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ASSESSMENT AND IDENTIFICATION OF THE POSSIBILITY FOR CREATING IT CLUSTERS IN KAZAKHSTAN REGIONS [1]

The paper is devoted to the development of general methodological approaches to evaluate and identify the possibility for creating IT clusters in Kazakhstan regions. The present study considers the formation of IT clusters as growth poles. These poles are based on the establishing the groups of interconnected companies and institutions in IT industry linked by commonalities. The analysis of previous literature has shown that this approach is a novel approach to IT clusters formation. The study employs methods, which focus on analyzing and identifying IT clusters in the interests of innovative development and the possibility of spreading information technology in Kazakhstan regions. We propose the methodological tools for presenting a standard form to assess innovative potential and industry specialization. This assessment allows to objectively and realistically define a potentially important region for creating IT cluster. The empirical analysis has identified certain trends in possibilities to create IT clusters in the cities of Almaty and Astana. Therefore, these regions play the role of specialized platforms for a new generation. This platform is to provide a multiplier effect on the development of the agglomeration and located in close territories or periphery. The results of this research can be used to elaborate important strategic documents in the field of the development of the IT industry, digital technology, knowledge-based and high-tech sectors in Kazakhstan on the way to Industry 4.0.

Keywords: region, regional development, growth pole, agglomeration effect, cluster, information technology, IT cluster, innovation, specialization, Kazakhstan

1. Introduction

Many CIS countries (Commonwealth of Independent States) beginning to move to innovative technologies to increase the competitiveness that is to apply the transition to a new industrial concept "Industry 4.0". The aim of the new industrial concept "Industry 4.0" is to increase competitiveness through the integration of industry and information technology (IT), including the use of digital technologies in conjunction with cyber-physical systems. In other words, "Industry 4.0" based on the interaction of machine-to-machine (M2M), which is to propose the rapid exchange of data and perform well-defined operations, and readiness for decision variable and "smart" tasks. In addition, these requirements are not only scientific and technological, but they linked to information breakthroughs. For example, communications between intelligent products, internet of things, smart cars and portable devices (laptops, ultra-books, tablets, smartphones, mobile phones).

Thus, special attention is given to the development of the IT industry and the creation of IT solutions based on automation, such as 3D modeling, robotics, computational linguistics and artificial intelligence, the use of volumes of data (Big Data, Smart Grid), cloud computing, interactive technology. This is due to the trends of the high technology concept "Industry 4.0", i. e., the new incentive and challenge of development for all countries. Thus, many developing countries, such as Kazakhstan, Russia, Belarus, Kyrgyzstan, etc., do not want to be among a number of countries who a catching-up, but want forward to strive in the field of high technology.

Therefore, there is a need to create a specialized platform for a new generation, which is to combine the elements of innovation and infrastructure of the IT sector. IT clusters as growth poles are playing the role of this specialized platform for a new generation, which is to provide a multiplier effect on the development of the agglomeration and territories located close to each other and the periphery.

Kazakhstan is facing global economic challenges, like many CIS countries. In Kazakhstan,

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the problem for creating IT clusters has been poorly investigated so far. This is due to the low level of scientific research in the field of organization of interaction of various structures, linked to geographically close territories, which are to provide access to IT infrastructure, and thereby reduce the level of a digital divide. This approach to clustering through establishing groups of joint companies and institutions in the IT industry — for 3D modeling, robotics, computational linguistics and artificial intelligence, cloud computing, interactive and digital technologies.

This paper contributes science-based approaches to regional policy, which is to aim for creating a new model of the knowledge-based economy, i. e., a model built based on the elements of innovation and infrastructure of the IT sector. In addition, such regional policy is to promote the creation of IT clusters as growth poles. They will be based on establishing groups of interconnected companies and institutions in the IT industry, linked by commonalities and complementarities.

Thus, this research aims at presenting a general methodological approaches and approbation to evaluate and identify the possibility for creating IT clusters in Kazakhstan.

This paper is divided into the following sections. Section 2 considers the theoretical aspects of the formation of cluster approach. Section 3 sets the methods of scientific research. Section 4 presents analysis and estimation results. Section 5 is the concluding part.

2. Theoretical Background and Literature Review

One of the most important economic problems for many CIS countries is to achieve a balance between three major industries — export of raw materials, manufacturing and knowledge-intensive industries. The most reasonable solution to this problem is the development of high-tech, digital and creative technologies. Therefore, one of the most effective tools for Kazakhstan to get rid of dependence on natural resources is a cluster approach. The significance of clusters increases with the development of a market mechanism in the context of global trends: globalization of economic relations, strengthening of the positions of major global players, information, computerization and intellectualization.

