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PREREQUISITES OF INTERNATIONAL CLUSTER FORMATION IN THE SECTOR OF TELECOMMUNICATIONS, INFORMATION AND COMPUTER SERVICES OF UKRAINE

Abstract. Existing studies into the international cluster formation and prerequisites of international innovation clusters formation are explored in the paper, the concept of cluster nucleus is described and approaches to the definition of cluster nucleus are analyzed. Criteria for cluster nucleus assessment as a triggering point for clusterisation and its potential for clusterisation are discussed in the paper.

The peculiarities of Ukrainian telecommunications, computer and information services industry development are explored in the paper and the results suggest that there are emergent processes of ICT services clustering in Kyiv, Lviv and Kharkiv regions. These processes takes place in the form of geographical concentration of business entities exporting ICT services together with establishing formal and informal interfirm agreements among them to provide cluster growth and development.

Keywords: cluster, international cluster, prerequisites of cluster formation, telecommunications, computer and information services industry.

Introduction. International innovation cluster formation is the issue of crucial importance nowadays, because they make structures of business entities stable, competitive and global shocks resistant.

Cluster structures are considered to be the most effective way for stimulating innovations and ensuring their implementation, because they act as complex business structures, which involve different business entities, scientific organizations, government organizations that can gain synergy from business interactions.

Analysis of the previous researches and publications. Features of formation and functioning of clusters described in the studies of such authors as A. Ruhman, D. Jacobs, M. Porter, L. Yang and others, as well as in the studies of Ukrainian authors such as I. Bakushevych, Z. Varnaliy, M. Voinarenko, D. Lukyanenko, V. Novytskii, V. Savchenko.

Porter offers a model that takes into account the following elements¹: inputs, demand conditions, related and supporting industries, firm strategy and competition. S.Kamath notes that M.Porter's model may be incomplete interpretation of the cluster success; to overcome the limitations of the model he offers its own assessment of the cluster formation prospects entitled GEMS (Global Economic Management System - GEMS). This model along with elements of M. Porter's diamond offers such elements as²: business climate, the anchor effect, industrial networks, the concentration of firms, innovation potential, historical factors. J.Nimen notes that the cluster success of the operation of the effect following elements³: general economic conditions, established for this industry; the potential for the development of new productive capacity; availability of qualified experienced entrepreneurs; availability of investors willing to invest in new businesses.

S.Sokolenko identified such prerequisites for the clusters formation as⁴: the existence of competitive enterprises or those with potential opportunities for development; geographical proximity of enterprises, the existence of "critical mass" of companies or potential for its creation; and the links between potential participants of the clusters and the availability of competitive advantages in general.

¹ Porter, M. (1990). *The Competitive Advantage of Nations*, New York: Free Press, 152.

² Kamath, S. (2012). Explaining Geographic Cluster Success-The GEMS Model, *American Journal of Economics & Sociology*. Jan. 2012, Vol. 71 Issue 1, 184-214.

³ Nieminen, J. (2012). The emergence of innovation-based wireless clusters: quality and timing matter, *International Journal of Innovation Management*. Dec. 2011, Vol. 15 Issue 6, 1271-1295.

⁴ Соколенко, С.І. (2004). *Кластери в глобальній економіці*, К., 250-320.

The above shows that there are several approaches to determining the prerequisites of clusters to assess the potential clustering of different aspects and levels, but not defined are specific conditions that contribute to the development of the international cluster that puts the need to systematize theoretical approaches to determining the prerequisites of clusters from the perspective of their international relations.

Thus, there are sufficient number of national and international studies dealing with clusters itself, their synergy effects and the role for strengthening national competitiveness, but there is still no research in international cluster effects for transition economies and the ways for effective integration of the Ukrainian entities into the international cluster systems. For that reason, the purpose of the research is to systemize existing studies into the international cluster formation and exploring the peculiarities of the Ukrainian ICT sector clusterisation.

Results and Findings

Prerequisites for industries or regions international clusterisation can be divided into general economic conditions and specific microeconomic conditions that reflect the peculiarities of economic entities functioning and development within sectors and regions. Estimation of cluster development prospects is based on assessment of international business environment factors affecting the development and functioning of the sector in which cluster operates. Among the factors influencing the cluster formation are structural shifts in global economic processes and changes in domestic economic relationships that can lead to changes in specialization. Thus, an important aspect of the cluster development is the international business environment factors changes, in comparison with previous periods, providing the possibility of changes in global economic relations that emerged.

Considering the prerequisites for the cluster formation at the macroeconomic level the next issues should be investigated. The cluster formation and development is a complex process that involve a wide range of participants, but usually there is a group of economic actors, which tend to be an engine of this development and are often identified as “key enterprises”⁵, “development centers”⁶, “nucleus”^{7,8}. Cluster nucleus play a decisive role in the cluster functioning and development.

