basis of the author's methodology was the model of national competitiveness assessment - M. Porter's "diamond" (Barnett and McKendrick, 2004), which is used worldwide to evaluate the competitive advantages of both existing clusters and sectors in which the introduction of the cluster approach is planned (Baldina *et al.*, 2017; Esen and Uyar, 2012; Porter *et al.*, 2010; Rugman, 1992; Santipolvt, 2015; Shashlo, 2017; Van *et al.*, 1992; Zhuang, 2014). Despite an active use of this model around the world, it becomes an object of criticism on the part of academic economists. The first category of scholars does not fully agree with M. Porter's concept of competitiveness. The main disadvantage is the static nature of rhombus, its orientation to the past (Dorzheva, 2012), the lack of ability to assess the unique national features of a specific sector or a state (Rugman, 1992; Shashlo and Petruk, 2017), and the impossibility to quantify model factors (Hamad and Duman, 2013; Khunthong *et al.*, 2013; Moon *et al.*, 1998). The criticism of the second category economists concerns the modification of national competitiveness rhombus determinants. Thus, J. Dunning was the first one who proposed to take into account the propensity for entrepreneurship and the influence of foreign direct investment (Dunning, 1993). South Korean researcher D. Cho focused on the clarification of human capital role in competitive advantage creation, which allowed him to develop a nine factor model (Cho and Moon, 2000). Despite the abundance of criticism, the model of national competitiveness "rhombus" is most demanded nowadays, it is complete and comprehensive and, as L.A. Alexandrova rightly notes, it "absorbed the achievements of other theoretical approaches, while acting as an umbrella model that sets the system of coordinates and the common basis for many studies" (Aleksandrova, 2005).

At the same time, the rhombus transformation studied by us for the national level allowed us to identify the need to modify M. Porter's model for its application in the development of methodological approaches to the creation of industrial clusters in the Russian conditions of management.

First of all, when the model of competitive advantages is applied, it is impossible to quantify the potential that exists in an industrial cluster. All the determinants of rhombus operate with qualitative indicators that can not be estimated and determined. Therefore, we will develop and test the methodology for cluster competitive advantage quantification, set out below.

Secondly, we adhere to the opinion that the use of rhombus in its original form is possible only for the analysis of economies or clusters in developed countries, for example, in the USA. Like F. Van Den Bos, we believe that it is necessary to take into account the national characteristics in each country (Rugman, 1992). In particular, if we consider Russia, then there are two unique features for our state - the abundance of natural and territorial resources. According to M. Porter's concept, they refer to the basic factors of production, that is, to those that were not created by man. In comparison with these basic factors, the developed factors (infrastructure, capital) constitute a much smaller part of the developed factors. During the analysis of industrial cluster competitive advantages that is being formed or already created, especially at its quantitative assessment, it is important to understand which of production factors of are the basic ones (set by default) and which were created in the process of socio-economic human activity (developed ones). The analysis revealed that the supplemented model should include both basic factors, as well as infrastructural factors, demand factors, the impact of related and auxiliary industries, certain conditions for strategic development and competition (Titova, 2014).

Study results. Highlighting these groups of factors, the study made it possible to obtain the dependence of the identified factors on each other and on a number of conditions of external and internal environment using mathematical methods. In order to determine the specific gravity of clustering factor groups, we conducted the survey on fishery activities among 10 experts. An expert was required to indicate the importance of each factor via a 5-point scale, where 1 is the most important, and 5 is the least important. The course of questionnaire processing involved the following analytical procedures. First of all, the matrix was compiled and presented in Table 1. This matrix contains the results of the questionnaire processing.