Successful international experience identifying IT clusters has been accumulated, which demonstrate the importance and necessity of clustering. This experience allows us to identify criteria and indicators, strengths and weaknesses faced by any IT cluster. The most famous examples of successful clusters include Silicon Valley, Boston route 128, the Research Triangle Park of North Carolina, the Emilia Romagna Region in Italy, and the Kumi Electronic Industry Complex.

International experience of countries with successful IT clusters shows that these clusters play a major and increasing role in shaping the economy of the information society [1]. Overall, the IT industry is growing much faster than other sectors of the economy. In addition, the IT sector has a significant impact on the global economy. For a clear understanding of structure and prospects the creation of IT cluster, it is important to investigate the theoretical background and literature review of clustering. Thus, this paper contributes to the expansion of the theoretical and science-based views in the area of the main ideas of development of IT clusters.

The theoretical and methodological basis of this study is the achievements of scientific thought, both of domestic and foreign in creating classics theories of regional economic and cluster issues. It is important to note that today, it is best to study a cluster model in a diffusion context, which shows interregional and intraregional disparities as the inevitability. Therefore, the examples of such theories are the model of "growth poles" and the agglomeration effect.

In the preceding studies of efficient organization of economic space based on the model of "growth poles" is the diffusion of growth to occur towards the surrounding region [2, 3, 4]. Also they highlight other theoretical views on agglomeration effects such as explanation of regional disparities by Myrdal "cumulative regional growth" [5], the "central place theory" by Christaller [6], "the core-periphery model" by Friedman [7], "generations of innovation" by Hagerstrand [8], , "theory of urban agglomeration" by Richardson [9] and the theory of "agglomeration effect" by Krugman [10].

It should be noted that the model of "growth poles" created by Perroux is highly abstract, but allows us to formulate the role of the leading sectors, creating new goods and services [2]. Myrdal argued that with the help of specialization and agglomeration economies, it is possible to achieve significant benefits in the region [5]. The core-periphery model by Friedman shows that important roles in the development of the country are central cities [7]. Boudeville noted that the impetus for the development of the territory is to have fast developing sectors [4. Further, according to Richardson, the main factor of growth in a region is the accumulation of production activities in major agglomerations, which are industrial centers, i. e., the "growth poles" [9].

According to the theory of "agglomeration effect" by Krugman, the main growth driver is the accumulation of industrial activity in certain geographically related regions [10]. This benefits companies by increasing their size or from positive externalities arising from other companies in the market. The emergence of agglomerations assigns a random factor or binds with the notion of increasing returns to scale. Therefore, Krugman proposed to create clusters not as a fixed flow of goods and services, but as a dynamic structure based on innovation and new knowledge.

Nevertheless, theoretical views of growth poles underwent several variations to accommodate those geographic characters. Recent studies have confirmed these ideas. It is significant that previous studies have focused on territorial development, which is based on the use of the endogenous potential of regions [11, 12, 13]. In addition, the R&D carried out in the regions, innovation activity, financial situation and quality of social capital and transport mobility are the most important factors [14, 15]. Thus, agglomeration is a kind of "growth pole", which is to provide a multiplier effect on the development of the agglomeration and territories located close to each other and the periphery. These growth poles are not only an "important support", but also the main "engine", to transfer innovations to the periphery [16].

In the field of regional planning, the theory of "growth poles" applies to the leading industrial branches surrounded by groups of interconnected industries in a territory, which show rapid development and promote the growth of other sectors through the agglomeration effect. After their emergence, clusters have been playing important roles as growth poles in the region.

Porter, who is the most frequently cited analyst of cluster policy, defines a cluster as a geographic concentration of interconnected companies and institutions in a particular field, linked by commonalities and complementarities [17]. In the view of Sternberg, cluster initiatives do not simply advocate targeting, but are geared to changing the relationships between local institutions and enterprises, that is, to provide an environment and incentives through which local agents learn to improve innovative capacity [18]. Some scientists argue that cluster is a geographic concentration of competitive firms or establishments in the same industry that has close buy-sell relationships with other industries in the region [19].

