An algorithm clusters and residents of special economic zones interaction

Daler Iskandarov, and *Svetlana* Borozdina[*]

Moscow State University of Civil Engineering, Yaroslavskoe shosse, 26, Moscow, 129337, Russia

Abstract. The article deals with the problem of inefficiency in using special economic zones (SEZ) as a tool for attracting direct investment in economic sectors. To solve this problem, the article identified the main quantitative indicators that reflect the negative trend. The purpose of the research was to study and analyze the existing special economic zones (SEZ) and clusters of the investment and construction sector (ICS), as well as their subsequent comparison based on geographical localization. The authors have developed a methodology for selecting clusters of ICS and SEZ. As a result of the scientific research, was developed the author's methodology for selection clusters and special economic zones functioning in ICS, also were established characteristics and indicators for assessing the interaction and the possibility of implementing an investment project and the synergistic effect from including a SEZ resident in the ICS cluster. As the key methods to determine the effect of interaction were used questioning and expert assessment. The authors propose to develop an algorithm for interaction between clusters of investment and construction sector (ICS) enterprises and residents of special economic zones for the joint investment and construction projects (ICP) implementation to solve the unused zonal infrastructure capacity problem and for assessing the synergistic effect of being included in ICS cluster a SEZ resident with important competitive advantages. Special attention is paid to land usage as the most important resource in the construction projects implementation. Conclusions are drawn about the need for changes in the SEZ and its structural elements management.

1 Introduction

Nowadays, special economic zones (SEZ) are one of the most complex and costly tool for attracting direct investment in promising sectors of the national economy [7, p.4]. However, the Accounts chamber of the Russian Federation does not recognize the special economic zones effectiveness as a "locomotive" of economic development [20]: "Preferential regimes do not have breakthrough impact on the economy, it is difficult to give a full assessment of their effectiveness," reads the report on the practice of preferential regimes in force in the territory of the Russian Federation [4].

The main reasons for the SEZ functioning inefficiency are: unfair use of preferences by SEZ residents to gain competitive advantages over conventional manufacturers, rather than

---

[*] Corresponding author: BorozdinaSM@mgsu.ru

to implement a technological breakthrough; production of standard products that have many analogues outside the SEZ; a small share of exports, about 80% of all products are sold on the domestic market, which contradicts creating the SEZ purpose.

The above-mentioned reasons lead to not enough SEZ infrastructure using, created at the expense of state budgets. According to the data published in the annual publication "Business Navigator for special economic zones of Russia-2020", about 60-67% of suitable land remains unused, technical infrastructure (gas, water, electricity) is loaded on average only by 40-45 %, while the share of used administrative premises is almost 90% [7, p. 19], which is an alarming sign and may indicate some trouble in the special economic zones' management.

The main conclusions reached by the Accounts Chamber are: it is necessary to accelerate the federal law development, which would set out a single mechanism describing the procedure for the SEZ territory development with an emphasis on supporting significant economic specializations; review and develop managing the SEZ mechanisms [4].

According to the authors of this article, cluster associations could become a mechanism that would "pull" special economic zones out of the crisis. The clusters and SEZs interaction prospects have been studied by many scientists, many of whom have proposed various methods for their development and integration (Table 1).

Table 1. Comparative scientific literature analysis on the SEZ and clusters interaction development.

Authors	Literature source	Brief description of the author proposed scientific vision
Zharkova N.N.	«A cluster and a special economic zone Integration as a tool for implementing the Concept 2020» [12].	It is proposed to create new type of SEZ – cluster, which would help to realize the goals of the Concept 2020 [12, p.99]
Ovechkina O.V., Rubtsova L.N.	«Clusters and special economic zones: similarities and differences» [13].	The researchers concluded that the cluster and SEZ - if it is not identical, it is very similar in meaning and content of the concepts that have many similarities.
Chelpanova Yu.V.	«Cluster structures in special economic zones» [15].	The possibility of SEZ creating by small and medium-sized enterprises is being considered.
Tserceil Yu.S., Kookueva V.V., Gryzunova N.V.	«Instruments of cluster policy in the Russian innovation company development » [14].	Clusters are considered as an effective way of organizing joint activities for cluster members in the SEZ. [14, p.9]

However, the construction industry role in this association is not enough studied. A feature of construction enterprises and the entire industry is its close relationship with a huge number of other industries and enterprises, which in the interaction process and economic processes and operations implementation can act as various economic agents, thereby forming wide horizontal and deep vertical ties that are typical for clusters.