Table-1. The matrix of expert estimates concerning the contribution of clustering factor groups

Group of factors, m_i	Experts, n_j										Sum of ranks, x_{ij}	Square deviations of ranks, S_i
	1	2	3	4	5	6	7	8	9	10		
Basic resource factors	5	4	5	5	5	5	5	5	5	5	49	361,0
Infrastructural factors	3	5	4	4	4	3	4	4	4	4	39	81,0
Related and auxiliary industries	4	1	3	2	1	4	3	3	1	1	23	49,0
Demand conditions	2	3	1	3	2	2	1	2	3	3	22	64,0
Conditions for strategic development and competition	1	2	2	1	3	1	2	1	2	2	17	169,0

Obtained results should be checked without fail for the consistency of expert opinions. The Kondall coefficient of concordance is used for this (Kendall and Smith, 1939). In order to calculate this coefficient after the filling of matrix rows and columns, it is necessary to perform a series of calculations. First, it is necessary to find S-sum of rank square deviations, which is calculated by the following formula:

$$S = \sum_{i=1}^n \left(\sum_{j=1}^m x_{ij} - \frac{n(m+1)^2}{2} \right)^2, \text{ где:} \quad (1)$$

S – the sum of square deviations for ranks,
 n– the number of experts,
 m – the number of factor groups,
 xij- the sum of ranks assigned to the i-th object by the j-th expert.

Then the concordance coefficient was calculated by the following formula:

$$W = \frac{12S}{n^2(m^3 - m)}, \text{ где} \quad (2)$$

W is M. Kendall concordance coefficient,
 n– the number of experts,
 m – the number of factor groups,
 S– the sum of rank square deviations.

The result of the calculations showed that the concordance coefficient W makes 0.724, which means a sufficient degree of agreement among experts. This indicates that the obtained data can be used in further calculations. Otherwise, the results of the questionnaire can not be applied in the study because of the large degree of discrepancy between the opinions of experts.

In order to develop an integrated indicator of fishery activity clustering, it is necessary to calculate the significance of each factor for its impact on the final indicator. Thus, it is necessary to calculate the weight coefficients for each group of factors. First, we need to calculate the final rank r_i , which was calculated by the following formula (Medhi, 1992):

$$r_i = \frac{\sum_{j=1}^n x_{ij}}{n}, \text{ где:} \quad (3)$$

r_i – the final rank of the group of factors,
 n – the number of experts,
 xij- the sum of ranks assigned to the i-th object by the j-th expert.

Then you need to calculate the total weighting factor G_i for each group of factors, which is calculated as follows:

$$G = \frac{(m+1) - r_i}{\sum_{i=1}^m r_i}, \text{ where:} \quad (4)$$

G_i - final weight ratio;
 m – the number of group factors,
 r_i – the final rank of factor group.

Having calculated the weight factors for each group of factors, we will present the obtained values in Table 2.

Table-2. Weighing coefficients of clustering factor groups

Group of factors	Rank sum, x_{ij}	Final rank, r_i	Weight coefficient, G_i
Basic resource	49	4,9	0,073
Infrastructural	39	3,9	0,140
Related and auxiliary industries	23	2,3	0,247
Demand	22	2,2	0,253
Strategic development and competition	17	1,7	0,287
Total	150	15,0	1,000

According to the calculated specific weights of the clustering factors, we have developed an integral indicator of Primorsky Krai fishing activity clustering. This integral indicator characterizes the overall degree of cluster initiative implementation. The higher its value, the more factors contributing to the processes of clustering, and accordingly the cluster environment in the fishery complex is more favorable. However, the integral characteristic gives the greatest characteristic during the analysis of each of its components - that is, the identified groups of clustering factors. Thus, the following form of the integral indicator is developed:

$$C = 0,073B + 0,14I + 0,247R + 0,253D + 0,287S, \text{ где:} \tag{5}$$

- C – integral indicator of clustering degree;
- B – basic resource factors;
- I – infrastructural factors;
- R – the factors of related and auxiliary industries;
- D – demand factors;
- S – the factors of strategic development and competition.

In order to identify the specific factors in each of the groups, the method of focus group behavior was applied, for which two groups of 25 people were formed from fishery industry (Belanovsky, 1996). During the focus group meeting, the members of the professional community from the Association of Fishery Enterprises of the Primorye Territory were involved, and the representatives of various fishery enterprises and associations acted as experts. The result of the focus group work was the questionnaire used to quantify factors.