The claim of this paper is that a more solid basis for technological development requires a better understanding of the processes of the creation of IT clusters. Therefore, it is necessary to investigate the processes of formation of high-tech clusters, i. e., the so-called IT clusters.

The scientific literature contains the concept that IT clusters can be used as a concept for high-tech clusters, which are built based on high-tech companies (i. e., the creative and digital technologies). Since the 1990s, IT clusters have become a popular strategy for regional development around the world. For some countries, especially for the newly industrialized economies of East Asia (Taiwan, South Korea, Singapore), IT clusters can attract investment, create new jobs, and increase the value of production. Such IT clusters are enhancements of national economic model based on the transition from an export-oriented policy to a new policy development of high-tech technologies.

Evolutionary theory is to explain the appropriate analytical bases for such a discussion. Based on Castells and Hall's approach, IT clusters in the U.S., represented by Silicon Valley, which is based on high-tech and IT companies, establishing groups of joint industries linking R&D and manufacturing. They divided the development modes of high-tech clusters all over the world into four types [20]:

— high-tech company industrial complex;
— science city;
— park of technology;
— Japan's high-tech city.

In this issue, the important impact of the regional economic literature is in the significance relating to the notion of "knowledge spillover" effect as a key for the clustering of enterprises of the IT industry. Especially the case research of successful IT clusters advocates for the importance of informal relations and social interactions. Thus, Saxenian argues that high-tech clusters consist of many companies and institutions interconnected by technology, information, communication, human resources, and other factors through close association and industrial links [21].

Some Chinese scientists believe that IT clusters are intelligence intensive areas, venture capital-intensive areas, government preferential policies, better natural environment and better infrastructure [22]. In particular, they suggest that the current mechanism of venture capital is far from perfect, and it is necessary to take steps to enhance and improve the venture capital system in the development of IT clusters. Chines scientists believe that a major impact of the location of the clustering of the IT industry is the intelligence-intensive areas, the quality of life and environment, and transport, especially air and highway [23].

The essence of the necessary theoretical framework is to present in the models of innovation sys-

tems based on high-tech clusters [24]. In particular, they ensure that IT clusters are dependent on new knowledge, although the organization of knowledge creation and diffusion varies. Grabher proposes a knowledge accumulated system in high-tech clusters, which is to make IT clusters as unique mechanisms [25]. Therefore, the level of accumulation of knowledge in an IT cluster continues to grow. Thus, IT clusters play a very important role as growth poles, which is to provide a multiplier effect on the development of the agglomeration and closely geographically located territories. IT clusters can gather all the factors and impetus for high-tech innovation together to make of the IT sector flourish in the region.

However, past research mainly discusses factors that influence IT clusters, it is often more descriptive than analytical, and has not solved the problem of the significance of these factors. The literature review shows that there is no universal methodological approach to define IT clusters.

In this paper, the focus is to develop general methodological approaches, and approbation's for the evaluation and identification of the possibility for creating IT clusters in the regions of Kazakhstan.

In Kazakhstan, clusters form based on the old industrial specialization or by close integration of enterprises as Kazakhstan has considerable natural potential (i. e., the raw materials). Nevertheless, such a cluster policy is built on the principle of path dependence after the Soviet Union times.

Since the beginning of the 21st century, Kazakhstan has been looking for new ways of divergence from dependence on raw materials. One the most of important tools for Kazakhstan is to establish regional policy through the creation of IT clusters, which play a very important role as growth poles — to provide a multiplier effect on the development of the agglomeration and territories located close to each other.

Further, it determines the need to develop methodological approaches and approbations for analyzing and identifying the possibility for creating IT clusters in the regions of Kazakhstan. Therefore, it is necessary to proceed to the next section of this research.

3. Research Methods

The world experience proves that the existing approaches for the identification and formation of IT clusters with a low variety of methodological tools in practice vary considerably. However, in foreign and in domestic practice there is no unique method for the identification and formation of IT clusters. In this paper, we propose to evaluate and identify the possibility of the formation of IT clusters by using two methodological approaches:

— The first approach is assessment, which is to involve the use of the method of evaluation of innovative processes. This method involves the evaluation of the possibility of the formation of IT clusters through the identification of innovation potential. The analysis focuses on identifying innovative advantages for 16 regions of Kazakhstan.

— The second approach is assessment, which is to assume the use of the method of regional specialization. We evaluate the possibility of the formation of clusters as organizational structures within certain territories, i. e., assess the regional specialization of the IT industry.

