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The Formation of Information Technology Clusters in Kazakhstan: System and Structured Approaches

Anel A. Kireyeva*

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Abstract

The aim of this study is to examine of the cluster approach to ensure high rates of innovation, information and communication enterprises of information technology cluster in order to enhance the competitiveness of regions. Keeping with the previous literature, the present research determined that the novelty of the problem, concerning of the creation IT clusters as drivers of new generation, i.e. a kind of platform of "startup accelerators" through the creation of previously not existing in the country high-tech industries and sectors of the economy. The study employs system approach involves to determine prospective directions of the formation of clusters of IT industry, also applies structured approach to shows relationships between elements of cluster systems (participants of cluster), as well as focusing on some aspects of cluster development such as networking. Based on this analysis we have proposed to create clusters in regions, which can play the role of translator's innovations at the periphery of the country. This research shows that formation of IT clusters is one of the most successful tools to avoid of dependence of Kazakhstan from raw materials.

Keywords: CLuster, Information Technology, IT Cluster, Regional Development.

JEL Classification Codes: O31, R11, R12.

1. Introduction

Many studies in recent years show that rapid economic growth usually accompanied by increased spatial inequality in CIS countries. Significant economic and currency changes that have taken place in August 2015 in Kazakhstan will lead to the formation of a new national geo-economic space. Certainly, what is happening in the world and in our country, the crisis in economic development necessitate significant innovation and technological transformations. In the period 2016-2020 years, regions of Kazakhstan will develop with the low level of global opportunities due to objective factors and barriers of development. Therefore, the right choice of policy priorities could strengthen influence of positive factors and reduce barriers to development. Nevertheless, the right choice will depend on the speed of industrialization and improve the competitiveness of regions of Kazakhstan.

The cluster approach considered as one of the measures to confront the barriers of development. The world's leading countries are actively involved in the development of clusters. Cluster initiatives have become an effective way of carrying out industrial policy, and are the leading measures for improving the competitiveness of enterprises and regions. The experience of many countries offers many ways to enhance in high-tech sectors such as computing, information technology (IT), electronics and microelectronics. Thus, the world is continuously moving towards the information society and the world economy towards global updates quick. Therefore, the interest to IT clusters s, which can play the role of clusters "future economy", i.e. a kind of platform of "startup accelerators".

This research have based on the achievements of advanced foreign and domestic economic thought. The most well-reasoned opinions and reflections on the theoretical approaches of the formation of clusters presented in scientific works Romer (1986), Krugman (1991), Porter (1998) Edquist (1997) and Malerba (2000). Some basic researches have focused on the theoretical and practical approaches of the creation of clusters of new generation (Pittaway et al. 2004; Bergman et al. 2013; Vardarher & Rana Cakır, 2015), including studies that involved various widely used conceptual views on the formation and development of IT clusters (Bramwell, et al., 2010; Boschma & Fornahl, 2011; Kireyeva, 2015).

In the previous studies on the theory of the structure and the efficient organization of economic space based on model of "core-periphery", agglomeration effect, which can play the role of the mechanism of transfer of innovations from the center to the periphery (Friedman, 1966; Christaller, 1966). From the point of view of the theory of industrial and regional development clusters, which implies optimal conditions for the creation of high-tech products it is possible to note research Solow (1987), Scott (1990) and Storper (1992). Special attention in the study

* Chief Scientist, Institute of Economics of the Ministry of Education and Science of the Republic of Kazakhstan [29 Kurmangazy Street, Almaty, 050010, Republic of Kazakhstan] E-mail: anele19@mail.ru

will be given to network formation clusters, which continuously exchange explicit and implicit knowledge, coordinating their decisions in order to experience on shared vision (Castells, 2001; Chamam & Pierre, 2009; Kireyeva, 2015).