The purpose of the article is to develop an algorithm for the investment and construction projects (ICP) clusters interaction and special economic zones residents employed in the construction industry. The algorithm developed will contribute to solve unused zonal infrastructure capacities problem through the investment and construction projects (ICP) implementation and will also help to determine the integrating a resident into the ICS cluster synergistic effect. To develop an algorithm, it is necessary to solve the following tasks:
1. Identify clusters and SEZ engaged in the investment and construction sector, and their subsequent systematization of specialization.

2. 2.Formation of a map of ICS and SEZ clusters, based on geographic localization. Drawing up possible unions for interaction.
3. 3.Determination of interaction goals for ICS clusters and SEZ.
4. A comprehensive methodology development for assessing the ICP implementation and the synergistic effect of integrating a resident into a cluster based on expert assessment methods.
5. An algorithm development for the interaction of ICS clusters and SEZ residents employed in the construction industry.

2 Methods

To develop an algorithm for the interaction of ICS clusters and SEZ residents employed in the construction industry, the following research methods were used:

- theoretical analysis;
- systematization;
- synthesis;
- expert assessment;
- measurement.

The scientific novelty of the research lies in the system of criteria for assessing the ICS clusters and SEZ resident's interaction development. The practical significance lies in the development of an algorithm that can be applied in practice for ICS clusters when interacting with SEZ residents in the implementation of joint investment and construction projects (ICP), as well as for assessing the synergistic effect of integrating a resident into a cluster. The research algorithm for solving the goal set in the article is shown in Figure 1.
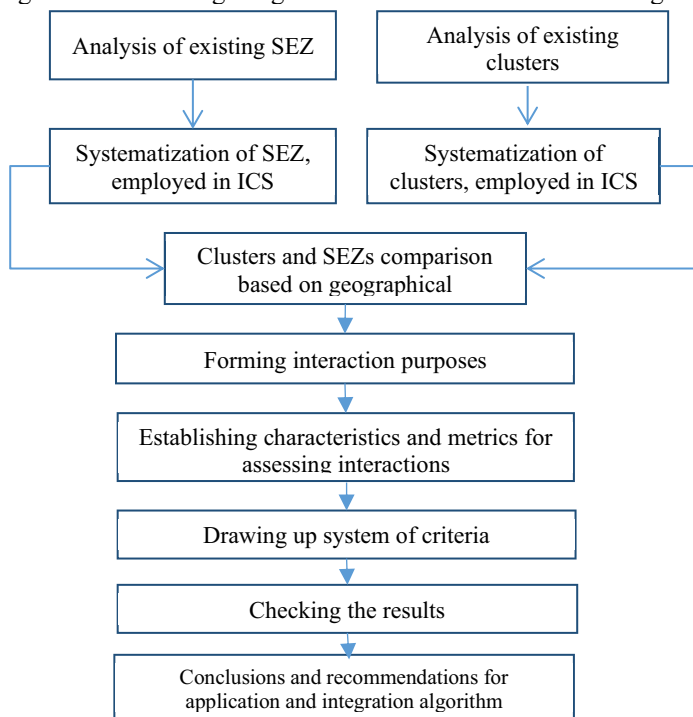
Fig. 1. The research block-diagram.

The authors have developed a selection method for the investment and construction sector clusters and special economic zones employed in ICS. In this article, according to the decision of the authors, the establishment of criteria and indicators for assessing the interaction of clusters of ICS and SEZ is formed based on the well-known characteristics of clusters and special economic zones.

At the first step of the research process all special economic zones existing were systematized and identified which are engaged in the investment and construction sector. Table 2 was generated.