This paper presents the developed methodological tools, which analyze and identify IT clusters as "growth poles" in the regions of Kazakhstan. Thus, we propose two approaches that the methodological positions with evident implication. These methods are not identical, but they are interlinked, and need to be clarified and expanded.

3.1. The Method of Evaluation of the Innovative Processes

This method involves estimating the level of development dynamics and directions of changes in key indicators of innovation processes. In domestic and foreign practices, there does not currently exist any unique method of estimation of the innovative potential of regions. [26, 27, 28]. The aim of this approach is to identify the level of innovative development of regions, and develop metrics, which is to ensure the proper calculation of the results and define the level of quality of management decisions.

One of the most informative methods is the assessment of innovation processes. This method is based on the ranking or rating evaluations of the regions, which identify their characteristics, advantages and disadvantages. The advantage of rating the level of the innovation process is that the final comparison uses ranked scores, which characterizes a particular indicator for a particular region of the country. The points obtained for the level of innovative development is used to identify the prospective regions for creating IT clusters. Thus, certain scientists note that "the region is increasingly the level at which innovation is produced through regional networks of innovators, local clusters and the cross-fertilizing effects of research institutions" [28, p.39].

Kuzika, Yakovets and Rudskiy argue a tendency of high technological dynamics [29]. These scientists propose a methodology of forecasting of mac-

roeconomics, and apply it to the development of a long-term forecast of dynamics of regional development in Russia. Numerous researchers propose the geographical dimension, which is to understand the innovation process and rating estimation of the innovative potential of regions [30, 31].

The implementation of innovation policy is to demonstrate a differentiation of the state's approaches to innovation depending on the parameters of a region [32]. Therefore, innovation policy requires the active involvement of regions in the process of forming clusters and the implementation of the mechanisms of innovative activity stimulation [33, 34].

In this paper, taking into account the existing methods of evaluation, we propose an integrated methodology, which is to include territorial factors and industry specificities. The proposed methodology is the calculation of a composite integral index of innovation attractiveness, which is influenced by many individual factors measured by appropriate indicators [25].

For the rating of levels of innovative development, there is a select set of indicators, which are taken from sources of the state statistics of Kazakhstan. In addition, a set of formulas has been developed for estimating the indexes of innovative development. An important advantage of the rating estimation of levels of innovative development is that the final comparison uses ranking scales and characterizes a particular indicator for a particular region of the country. The points obtained for the level of innovative development allow identifying the most promising regions for creating IT clusters.

The regions of Kazakhstan are characterized by high level of diversity and heterogeneity. Therefore, the rating criteria for innovative development of the territory are divided into two groups: indicators of innovative susceptibility (labor productivity; the impact of fixed assets; sustainability of production) and indicators of innovative activity (cost of research and development; expenditure on technological innovation; innovative output per capita of the region).

Each of the proposed six indicators is determined by the leading region, which is to have the maximum value of the index, taking as 100 %. Further, relevant parameters of the other regions are calculated as a percentage relative to the leader by the formula below:

$$I_R = (X_R / X_{\max})100\ \%, \quad (1)$$

where R — region of the country; X_R — parameter value for the R region; $X_{\max}$ — the value of the parameter for the leading region; I_R — the ratio parameter value in the R region against the leading region.

Accordingly, the rating assessment of an innovative susceptibility and innovative activity in the region is determined by formulas (2) and (3):

$$I_{IS} = (J_D + J_E + J_F)/3, \quad (2)$$

where I_{IS} — rating estimation of innovative susceptibility of the region; J_D — the ratio of labor productivity in the economy of the region to the maximum value of the aggregate; J_F — the ratio of impact of fixed assets in the regional economy to the maximum value of the aggregate; J_E — the ratio of sustainability of production of the region to the maximum value in the aggregate.

$$I_{IA} = (J_A + J_B + J_C)/3, \quad (3)$$

where I_{IA} — rating estimation of innovative activity of the region; J_A — the ratio of spending on research and development to 1 employee to the maximum value of the aggregate; J_B — the ratio of expenditure on technological innovation in 1 of the employed to the maximum value of the aggregate; J_C — the ratio of volume of innovative output per capita of the region to the maximum value of the aggregate.

The final rating estimation of innovative development of the region is constituted of an aggregated index, i. e., the arithmetic mean of I_{IS} and I_{IA}. Thus, the weighting factors of innovative activity and innovative susceptibility are the same — 0,5:

$$I_{IS}\, I_{IA} = (I_{IS} + I_{IA})/2, \quad (4)$$

where $I_{IS}\, I_{IA}$ — the aggregated index of innovative development of the region.