The greatest difficulty in the work of the focus group was the translation of identified factor qualitative components into quantitative ones. The assistance in the conversion of qualitative indicators into quantitative ones was provided by the modified SWOT analysis technique proposed by Rakhmanova and Solodukhin (2009). The essence of this technique is the evaluation of each factor by three parameters: embodiment, importance and the rank of each of the identified factors. According to Table 3, a zero-to-five scale is used for the assessment, where the closer the score to 5, the higher the degree of clustering prerequisite development, and the more it tends to 0, the less such a degree.

Table-3. Evaluation criteria of clustering factor implementation degree and importance

i-th factor indicator	Criterion development degree					
	0	1	2	3	4	5
Implementation evaluation, Z_i	Absent	Very weak	Weak	Average	Strong	Very strong
Importance evaluation, N_i	Absent	Very weak	Weak	Average	Strong	Very strong

After the processing of questionnaires, a final matrix of implementation and importance expert assessments is drawn up. The final score for each of the factors is calculated using the formula of the arithmetic mean. Then, based on the performed calculations, it is necessary to find the rank corresponding to each factor. The rank of the i-th factor k_i determines the contribution of each factor to the competitive potential of the region, taking into account its importance and it is found by the following formula:

$$k_i = N_i * Z_i, \text{ where:} \tag{6}$$

- k_i - rank of the i-th factor;
- N_i - the evaluation of the implementation for the i-th factor;
- Z_i - the evaluation of the i-th factor importance.

Then, we calculated the final value of the indicator for the entire group of identified factors. It will be equal to the average value of ranks according to the formula of the weighted average arithmetic:

$$B_i = \frac{\sum k_i f_i}{\sum f_i}, \text{ where} \tag{7}$$

- B_i – one of the indices of industrial clusterization group of factors of the final integral indicator (in this case - the basic resource);
- k_i – the rank of this factor;
- f_i – factor repetition frequency;
- i – the number of factors identified in the group.

Since we identified 5 groups of factors and the sum of all factors in all identified groups can be as much as 25, therefore, it is necessary to introduce a scale to assess the degree of factor influence on the clustering of fisheries in the region, presented in Table 4.

Table-4. The degree of factor influence on the creation of clusters in the fishing industry of the Primorye Territory

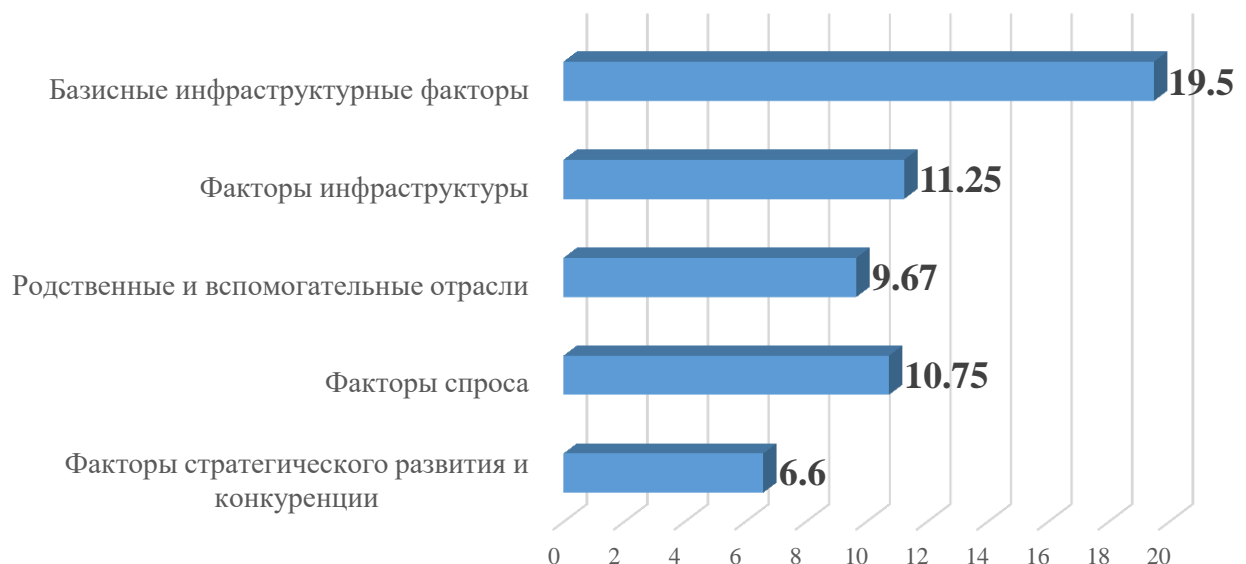
Indicator	Degree of competitive advantage development				
	Vey weak	Weak	Average	Strong	Very strong
Clustering factor group	from 0 to 5	from 5 to 10	from 10 to 15	from 15 to 20	from 20 to 25
Total integral indicator	from 0 to 5	from 5 to 10	from 10 to 15	from 15 to 20	from 20 to 25