**Table 2.** Special economic zones systematization by activity specialization (ICS).

SEZ	Specialization	Geographic localization
1. IPT «Alabuga»	Construction materials, composite materials	Republic of Tatarstan
2. IPT «Tolyatti»	Auto components, construction materials	Samara region
3. IPT «Moglino»	Construction materials, railway equipment	Pskov region
4. IPT «Uzlovaya»	Construction materials, special equipment	Tula region
5. IPT «Kaluga»	Wood products	Kaluga region
6. IPT «Oryol»	Construction materials	Oryol region

At the second step, construction clusters were considered, which operate in the same regions where the SEZs from Table 1 are localized. According to the "Cards Russian clusters" [17], there are now 113 different directions clusters. Of these, relatedly employed in the investment and construction sector: 9 (table 2).

Table 3. ICS clusters of Russian Federation.

Cluster	Specialization	Geographic localization
1.Moscow composite cluster	Construction materials production, construction	Moscow
2.Cluster «Akotech»	Construction, architecture, technical tests	Kaluga region
3.Smolensk composite cluster	Construction, architecture, technical tests	Smolensk region
4.Composite materials cluster of Lipetsk region	Production of construction materials	Lipetsk region
5. Cluster to produce building materials of the Volgograd region.	Production of construction materials	Volgograd region
6.Wooden house building cluster	Construction, architecture, technical tests	Vologda region
7.Timber cluster "PomorInnovaLes"	Construction, architecture, technical tests	Arkhangelsk region
8.Altai composite cluster	Construction, architecture, technical tests	Altai region
9.Cluster of woodworking and related industries	Production of construction materials	Yakutia

At the third step clusters and special economic zones of the same geographical localization (Fig. 2.) were correlated since it is one of the basic conditions for the clusters [8] and the prepared possible associations (Table 4) formation.
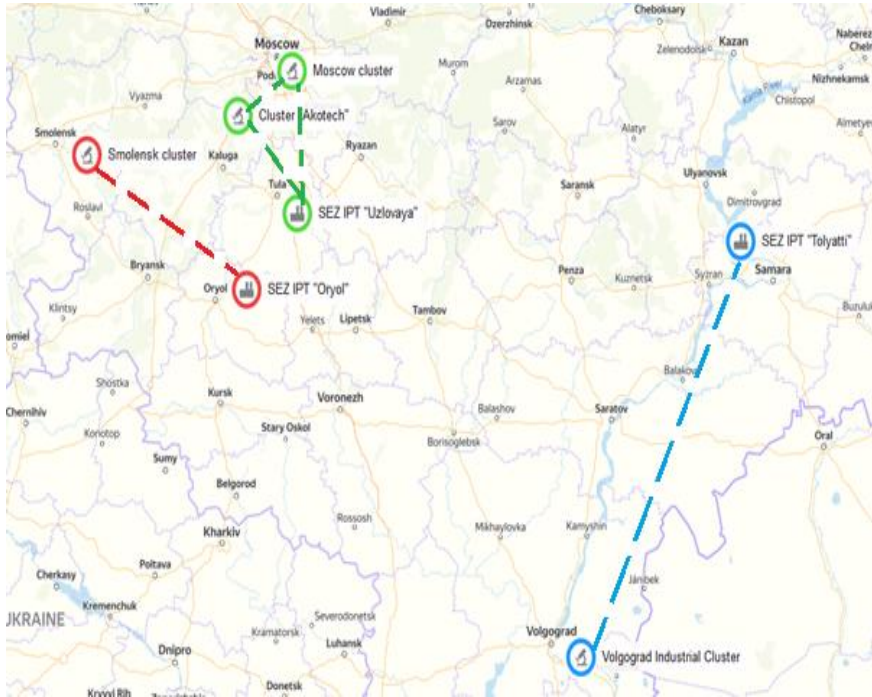
Fig. 2. Map of interaction clusters of ICS and SEZ [22]

Table 4. Possible unions of ICS clusters and SEZ.

SEZ	Cluster	Probability of interaction
1. IPT «Tolyatti»	Volgograd industrial cluster	Minimum
2.IPT «Uzlovaya»	Cluster «Akotech»	High
	Moscow composite cluster	Average
3. IPT «Oryol»	Cluster «Akotech»	Average
	Smolensk composite cluster	Average

At the fourth step of the research for development an algorithm clusters ICS and residents of SEZs interaction their purposes were defined.