Today clusters of different industries are an effective tool of development of regions and countries near and far abroad, which they use to increase competitiveness. Particular importance for the development of the regions and the national economy is the creation of clusters to promote innovation. Especially the creation of scientific-technological and high-tech clusters in modern conditions it is expedient to consider as a special regime of functioning of regional economy, focused on the positive dynamics of parameters of level and quality of life of the population. In our country, the problem of the formation of IT clusters in the regions of Kazakhstan until now poorly designed. This is due to low level of development of fundamental researches in the field of effective interaction of organizations, related with geographically close location in IT sector, as well as expanding access to innovative infrastructures, information and communication platforms by reducing the level of digital divide at the level of its regions. For solving tasks on formation of new cluster projects requires the development of scientifically based approaches to the formation of a regional policy aimed at the formation of a new model of the region through the creation IT clusters.

The aim of the study is the conceptual justification of the cluster approach to ensure high rates of innovation, information and communication enterprises of IT cluster in order to strengthen the trend of innovative industrialization and to increase competitiveness of regions of Kazakhstan. The study divided into the following sections. The Section 2 proposes to consider the theoretical review of the formation of IT clusters. Section 3 sets the methods of research: system and structured approaches. Section 4 is a concluding part.

2. Theoretical Review of the Formation of IT Clusters

To ensure accelerated industrial and innovative development of Kazakhstan to increase the competitiveness of regions and to improve the sustainability and profitability require adequately developed integration structures supported by state and self-developing. The way to innovative industrialization of Kazakhstan economy involves the solution of some fundamental problems by giving the national economic system of high-tech development. Innovation is the only way of solution to achieve sustainable growth, social welfare and employment in a country, and to that end, a climate that would foster innovation must create in the country (Vardarher & Rana, 2015). Especially in developing countries like Kazakhstan, Kyrgyzstan, Belarus, Ukraine, Russia and other.

Since the beginning of the XXI century in Kazakhstan at all levels of public administration have become increasingly supported new effective methods aimed at identifying, analyzing and resolving issues in order to enhance the competitiveness of regions including one of its promising and globally competitive industries – information technology (IT). IT sector can be to divide broadly into telecommunications, other IT services, electronics and microelectronics, software and hardware segments. So, in Kazakhstan approved the Concept of formation of prospective national clusters until 2020 (CFPNC, 2013). The main goal of this national program is to identify key institutional, methodological, and institutional bases of cluster development. In one of the directions of innovative development program required the formation of clusters in the sectors of "future economy". We think that IT clusters can be drivers of new generation, i.e. a kind of platform of "startup accelerators" through the creation of previously not existing in the country high-tech industries and sectors of the economy.

In Kazakhstan clusters formed, as a rule, based on the old industrial specialization of regions or by levelling policy of the state. We believe that for effective implementation of cluster policy should be looking for new effective creative ways aimed at improving the competitiveness of regions. Thus, it should created conditions for the formation of successful clusters, capable of ensuring stable innovation development in the long period. Cluster initiatives are only successful when they designed for a longer period and when they include a different set of measures (Cooke, 2006). For the development of effective policy is important to study the conceptual foundations of the formation of IT clusters. Thus, our study will attempt to expand the conceptual views as regards the three main ideas of cluster development. We will allocate these three ideas:

First idea – core periphery theory of spatial development, created by Friedman. He noted that the centers of different levels, always pulling together resources (human, financial, natural, production) with its periphery, the concentration of resources creates opportunities for innovative changes in the centers themselves, and then those innovations are translated to the periphery (Friedman, 1966). According to him, core and periphery at any spatial level related information flow. The generic title for these areas are agglomeration economies based on the observations of Marshall and Schumpeter who suggested that firms locate together to reduce transaction costs, to increase flexibility and to achieve maximum information flow (Marshall, 1925; Schumpeter, 1934). In the middle of the XX century, the theory of core periphery developed and added Christaller (1966). He introduced the concept of "central places". In his scientific works, portray the analysis of the location and distribution of the periphery relative to the center eventually setting the quantitative method and model, characterizing socio-economic relations of center and periphery.

In our opinion, the use of a core periphery model is of special relevance that can be solved problems of formation of IT clusters. For example, the use of this model led to the development of the most important mechanisms of formation of cluster policy in IT industry developed in USA and European Community. The experience of these countries shows that they associate the main tasks of regional management with the organization of certain areas of interaction between different levels of spatial theory of core periphery development.