3. Results and Discussions

The higher the value of the integral indicator, the more favorable the environment of the industrial cluster in the subject, and, accordingly, there are fewer factors hindering the clustering processes. However, the evaluation of each component of the integral indicator is most important. Using the method of expert assessments, the assessment of implementation and importance degree for each of the identified factors is carried out. The experts were asked to assess the degree of implementation and importance for each identified factor in the questionnaire developed on the basis of the focus group results. During the processing of the questionnaires, the data presented in Table 5 were obtained.

Table-5. Integral assessment of clustering factors at Primorsky Krai fishing complex

Group of factors	Implementation evaluation	Importance value	Rank
	Z_i	N_i	r_i
Basic resource factors			
The presence of hydrobionts	4	4	16
The ability to cultivate aquaculture products	5	5	25
Strategically advantageous geographical location	5	5	25
Quoting	3	4	12
B	19,50		
Infrastructural factors			
High staff potential	5	4	20
The fall of profession prestige	3	5	15
Developed transport infrastructure	4	5	20
Depreciation of fixed assets	1	4	4
State subsidizing of activity	2	3	6
Investment crediting	1	5	5
Research potential	4	2	8
Interaction of science and business	3	4	12
I	11,25		
Related and additional sectors			
A large number of developed professional associations and the associations regulating FI	4	4	16
The absence of developed links	1	5	5
The state of shipbuilding and ship repair resource base	2	4	8
R	9,67		
Demand conditions			
The presence of constant demand	5	4	20
Raw material orientation of Russian exports	1	5	5
Low culture of fish product consumption	3	4	12
Complex logistics from producer to consumer	2	3	6
D	10,75		
Strategic development and competition conditions			
Competition of price parameters	3	3	9
The presence of intermediaries during the promotion and sale of products	3	2	6
The presence of administrative barriers	1	5	5
The transfer of products into the shadow market	1	5	5
High competition	2	4	8
S	6,6		
C	10,00		

Figure-1. clearly demonstrates the way the obtained values are related to each other by the groups of factors

Базисные инфраструктурные факторы - Basic infrastructural factors / Факторы инфраструктуры - Infrastructure factors / Родственные и вспомогательные отрасли - Related and auxiliary industries / Факторы спроса - Demand factors / Факторы стратегического развития и конкуренции - The factors of strategic development and competition

Figure 1. Quantitative estimation of clustering factor groups

Thus, the indicator of fishing industry cluster creation possibility calculated according to the given parameters is equal to 10, and according to the criterion scale presented above, this possibility is estimated as an average one. But, when the aggregate indicator is evaluated, it is necessary to analyze each of the calculated factors. According to the obtained results, three groups of factors are in the range of 10 - 20, which indicates an absolute need for active state intervention in the development of cluster policy. First of all, it is necessary to make efforts to eliminate the unfavorable factors in the range of 1 to 10, and then from 10 to 15, having developed certain recommendations.

The greatest attention should be paid to the elimination of identified adverse factors under the terms of strategic development and competition (S), estimated at 6.6. The presence of a large number of intermediaries during the sale of aqua products exacerbates this problem. Undeveloped transport logistics and the availability of administrative barriers make hydrobionts even more expensive. In this regard, the primary measures for implementation within the cluster policy should be:

- 1) the reduction of controlling bodies and the introduction of electronic document management;
- 2) the restoration of preferential railway tariffs for the transportation of fish products;
- 3) the harmonization of statistical reporting on the export and import of goods and the creation of a unified statistical database;
- 4) the increase of border control efficiency over the activities of Russian and foreign vessels in the fishing areas in the exclusive economic zone of Russia and on the continental shelf;
- 5) an effective control provision over foreign trade activities on the basis of fishery ship satellite monitoring.