For ICS clusters next purposes were determined:

1.Increasing the «strength» of the cluster by including a SEZ resident with important competitive advantages.

2.The possibility of realization investment and construction project to make a profit ($ + \Delta P$ (↑ Capital)).

3.Combined purpose, which consists in simultaneous realization of ICP and the search for promising residents for inclusion in the cluster.

From the standpoint of SEZ and residents, the following interaction purposes can be distinguished:

1.Support in realization underfunded projects.

2.Assistance in creating new jobs (N_J↑) and increasing labor productivity (LP).

At the fifth stage, characteristics and indicators for assessing interaction were established for the possibility of implementing an investment project and a synergistic effect from the inclusion of a SEZ resident in the ICS cluster. When considering decisions on the realization of ICP, were highlighted the following characteristics that used in the "Business Navigator for Special Economic Zones of Russia 2020" [7]:

1.Investment attractiveness (S1).

2.Favorable conditions for entrepreneurial activity (S2).

3.SEZ infrastructure provision (S3).

4.Land resources and capital construction objects (S4).

5.SEZ investment activity (S5).

6.Information openness of SEZ (S6).

To evaluate the synergistic effect of the inclusion into a cluster a SEZ resident the questionnaire method and expert assessment in a professional environment were used. The characteristics of clusters are formulated by E.M. Belotserkovskaya were used [8], for each characteristic the authors of the article developed assessment criteria, which are estimated by the expert method on a 10-point scale, and then on a 3-point final scale (Table 5).

Table 5. The scale of the final expert assessment criteria for the synergistic effect ICS cluster and SEZ.

Qualitive characteristic	Quantitative indicator
Significant	10
Moderate	5
No effect	0

Experts for each criterion determined the level importance so that the sum of the importance for all criteria was 100%.

Table 6. An example questionnaire survey and expert assessment for the synergistic effect.

Question: Evaluate the importance of the indicator when assessing the synergistic effect by including resident in the ICS cluster							
Criterion for evaluating the synergistic effect the cluster and a SEZ resident (ki)	Specific weight of the criterion (K_i)	An expert evaluation from 1 to 10			Assessment by criterion ($k_i K_i$)		
		№1	№2	№3	№1	№2	№3
Geographic proximity	0,30	8	6	10	2,4	1,8	3
Technological interconnection	0,20	7	3	4	1,4	0,6	0,8
Reducing research and development costs	0,15	9	7	9	1,35	1,05	1,35
Gaining access to new distribution channels	0,10	5	8	3	0,5	0,8	0,3
Increased creditworthiness	0,05	5	4	7	0,25	0,4	0,35
Accessibility to common infrastructure	0,20	8	8	2	1,6	1,6	0,4
TOTAL	1,00	-	-	-	7,5	6,25	6,2

At the final step the results are checked and chosen direction of interaction between the SEZ and ICS clusters is selected.

3 Results

Approbation of developed by the authors method of interaction and its results are systematized in tabular form. The results of an assessment for the investment attractiveness special economic zones, related with investment and construction sector, are presented in Table 6. An assessment the possibility of a synergistic effect for ICS clusters and SEZ is

presented in Table 7, for the example used the interaction between «Akotech» cluster and SEZ IPT «Uzlovaya».

Table 7. Investment attractiveness of SEZ with construction orientation [7]

| SEZ	Final score	Relation to the average Russian value, %	S1	S2	S3	S4	S5	S6
Group 1: High investment attractiveness								
IPT «Tolyatti»	9,42	104,7	1,02	1,72	1,74	1,88	2,02	1,05
Group 2: Sufficient investment attractiveness								
IPT «Moglino»	8,57	95,3	0,94	1,40	1,89	1,66	1,60	1,09
Group 3: Moderate investment attractiveness								
IPT «Kaluga»	8,45	93,9	0,87	1,37	1,54	1,81	1,94	0,92
IPT «Uzlovaya»	8,30	92,2	1,05	1,65	1,29	1,47	1,82	1,01