Second idea – industrial and regional theory created by Storper (1992). He was studied the causes of high competitiveness, and comes to the conclusion about existence of special technological regions, which can be had optimal conditions for the creation of high-tech products. According to Storper (1992), companies set up their regional context, thus creating its own economic environment that is adapted to specific local conditions and an increase in the territorial concentration of production that receives its own dynamics. Thus, the strong impact of benefits from the centers, which are functionally, connected with one industry (Storper, 1997). Thus, growth model Solow (1987) contributes to the further development of industrial and regional idea. Relatively higher cost of resources in a particular area or in any industry encourages flow and provides economic growth (Solow, 1987). This statement reflected in numerous studies and strategies on improving the competitiveness of individual areas through the formation of cluster structures of high-tech manufacturing such as IT clusters (Bramwell, et al., 2010; Boschma & Fornahl, 2011; Kireyeva, 2015).

Generally, industrial and regional development are the second type of cluster under consideration here. This idea tend be knowledge-based – that is they often have a high proportion of companies in high-tech sectors such as IT industry. Like almost no other industry, IT characterized by innovation. They tend to be located on the fringe of urban areas or even at some distance from them – examples include Silicon Valley in California and Motorway Corridor in Britain (Hall, et al. 1987; Scott, 1990; Storper, 1993). In a knowledge, intensive business as IT industry the access to external knowledge is crucial for the success of companies (Pittaway et al., 2004).

Third idea –theory of new regional development created by Harris (1954). The new model of regional development acknowledges the dependence of economic development of the territory from the indicator on "potential market". Another approach to the theory of the new regional development model is the "base multiplier" regional income Pred (1966). Krugman (1991) proposed to create clusters not as a fixed flow of goods and services, but as a dynamic structure based on knowledge creation and innovation. The cluster approach is part of the growing family of innovation systems approaches (Edquist, 1997; Malerba, 2000). Krugman's theory based on cluster concept of Porter, which described idea of competitive advantage and the concept of a regional cluster (Porter, 1998). Then, new regional theory developed by Romer (1986). According to him, the main factor of the development in theory of "innovative growth" is the accumulations of productive activities in certain regions, which can united by a certain sphere of activity.

In this regard, we have concluded that clusters formed at the level of a specific region or industry and requires the development of specific actions to a specific cluster project. Theoretical review of the cluster development leads to the conclusion that the bulk of scientific research gives a greater degree of spatial view of the conceptual aspects to the formation of IT clusters. Theoretical review was as first part of a wider research of clustering of IT sector and serves as a pre-study for this paper. The structure of the cluster model of development of IT industry should contain a science-based methodological scheme. Any cluster project implemented based on certain methodological approaches of specific industry or region. Therefore, we proceed to the next section of this research – methodology.

3. Methods

The proposed study aimed to systematize of process of the formation IT clusters considered with the use of scientific methods of research, taking into account generalization and system analysis of the existing theories and models, similarities and differences of their structure and development of the cluster approach. This study will attempt to use methods that can essentially enrich the theory and practice of cluster development, especially in conditions where global trends dominate the information market and interactive innovations. In particular, to supplement understanding of cluster theory with new content and to explore features of the organization of cluster development based on networks. In particular, this research used the following methods:

System approach – this specific method involves determination of properties of a whole object by identifying the different relationships. Thus, approach means identifying the constituent components of a system and the relationships between them that ensure purposeful functioning of the whole object (Ritchey, 1991). This method can be used to determine prospective directions of the formation of clusters of IT industry, i.e. to determine the set of elements a cluster system.

Structured approach – this universal method involves the study of the object through the development and construction of the structure. The structure shows relationships between elements in the system, necessary and sufficient to ensure that the system has achieved its goal (Rittel & Webber, 1972). The structure acts as a kind of instrument of knowledge of its specific traits and characteristics (Vedenov, 1988). This method can be to explore and to determine the characteristics, and to study of cluster systems (participants of cluster), as well as focusing on some aspects of cluster development such as networking.