Therefore, according to the assessment of the level of innovative development of the region is given the rank from 0 to 100 %. Accordingly, when the value of index I_{IS} and I_{IA} is growing that implies the region's place in the ranking of innovative development is growing too.

Overall, the methodical tools present a general form of evaluation of the innovative process, and it objectively and realistically defines a prospective region for creating an IT cluster. The proposed indicators of the assessment of the level of innovation development take into account regional specificities. In addition, they differ in the availability of calculation and analysis of indicators at the regional level.

3.2. The Method of Evaluation Specialization

This method is to assess the IT industry and its impact on the identification of IT clusters, which allows analyzing of spatial economic dynamics taking into view the specifics of industrial spe-

cialization. In both domestic and foreign practice, there is not currently a unique method of assessment of industry specialization [35, 36, 37]. The aim of this approach is to study the effect of agglomeration based on the coefficients of specialization of the IT sector, as well as develop indicators to ensure the proper calculation of results and define the level of the quality of management decisions.

The study of the foreign experience of clustering shows that the original algorithm of identification of prospective cluster projects includes methodological evaluations with a quantitative basis: identification of clusters by estimating industry specialization and determination of the impact of the agglomeration effect [38, 39].

In order to offer specific methodological tools, the concepts "specialization" and "agglomeration effect" should be explained. Although Feser noted that the value chain clusters should be built based on the evaluation of specialization of industries in terms of employment [39]. Bertinelli and Decrop proposed to assess the geographic concentration of the regions based on industry principle [40]. Thus, specialization is a result of the territorial division of labor, which reflects the degree of concentration of a certain industry (IT sector) in the region.

In turn, the agglomeration effect benefits from territorial specialization, which contributes to the emergence of competitive clusters [41]. The regions flourish and become industrial centers in the agglomeration effect, i. e., these regions have a high level of infrastructure and relationships, which attracts more firms to the region.

Therefore, to assess the level of industry specialization, we select set of indicators, which are taken from sources of the state statistics of Kazakhstan. In addition, to assess industry specialization the Krugman Specialization Index (*KSI*) should be used.

KSI is one of the most used indexes, and is, therefore, taken as the starting point for this research. In our research, we assess regional specialization through applying KSI index. The analysis shows relative magnitude of structures of the IT industry, i. e., the share of individual parts of the total volume of the aggregate or the relative size indicators under different regions and the same temporal determinacy.

KSI index shows sufficient information to determine a place of a region [10].

This index is used conditionally for international comparisons. This comparison allows drawing conclusions about trends and patterns of change over a certain period. We use the data of the volume of industrial production in IT industry. Moreover, we propose the modified *KSI* index, which is to provide a standard calculation of the level of specialization of a region in the IT industry by the following formula (5):

$$I_{KSI} = R_{IT} / C_{IT} \quad (5)$$

where I_{KSI} — the modified index *KSI*; R_{IT} — the gross value added of IT industry in the region; C_{IT} — the gross value added of IT industry in the country.

Overall, the higher indicator of *KSI* of a region is (i. e., one of the regions deviates from the reference group), the more this region is specialized. The methodological tools present a standard form of evaluation of the industry specialization of a region, and objectively and realistically define a potentially important region for creating an IT cluster. The analysis generally highlighted the importance of conducting specific research. As well as this, the analysis clearly shows that the modified Krugman index (*KSI*) is characterized by availability, the simplicity of calculation and analysis at the regional level.

4. Analysis and Results

After taking into consideration methods of processing the initial data and the set of values of the primary indicators of ranking, we propose to structure the rating scale indices of the innovative development of regions of Kazakhstan. Furthermore, it seems reasonable to conduct the rating based on the ranking points, which is to characterize a particular indicator for a particular region. Attention should be paid to the fact that the units of measure used in the rating indicators are not absolute, but are relative to describing both points of view of the innovative process: innovative activity and innovation receptivity. The initial data for ranking is taken from sources of the state statistics of Kazakhstan. Here, we calculate the indexes of innovative development of the regions of Kazakhstan for 2010 and 2016.

Thus, the final rating estimation of innovative development presents the aggregated indexes in accordance with the symbolic scale. The results of this estimation are presented in Table 1.