Table 8. Assessment the possibility of a synergistic effect between "Akotech" cluster and the SEZ IPT "Uzlovaya"

Question: Evaluate the importance of the indicator when assessing the synergistic effect of including a SEZ resident int the ICS cluster							
Criterion for evaluating the synergistic effect of the cluster and a SEZ resident (k_i)	Specific weight of the criterion (K_i)	An expert evaluation from 1 to 10			Assessment by criterion (k_iK_i)		
		№1	№2	№3	№1	№2	№3
Geographic proximity	0,30	9	9	10	2,7	2,7	3
Technological interconnection	0,20	7	7	8	1,4	1,4	1,6
Reducing research and development costs	0,15	6	5	4	0,9	0,75	0,6
Gaining access to new distribution channels	0,10	8	8	6	0,8	0,8	0,6
Increased creditworthiness	0,05	5	7	9	0,25	0,35	0,45
Accessibility to common infrastructure	0,20	9	10	9	1,8	2,0	1,8
TOTAL	1,00	-	-	-	7,85	8,0	8,05

Selection of such an interaction is caused by the very high probability, because of the geographical location. The average value of the final assessment for the criteria is 23.63 / 3 = 7.87. According to the scale of the final expert assessment, the synergistic effect of interaction between «Akotech» cluster and the SEZ IPT «Uzlovaya» will be moderate.

4 Discussion

Based on the research conducted by the authors, an algorithm for the interaction of ICS clusters and special economic zones, was developed and shown on figure 3.
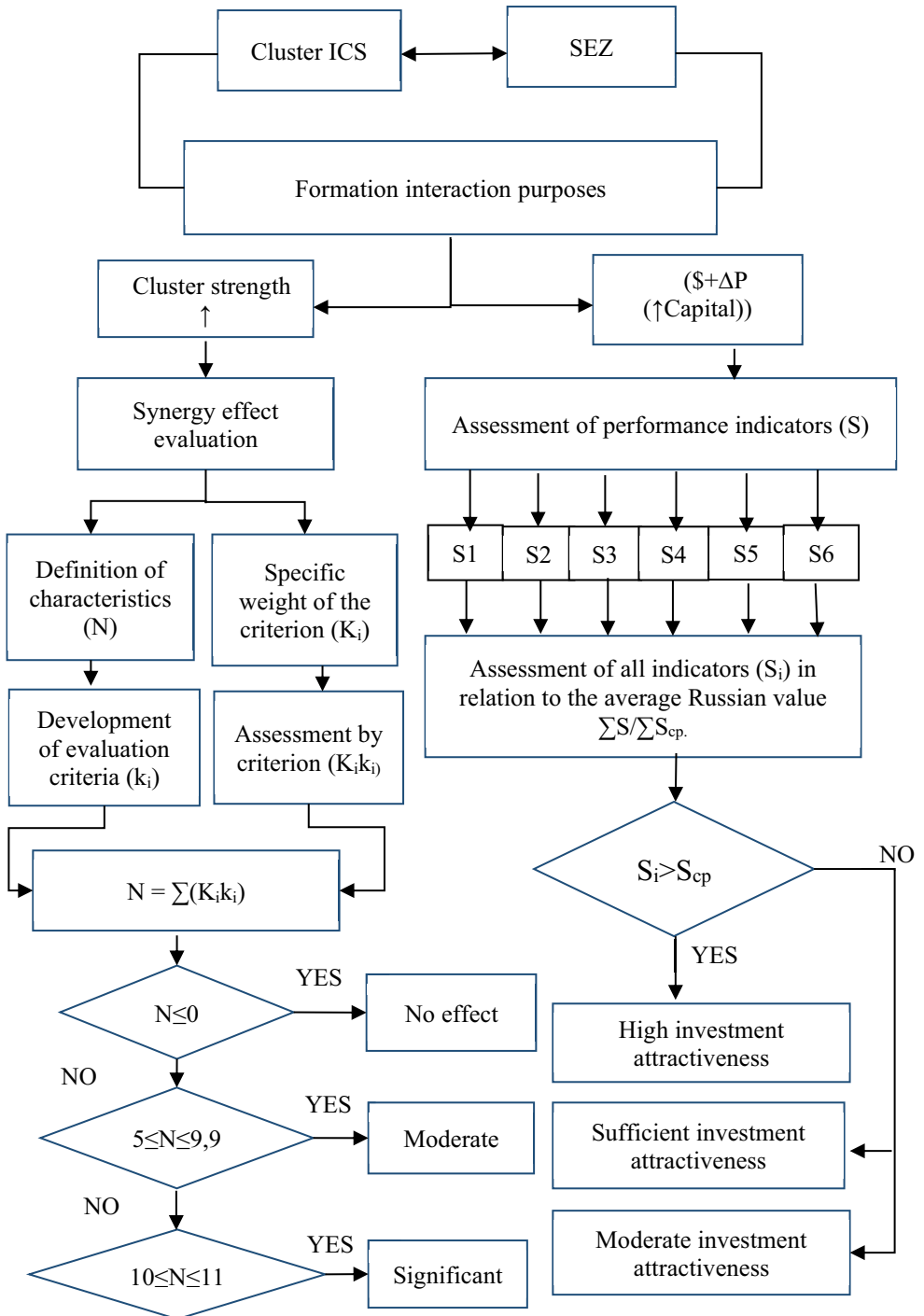
Fig. 3. Algorithm for the interaction of ICS clusters and SEZ