3.1. System Approach of the Formation of IT Clusters

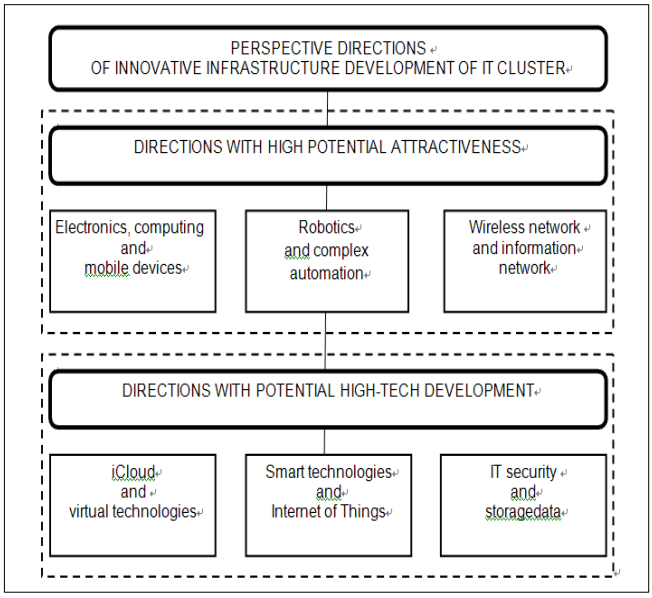
In the era of digital revolution IT sector has considerable innovative and production potential. In many cases, IT stimulated economic growth, created opportunities and increased the efficiency of service delivery. In IT sector are many directions of development: electronics, microelectronics; nano electronics; virtualization etc. In addition, development of IT industry is one of strategic directions of innovative economy. The modern innovative economy implies taking into account regional specificity, active involvement of the regions in the processes of formation and implementation of mechanisms of stimulation of innovative activity (Foray et al., 2009).

The formation of IT clusters should be as a special regime of regional economy. This regime must focused on the positive dynamics of parameters of level and quality of life, secure sustainable, balanced and multi-factorial reproduction of social, innovative, resource and environmental potentials of the territory. With innovative regional development we mean the capacity of territory to innovate, especially business model, product and process innovation has become imperative for many organizations especially in industrial sectors where the environment is changing constantly and rapidly like in IT sector (Prajogo & Ahmed, 2006). IT companies can develop a capacity to innovate stimulated by a conducive environment supporting the process cheaper and current an order of magnitude faster.

Actually, there are many different examples of how to use of IT clusters which give a real benefit. We have highlighted Silicon Valley, Seattle, Austin, Washington DC and Boston, which has come to be as a center for semiconductor work. Metropolitan areas emerge as highly ranked centers of employment in IT: New York, Los Angeles, Chicago and Philadelphia. Spanish IT clusters, one telecommunication based cluster-surrounding Madrid and electronics cluster in the Catalan region (Chaminade, 2001). Flemish IT clusters, for example, this resulted in different specialized in IT and microelectronics valleys (Larosse et al., 2001). Korean IT cluster Gumi, located inland in Gyeongbuk Province, developed for the electronics industry (ICCPK, 2010). Therefore, for the future development of IT industry in Kazakhstan, it is important that IT projects must do domestic companies, and it is not just an issue of security and prestige, this is a unique opportunity to grow a large number of highly qualified IT specialists.

In this regard, it is very important the creation of specialized areas, which can be used to implement the national IT projects and to bring to the region investments, new technologies, creative resources and world-famous trends. We think that IT clusters can play the role of such specialized areas, i.e. a kind of "startup accelerators" – a modern innovative platform for startup companies where the ideological inspirer and motivated professionals and experts from IT industry can be worked together on the creation and development of new products and services. Therefore, based on system method we have identified the perspective directions of innovative infrastructure development of IT cluster (Figure 1).

Thus, we identified as promising areas of development of innovative infrastructure of the IT cluster can lead to the formation of self-developing environment. It will give a chance to consider major regions of Kazakhstan as growth poles, aimed at the transfer of IT products and services for a broad periphery of the country. In the near future, IT sector closely interwoven with many other activities: computational linguistic; artificial intelligence; robotics; 3D-design; cloud technology; electronics; bio informatics. Therefore, the formation and functioning of IT cluster can change the face of the region and create a number of potential opportunities, the use of which can improve the efficiency of management and operation. This puts the task of ensuring the establishment of IT industry in regional development, the purpose of which is to attract to the territory of new investments and businesses.