The obtained results of the aggregated indexes of innovative development of the regions of Kazakhstan allow drawing the following conclusions.

Firstly, Almaty city is the leading region with rank "A" in 2016, which accounts for about 18,4 % of the national potential of Kazakhstan. However, the innovative nature of the development of Almaty is a destabilizing vector due to the isolation from of the cost of R&D to the introduction in

Table 1

The aggregated indexes of innovative development of Kazakhstan regions in 2010 and 2016

No.	Region of Kazakhstan	The aggregated index, 2010	Rank by symbolic scale, 2010	The aggregated index, 2016	Rank by symbolic scale, 2016
1	Akmola region	11,25	C	25,59	C+
2	Aktobe region	17,47	C	17,98	C
3	Almaty region	10,55	C	18,05	C
4	Atyrau region	31,34	C++	46,49	B
5	East-Kazakhstan	13,75	C	32,02	C++
6	Zhambyl region	13,36	C	24,02	C+
7	West-Kazakhstan region	10,89	C	21,56	C+
8	Karaganda region	25,69	C+	30,28	C++
9	Kostanay region	18,70	C	25,48	C+
10	Kyzylorda region	26,08	C+	15,57	C
11	Mangystau region	13,27	C	51,83	B+
12	Pavlodar region	29,17	C+	29,30	C+
13	North-Kazakhstan region	10,65	C	23,74	C+
14	South-Kazakhstan region	34,94	C++	27,00	C+
15	Astana city	26,07	C+	57,83	B+
16	Almaty city	51,93	B+	76,05	A

Source: calculated by the authors according to the statistical compilations of the Republic of Kazakhstan.

the production of results. It is possible to propose two hypotheses of this fact:

— Almaty city is financial, economic and research center, which generates knowledge for other industrial regions. Thus, Almaty city operates the agglomeration effect of the so-called "growth pole", which is to provide a multiplier effect on the development of the agglomeration and located geographically close territories or periphery;

— Almaty city has a low share in the economic efficiency of expenditure on research and development due to the low level of its commercialization.

Secondly, the region of zone "B+" is Astana city (the capital of Kazakhstan). It should be noted that in Astana city, the cost of research and development is inversely proportional to the share of produced innovative products. However, it is has allowed Astana city to get the rank «B», and confirm the status of a research center of Kazakhstan. Obviously, Astana city has huge scientific and educational potential owing to the Nazarbayev University [42]. The main advantage of Nazarbayev University that it develops the same lines that western universities. In addition, it is related to the events of the international specialized exhibition "EXPO-2017" in Astana city. They were a powerful breakthrough in high technology. In particular, within the framework of "Astana EXPO-2017", there was work on three main projects, which were to provide the development of innovative platforms:

— platform "Astana Green City" — in the field of energy efficiency and renewable energy;

— platform "Astana Mobility" — in the field of renovation and improvement of the quality of transport infrastructure and logistics;

— platform "Welcome to Astana" — in the sphere of unification of the infrastructure of hotel business and services sector.

Thirdly, the rating of innovative development shows that there are three regions of Kazakhstan in zone "B" — Astana city, Mangystau region and Atyrau region. The level of innovative development of the rest of the regions of Kazakhstan low, i. e., they are in zone "C". At the same time, one of the important factors of intensive innovative development of regions is the increase in the number of regions that have moved from zone "C" to zone "C++" and "B". Compared to 2010 their number increased markedly in 2016.

Fourthly, the regions zone "C" present an interesting case. According to the rating, in 2016, the share of innovative products produced in these regions is several times higher than the share of expenditure on research and development. These are industrial regions — Kostanay region, East Kazakhstan region and Pavlodar region. Thus, the economic efficiency of expenditure on research and development regions with rank "C" is several times greater than the regions with the higher level of zones "A" and "B".

Furthermore, the IT industry of Kazakhstan should be assessed with the previously proposed methodological approaches. In Kazakhstan number of enabling conditions is being developed. It is associated with the potential accelerated growth of IT sector, extension in the size of demand for

Table 2

The volume of industrial production in the IT industry in Kazakhstan regions from 2010 to 2016, in million KZT