The algorithm developed opens wide opportunities for the development in the construction industry and helps to find an «exit» for special economic zones from an ambiguous period of operation [4,19,20].

The algorithm can be used to implement joint ICPs as well as to assess the synergistic effect of including a resident into a cluster.

As a result of analysis the conclusions obtained after the research, authors of the article would like to agree with the conclusion was made in the following article: "Instruments of cluster policy in the development of the innovative economy of Russia (on the example of individual special economic zones)" by Tserceil Yu.S., Kookueva V.V. and Gryzunova N.V., [14] which reads as follows: "innovative territorial clusters are considered as an effective mechanism for increasing the competitiveness of territories, an effective way of organizing joint activities of various cluster members in the corresponding territory" [14, p.9]. As for possibility of creation a cluster-type SEZ, for solving goals of various strategic orientations, which is mentioned in the article by N.N Zharkova [12], then, obviously, in the near future this is unlikely due to the ambiguity of the SEZ's position as a tool to attract investment [4 , 19,20], right now SEZ needs a revision of the mechanism [4], which would give it a breakthrough to get out of the crisis situation.

5 Conclusions

The authors of the article believe that the value of algorithm developed consists in its ability to solve the problems of unused capacities SEZ infrastructure [7, p. 19] and of building up empty land [7, p. 19]. For ISS clusters, the algorithm opens opportunities for enhancing its sustainability by including residents who have important advantages for the cluster. The role of the SEZ in this interaction is to attract clusters to solve problems for which there is not enough budgetary funds.

In many ways, the need to develop such an algorithm is justified by the fact that SEZs have demonstrated low efficiency for a long time, which led to a moratorium on their creation and its subsequent withdrawal [21].

The authors come to the conclusion, that the prospects for the special economic zones development as a tool for attracting investment lie in interaction with clusters, that will take on part of the financial risks, while having the opportunity to strengthen their competitiveness.

The practical significance of the algorithm is: its application is universal for various ICS clusters during the investment and construction projects implementation, as well as for assessing the synergistic effect of integrating a resident into a cluster.

Novelty of the research consists in the development of a system of algorithm criteria for assessing the interaction of ICS clusters and SEZ residents. The results obtained make it possible to launch the process of interaction between ICS clusters and SEZ, also consider possible options for interaction. In conclusion, it should be noted that as a part of the development of the scientific idea, the authors are going to conduct a number of additional studies in order to clarify the elements of the algorithm.