<Figure 1> Perspective directions of innovative infrastructure development of IT cluster

3.2. Structured Method of the Formation of IT Clusters

Theoretical review shows that the transition of economic systems to a new growth model begins with identification at the level of a specific region or industry and requires the development of specific actions to a specific cluster project. This will provide an impetus to the creation of effective cluster model based on networks. Interaction networks between firms to increase innovations and lead to a rapid development of clusters. Therefore, Krugman (1991) proposed to create clusters not as a fixed flow of goods and services, but as a dynamic structure based on knowledge creation and innovation. Krugman's theory was the basis of the cluster concept of Porter (1998), based on the idea of competitive advantage and the concept of cluster.

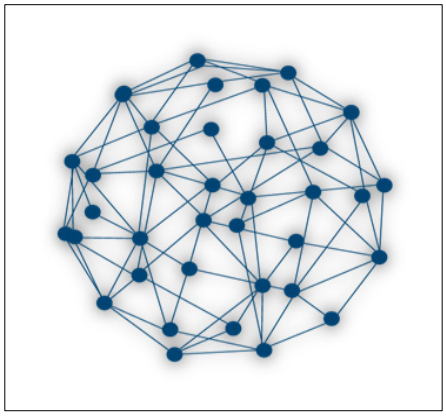
Definitely, an important variable that often makes clusters so different from one another is the considerable variation in networks. Effective cluster based on networks not only requires a certain level of trust and preparedness but also the ability to define common goals, to engage in partnerships across industries to engage in relationships with research and public institutions, and as well as establishing networks with end users. Networking within a cluster enhances the competitive advantage and creates a powerful impetus to exchange explicit and implicit knowledge, coordinating their decisions in order to experience on shared vision (Castells, 2001; Chamam & Pierre, 2009). Romanainen (2001), discussing about the Finnish approach towards cluster policy, lists as the major benefits of the cluster approach, the help it provides in identifying networks and linkages between industries.

The experience of Silicon Valley demonstrates the operations of the network platforms, which promoted development through the integration of networks, implementing the principles of "triple

helix" (Etzkowitz, 2008). Multi-stakeholder partnership of companies, inventors, and other organizations have made Silicon Valley a global center in the field of electronics, microelectronics, semiconductors and computing. As it becomes clear that such synergistic effect of cluster development improves the conditions for the spread of innovation in spatial context (Kireyeva, 2015). Certainly, as we note earlier, IT clusters can be drivers of new generation, i.e. a kind of "startup accelerators" through the creation of previously not existing in the country high-tech industries and sectors of the economy. It should be to allocate the following types of networks operating in IT cluster:

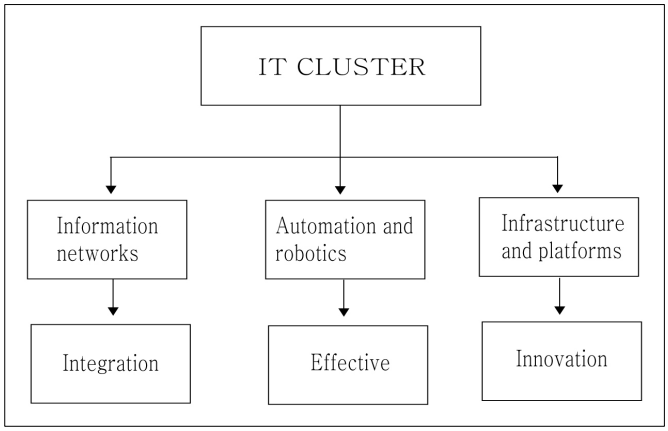
1) production networks – captures the interaction of cluster participants which have technological and organizational communications, and jointly implement various goods and services;
2) information networks – represent the interaction between cluster participants within the intellect, knowledge and new information technologies as the main renewable resource for sustainable socio-economic development;
3) infrastructure networks – interaction between cluster participants, representing a range of conditions providing a favorable economic development and meeting the needs of the whole population (transportation networks, financial and institutional networks);
4) socio-economic networks – captures the interaction of cluster participants which have sustainable contacts or similar social relations between individuals or groups;
5) innovation networks – represent the cooperation aimed at the process of creation, dissemination and implementation of innovations and advanced technologies.