Region of Kazakhstan	2010	2011	2012	2013	2014	2015	2016
Akmola region	46,8	—	17,6	8,6	5,1	29,0	56,6
Aktobe region	3258,1	3911,5	2233,5	1658,8	1269,2	593,0	1090,0
Almaty region	165,8	155,6	178,7	131,8	142,9	113,0	255,5
Atyrau region	—	0,056	0,048	—	—	—	—
West-Kazakhstan region	36,5	19,3	1, 9	3,7	202,8	739	—
Zhambyl region	0,1	—	—	143,9	144,7	376	72,3
Karagand region	660,7	2029,3	1482,2	1770,4	2034,0	1929	2476,1
Kostanay region	—	—	—	—	—	—	—
Kyzylorda region	—	—	—	—	—	—	—
Mangystau region	—	—	24, 4	8,9	—	—	—
South-Kazakhstan region	—	102, 9	48,8	382,3	332,3	316,0	861,8
Pavlodar region	53,1	1,1	0,6	33,3	48,0	38,0	759,1
North-Kazakhstan region	340,0	3071,7	2911, 1	6268, 8	2071,7	2338	4774,4
East-Kazakhstan region	75,1	26, 4	297,6	216,4	185,1	414,0	306,1
Astana city	650,3	1988,9	100,5	3029,4	7098,9	12092,0	7464,8
Almaty city	11268,1	12121,1	19550,5	19512,7	23455,2	17220,0	20152,4

Source: calculated by the authors according to the statistical compilations of the Republic of Kazakhstan.

the sector's products in domestic and foreign markets, and the growth of competitive advantages of domestic business in high technology. The IT market of Kazakhstan is based on new types of devices and high technology, this leads to an increased convergence of communication networks. The demand for convergent services is constantly increasing in the world, mainly due to the rapid transition to the new concept "Industry 4.0".

The IT market of Kazakhstan is constantly growing and being updated. In recent times, the demand for IT products and IT solutions has shown a small reduction. The maximum rate of decline in the supply of equipment is demonstrated by personal computers, tablets and printing peripherals, because of the high consumer component in these segments. The main factor influencing the decline of the IT market was a reaction to the deteriorating economic conditions and devaluation of the national currency.

As discussed, in the IT-market of Kazakhstan, there is a tendency for convergence of communication networks and links, which is based on new types of devices and high technology. Consequently, the demand for convergent services is increasing worldwide. It should be noted that the IT market of Kazakhstan characterized a trend of global growth. The share of industrial production of products of IT industry in the total GDP of the country in 2016 amounted 36,5 billion KZT. The volume of industrial production in the IT industry from 2010 to 2016 is presented in Table 2.

The data presented shows that the total volume of output of the IT industry for the period 2010–2016 amounted to 120,3 billion KZT. The volume of production in the IT sector in comparison with the same period in 2010 increased two times in 2016. This is due to the increase in the sales of servers with the need to complete large IT projects in mind, and with preparations for the international exhibition «Astana EXPO-2017» and the implementation of the program «Information Kazakhstan-2020».

Let us go straight to the evaluation of regional specialization, thus, we identify which regions are prospective for creating IT clusters according to the KSI index. We should pay attention to the fact that all indicators show the relative magnitude of structures of the IT industry, i. e., the share of individual parts of the total volume of the aggregate or the relative size indicators under different regions and the same temporal determinacy. As discussed, the higher indicator of KSI of a region in the structure of the IT industry (i. e., one of the regions deviates from the reference group), the more this region is specialized. The initial data for the evaluation is taken from Table 2. We calculate regional specialization through applying the KSI index to Kazakhstan regions in 2010 and 2016. Table 3 presents the estimation results.

The obtained results of the regional specialization allow drawing the following conclusions.

Firstly, according to the calculations, the most specialized region in the IT industry — Almaty city, which forms 70 % of the total sales of IT products. This is due that in Almaty city, there is a number of domestic IT companies (Logycom, Asia Soft, Real Soft, etc.), and also the best utilization of IT services and the high level of educated population. In particular, in Almaty city, there is

Table 3

Indexes of specialization (KSI) for the IT industry of Kazakhstan regions in 2010 and 2016

No.	Region of Kazakhstan	Indexes of specialization, KSI	
		in 2010	in 2016
1	Akmola region	0,003	0,002
2	Aktobe region	0,197	0,033
3	Almaty region	0,010	0,008
4	Atyrau region	—	—
5	West-Kazakhstan region	0,002	—
6	Zhambyl region	0,000	0,002
7	Karaganda region	0,040	0,074
8	Kostanay region	—	—
9	Kyzylorda region	—	—
10	Mangystau region	—	—
11	South-Kazakhstan region	—	0,026
12	Pavlodar region	—	0,023
13	North-Kazakhstan region	0,021	0,144
14	East-Kazakhstan region	0,005	0,009
15	Astana city	0,039	0,224
16	Almaty city	0,683	0,606

Source: calculated by the authors according to the statistical compilations of the Republic of Kazakhstan.