References

1. Federal law of the Russian Federation of July 22, 2005 №116-FL On special economic zones of the Russian Federation (2005)
2. Ministry of Economic Development of Russian the Federation Special economic zone (2020) URL: https://www.economy.gov.ru/material/directions
3. Federal State Statistic Service Construction (2020) URL: https://rosstat.gov.ru/folder/14458
4. Accounts Chamber of Russian Federation. Analysis of the practice of applying preferential regimes operating in the territory of the Russian Federation, in terms of their

impact on economic growth and compliance with the stated goals (2020) URL: https://ach.gov.ru/upload/iblock/d22/d22daa028b1854b51b99c9d2927c2e06.pdf

5. Decree of the Government of the Russian Federation of July 31, 2015 N 779 On industrial clusters and specialized organizations of industrial clusters" (with amendments and additions) (2015)

6. RUSSEZ. Russia. Special economic zones (2020) URL: http://www.russez.ru/oez/

7. Assosciation for the Development of Clusters and Technoparks of Russia Business Navigator for Special Economic Zones of Russia (2020)   URL: https://www.economy.gov.ru/material/file/5cdf79d1b333894973750b98b4cc9f10/Business_Navigator_2020.pdf

8. E.M. Belotserkovskaya, M.V. Kalieva, M.V. Sheptukhin, Young scientist «On the essence of the economic concept "cluster" **12**, 228 (2017) URL: https://moluch.ru/archive/146/41019/

9. Borisov A.V., Torchan N.F, Frangulyan N.A, «Implementation of the cluster approach in construction» (VGASU) **42**, 2 (2016) URL: https://novainfo.ru/article/4878

10. I.A. Garkina, I.N. Garkin, Molodoi Uchenii «Construction cluster: interaction between construction organizations» **4**, 155 (2014) URL: https://moluch.ru/archive/63/10103/

11. K.N. Emelyanova, Economics and management «Comparative analysis of various types of special economic zones operating on the territory of Russia» **1**,112 (2017) URL: https://moluch.ru/th/5/archive/51/1937/

12. N.N. Zharkova, Ekonomika, predprinimatel'stvo I pravo «A cluster and a special economic zone Integration as a tool for implementing the Concept 2020» **7**, 95 (2017) URL: https://cyberleninka.ru/article/n/integratsiya-klastera-i-osoboy-ekonomicheskoy-zony-kak-instrument-realizatsii-kontseptsii-2020/viewer

13. I.V., Ovechkina, L.N. Rubtsova, «Clusters and special economic zones of similarities and differences» (2017) URL: http://cscb.su/n/√30222s01/0222s01020.htm

14. Yu.S., Tserceil, V.V., Kookueva, N.N., Gryzunova, It Portal «Instruments of cluster policy in the Russian innovation company development» **1**,13 (2017) URL: https://itportal.ru/science/economy/instrumenty%C2%ADklasternoy%C2%ADpolitiki%C2%ADv%C2%ADr/%D0%90%D0%B2%D1%82%D0%BE%D1%80%D1%8B:

15. Yu.O., Chelpanova, Annual all-Russian competition for the achievements of talented youth Cluster structures in special economic zones (2017)   URL: https://nsportal.ru/ap/library/drugoe/2017/12/12/klasternye-struktury-v-osobyh-ekonomicheskih-zonah

16. S.G. Shalumov, Issues of economic regulation «Territorial industrial construction clusters: principles of development trajectory formation» **8**,59 (2017).URL: https://www.hjournal.ru/files/JER_8_4/JER_8.4_5.pdf

17. HSE University «Map of Russian clusters» (2020)URL: http://map.cluster.hse.ru/

18. Russian industrial park «List of industrial clusters of Russia» (2020) URL: https://russiaindustrialpark.ru/article/perechen-spisok-promyshlennyh-klasterov-rossii-2020-god

19. RBK «The Accounts Chamber did not see a breakthrough effect from special economic zones»   (2020)   URL: https://www.rbc.ru/economics/09/04/2020/5e8eb2679a79477a36b61c5f

20. Izvestia «Diagnosis - SEZ. The Accounts Chamber criticized the special economic zones» (2019) URL: https://iz.ru/883365/dmitrii-grinkevich/diagnoz-oez-schetnaia-palata-raskritikovala-osobye-ekonomicheskie-zony

21. TASS Putin agreed to lift the moratorium on the creation of SEZs in the regions (2018) URL: https://tass.ru/ekonomika/4923632

22. Yandex Search and Information Map Service «Yandex.Maps» (2020)