As a result, above-mentioned extensive networks within IT cluster form a structure as shown in figure 2.



<Figure 2> Structure of extensive networks in IT cluster

We think that the activation of networks in IT cluster will contribute to the diversification of production, in order to avoid further dependence on the oil sector. As a result, innovative development of the regions of Kazakhstan based on IT cluster, which can be used to implement the national IT projects and to bring to the region investments, new technologies, creative resources and world-famous trends. Kazakhstan's accession to the WTO puts the country in front of the urgent need to take action innovative and technological character. Thus, the clusters can be drivers of innovation development of Kazakhstan. Thus, overcoming information barriers, increasing production resources and changing the nature of the products, IT clusters can be more integrated, effective and innovative (Figure 3).



<Figure 3> Scheme of networks effect to the structure of IT cluster

It is reasonable that we have highlighted the following benefits from the formation of IT clusters:

Firstly, IT clusters have a sustainable system of dissemination of new technologies and knowledge, which based on a joint information base, so-called networks aimed to the integration.

Secondly, companies fully automated within the IT cluster, and thereby contributed to the effective provision of products and services.

Thirdly, participants of IT cluster can help to scale up innovations. Companies of IT cluster have competitive advantages due to the possibility to carry out an internal specialization and standardization and to minimize the cost of implementation of electronic, analog and digital technologies.

Fourthly, IT clusters are extremely important for the development of small business: they provide small firms a high degree of specialization in servicing specific business niches, as this will facilitate the access to capital IT companies, but also actively, exchange ideas and knowledge transfer from experts to the entrepreneurs.

4. Conclusions

This work marks a starting point for further research in the field of the formation of IT clusters as drivers of new generation, i.e. a kind of "startup accelerators" through the creation of previously not existing in the country high-tech industries and sectors of the economy. It provides some suggestions for improvement of future studies dealing with this subject. Based on this research finding of this paper, the practical implications listed below:

Firstly, cluster approach is an important factor in increasing the competitiveness of the national economy to the CIS countries. For effective implementation of cluster policy should be looking for new effective creative ways aimed at improving the competitiveness of regions. It should be to create conditions for the formation of successful clusters, capable of ensuring stable innovation development in the long period. Therefore, we propose that IT clusters can be drivers of new generation, i.e. a kind of platform of "startup accelerators"through the creation of previously not existing in the country high-tech industries and sectors of the economy.

Secondly, theoretical review shows that the content and structure of cluster concepts had influenced common economic, innovation and spatial development. In particular, we have identified three ideas, which affected for the formation of clusters: center-periphery theory; industrial and regional theory; new regional theory. Theoretical views on the theory of clusters is not straightforward, giving rise to many disputable issues in innovative and spatial development. However, this does not preclude wide use of cluster approaches, as in the world, and in Kazakhstan, which once again proves the effectiveness and controllability of the processes of clustering.

Thirdly, role of the IT cluster is the ability to make the process cheaper, faster and more creative. Based on a system method we have identified the perspective directions of innovative infrastructure development of IT cluster, including electronics, mobile communications, robotics, computing, e-Commerce, internet services, etc. The formation of IT cluster can change the face of the region and create a number of potential opportunities, the use of which can improve the efficiency of management and operation. Thus, forthcoming exhibition "EXPO-2017"in Astana region can be as growth pole, which to aim at the intelligent transfer of technology and knowledge on the broad periphery of the country. Objects erected within "EXPO-2017", will allow in the future considering Kazakhstan as a major international information and communication platform for IT clusters. Already built in Astana region major projects of innovative, information and communications infrastructure (industrial parks, techno polis, research laboratories and business incubators).

Fourthly, world practice shows that successful IT clusters, offer unique opportunities for ownership markets in the era of digital revolution. Therefore, activation of networks in IT cluster will contribute to the diversification of production of Kazakhstan, in order to avoid further dependence on the oil sector. This study showed that the formation of IT clusters that will enhance the integration, efficiency and innovation. As a result, innovative development of the regions of Kazakhstan based on IT cluster, which used to implement the national IT projects and to bring to the region investments, new technologies, creative resources and world-famous trends.

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