"International IT-University", which cooperates with American IT University Carnegie — Mellon. Today, "International IT-University" is a Central-Asian leader in training highly skilled and internationally recognized IT experts. It should be noted that according to the calculations, Almaty city in 2016 showed a small reduction in comparison with the similar period in 2010 by the level of development of the IT industry. This decline is due to reduced sales in the field of hardware, licensed software, and enterprise hardware, namely, servers, data storage systems and telecommunication equipment.

Secondly, according to the calculationsб the medium specialized regions — Astana city, Aktobe region and North-Kazakhstan region. The national company "Kazakhtelecom" JSC is actively engaged in the implementation of the ambitious project to the creation of the backbone of IT network, and is attracted large system integrators (for example, Jet Infosystems and NVision). In particular, NVision performs a large-scale project to build high-speed network IP/MPLS with a bandwidth of 10 GB/s in-between the cities of Almaty, Astana, Aktobe, Ust-Kamenogorsk and Petropavlovsk. In turn, Jet Infosystems provides construction services regional data centers in Astana city, Ust-Kamenogorsk city and Petropavlovsk city.

Thirdly, it is necessary to pay attention to the group of outsiders, i. e., the regions with a significant delay in development of the IT sector. In particular, there are regions of Kazakhstan, which do not involve in the production of IT (Atyrau region, Kostanay region, Kyzylorda region, Mangystau region, South-Kazakhstan region and Pavlodar region). Apparently, this improvement is due to the implementation of the state program "Information Kazakhstan-2020", which is to provide a growth stimulation of the IT industry and establishment of IT parks, i. e., the creation a base for the implementation of modern IT devices and IT services, electronic commerce, cloud computing, interactive technology, etc.

5. Conclusions

This work marks a starting point for further research in the field of methodological approaches and their approbation for the evaluation and identification of the possibility to develop IT clusters. It provides some suggestions for the improvement of future studies dealing with the subjects of transfer of innovations and information technology for geographically close territories. Based on these research findings, the practical implications are listed below:

Firstly, the theoretical part of this study shows the importance of theories "growth poles" and "agglomeration effect". Thus, agglomeration is a kind of "growth poles", which play a very important role as it provides a multiplier effect on the development of the agglomeration and territories located close to each other. After their emergence, clusters have been playing good roles as growth poles in the region. This study has shown that it matters not only from a theoretical background but also from the empirical application. However, the past research mainly discusses the factors that influence IT clusters, they are often more descriptive than analytical, and have not solved the problem of the significance of these factors. Despite the many studies in this field, we argue that too little attention has been given for the development of general methodological approaches to define IT clusters.

Secondly, taking into account the existing methods of evaluation, we propose to evaluate and identify the possibility of the formation of IT clusters by using two methodological approaches, the method of evaluation of innovative processes and the method of the assessment of regional specialization. The method of the assessment of innovation processes is based on the ranking or rating evaluations of the regions, which identify their characteristics, advantages and disadvantages. The method of evaluation specialization is based on the use of the *KSI* index. It shows the relative magnitude of structures of the IT industry, i. e.,

the share of individual parts of the total volume of the aggregate or the relative size indicators under different regions and the same temporal determinacy. In this analysis, we use a set of indicators, which is taken from sources of the state statistics of Kazakhstan. In addition, they differ in both the availability of calculation and the analysis of indicators at the regional level.

Thirdly, the methodological tools for presenting the standard form of the evaluation of innovative potential and industry specialization gives the objective and realistic definitions of a potentially important region for the IT clusters formation. We applied the developed methods and identified certain trends for the possibility of the formation of IT clusters in Kazakhstan. The obtained results of the estimation of the level of innovative development are practically similar with the conclusions of the assessment of industry specialization. Therefore, given the great size of the territory of Kazakhstan, we propose the formation of IT clusters in the following prospective regions:

— IT cluster — "Digital cyber port Almaty" in Almaty city;

— IT cluster — "Information technology cluster Astana" in Astana city.

Therefore, these regions as growth poles are playing the role of this specialized platform of the new generation, which is to provide a multiplier effect on the development of the agglomeration and territories located close to each other.

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