It is reasonable to solve these issues at the organizational and operational stages of cluster development directly. The authority to monitor the improvement of the situation with the administrative barriers should be assigned to the cluster association.

An expert assessment of related and auxiliary industry condition was 9.67. In many respects, the negative assessment of experts is conditioned by the crisis state of ship repair and shipbuilding on the territory of the region. Due to the fact that the average age of fishing vessels makes 27 years at present, an unstable financial situation of many industrial organizations does not allow the use of additional investments in the renewal of their fleet, it requires high costs and implies high risks. In this regard, the following activities of cluster policy development are proposed in this direction:

- 1) the development of a uniform procedure for the provision of subsidies to commodity producers engaged in commodity fishery on inland waters and coastal marine areas;
- 2) the provision of guarantees to enterprises during bank loan obtaining or during the drawing up of leasing;
- 3) the subsidizing of interest rates during the obtaining of loans for fishing fleet renewal.

The estimation of the demand conditions for fishery complex products at Primorsky Krai (D) made 10.75, which characterizes their degree of development as an average one. One of the most important factors hampering the increase of coastal fish product competitiveness is the raw material nature of exports. Besides, the population of the state does not have enough information about the biological value of fish products, and the variety of extracted aquatic biological resources. In order to solve this problem, the following measures should be included in cluster policy:

- 1) the support of domestic prices for fish products;

- 2) the establishment of export and import taxes for certain types of fish products;
- 3) protective measures in the foreign trade by fish
- 4) products, in the field of high-technology goods (fish fillets, canned fish, etc.), including compensation duties, anti-dumping, special protective measures;
- 5) improved tariff and non-tariff measures to regulate foreign trade activities of fishing industry various sub-sectors (ship repair, fish processing, marine fishing ports, etc.)
- 6) the quotas for the export of a number of fish products in order to increase supplies to the domestic market of Russia (Alaska pollack, salmon, etc.).

The main recommendations for the elimination of unfavorable factors among the infrastructure group should be implemented at the stage of the industrial cluster functioning. The main ones are the following:

- 1) the construction of additional cooling capacities of long-term storage with a capacity of more than 500 thousand tons;
- 2) the transfer of berthing facilities to long-term lease for the industrial organizations of the cluster;
- 3) the development of personnel targeted training system in a fishing cluster: the allocation of budgetary places according to profession profile and a graduate's obligations to work on a long-term contract after a training period expiration;
- 4) the performance of research works by students within the term paper and diploma design on the topics relevant for the industrial cluster;
- 5) the development of tax incentives and preferences for cluster participants introducing domestic research and development into production processes.

Currently, many fishing industry organizations around the world face a decline of aquatic biological resource availability. In the context of globalization, this problem led to the observance of responsible fishery code, which presupposes the rational use of biological resources. Quoting is the main mechanism for their state regulation. Nowadays the main problem for all RF fishing organizations is the lack of long-term prospects for the access of main industrial organizations to basic production resources, expressed in the unclear distribution of quotas since 2018. According to experts, this factor is the only one among the basic resource factors that hinder the development of clustering processes. The modernization of the current legislation on this issue presupposes the abolition of quoting on a historical basis and their fragmentation. This uncertainty of future prospects becomes an additional factor, exacerbating the situation of enterprises that do not have sufficient production capacities. In this case, the recommendation of this situation elimination is the increase of time for quota share record to the users of aquatic biological resources within the period of 25 years.

4. Summary

Thus, the analysis of the current state of the fishery complex at Primorsky Krai made it possible to identify a number of factors that contribute to and hinder the clustering processes. Based on a quantitative assessment of these factors, recommendations have been developed to eliminate unfavorable clustering factors. The implementation of these recommendations will be a powerful incentive for regional competitiveness increase, as well as one of agitation measures to include industrial structures in the cluster. At the same time, the developed methodology can be used to analyze the prerequisites for the clustering of different types of economic activity in other regions of Russian Federation.

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