Describing the “cluster nucleus” concept in general terms, one can agree with A. Trofimov that “cluster nucleus” – is the objects that the cluster grouped around⁸. The nucleus of the cluster according to the “pearls model”⁹ is a key firms that are highly specialized, geographically closed to each other, there is interaction between them, they have established contacts in foreign markets. The cluster nucleus can be assessed for clusterization potential (Table 1).

Mature cluster includes qualitative and balanced composition of commercial, public and educational sectors, the presence of related and supporting industries¹⁰.

Defining prerequisites for the potential cluster development requires estimation of such components as geographical proximity, the presence of a “critical mass of participants”, composition of the potential participants.

S. Sokolenko outlines geographic concentration of potential cluster members as the prerequisites for cluster development. When key cluster participants are in high proximity to each other, it opens the opportunities to activate interaction and increase the number of contacts and relationships among them¹¹, which generally can be described as spatial proximity. Therefore, it is important to determine the prospects of the formation of the participants in the early stages of the cluster formation that will create “an anchor effect”¹², open opportunities for the development of relations between business entities in the region and make the cluster formation and development more sustainable.

⁵ Соколенко, С.І. (2004). *Кластери в глобальній економіці*, Київ, 250-320

⁶ Куйбіда, В.С., Ткачук, А.Ф., Толкованов, В.В. (2009). *Транскордонне співробітництво та розвиток транскордонних кластерів*, К., «Крамар», 142.

⁷ Войнаренко, М.П (2008). Формирование инвестиционной политики на основе инновационных региональных кластеров. *Бизнес-партнер. Вип. № 2 (101), 9-10.*

⁸ Трофимова, О.М. (2011). Теоретические аспекты формирования инновационных кластеров в старопромышленных регионах. *Вестник Южно-Уральского государственного университета. Серия экономика и менеджмент. Выпуск № 8 (225).*

⁹ Войнаренко, М.П (2008). Формирование инвестиционной политики на основе инновационных региональных кластеров. *Бизнес-партнер, Вип. № 2 (101), 9-10.*

¹⁰ Kasabov, E. (2012). Towards a Theory of Peripheral, Early-stage Clusters, *Regional Studies. Jun. 2011, Vol. 45 Issue 6, 827-842.*

¹¹ Соколенко, С.І. (2004). *Кластери в глобальній економіці*, Київ, 250-320.

¹² Kamath, S. (2012). Explaining Geographic Cluster Success-The GEMS Model, *American Journal of Economics & Sociology, Jan. 2012, Vol. 71, Issue 1, 184-214.*

Table 1

Evaluation criteria of clusterization potential in terms of international business environment

Group	Criteria	Sufficiency level
Business entities' agglomeration	<ul style="list-style-type: none"> • spatial proximity of enterprises; • concentration of enterprises; • specialization, complementarity of participants 	the existence of "critical mass" or possibility for its creation; the ability to create "anchor effect" for the formation and attraction of new businesses
Recourses	<ul style="list-style-type: none"> • Natural • Employment • Capital • Technology and know-how • Infrastructure • Intangible non-profit resources 	lack of natural resources can be compensated by international activity development; capital resources can be compensated in case of high yield planned activities; lack of material capital resources and infrastructure also can be compensated in the same case, but it needs time.
Networking	<ul style="list-style-type: none"> • Internal networking development in the region • External networking development in the region • International economic relations development. 	communications between parties potentially can be established, if there is institutional possibilities of establishing cooperation between the parties in the business sector, public authorities and research organizations and there is no obstacles for establishing such relationships

One of the most important prerequisites for cluster formation, as already mentioned, is the existence of "critical mass" of companies or potential for its creation. There is an interconnection between the industry stage and the geographical concentration, as the M. Menzel outlines¹. For industries that are at maturity stage, an indicator of potential for cluster development is an existence of such a "critical mass", which designates a favorable base for entrepreneurship development in the region. If the industry is at its maturity, and the concentration of businesses and individual initiatives are low, this designates low region or industry potential for clusterization. For industries at the beginning of the life cycle distinct spatial concentration is observed, except for some small agglomerations. Enterprises begin agglomerate as the industry starts growing.

Telecommunications, computer and information services industry in Ukraine is on the emergent stage of life cycle, especially computer and information services sectors. Considering the overall ICT market trends the next issues should be outlined. Ukrainian ICT services export gradually increased in 2010-2014 as opposed to other types of services that were gradually declining. In 2014, exports of ICT services amounted to \$1675.5 million, ranking second (after transportation services \$6101.9 million) in exports of services of Ukraine, the share of ICT services in total services exports increased to 15% in 2014 from 10% in 2013².

An important feature of the IT sector is a trend towards spatial concentration of exporters. The main production regions of these services are Kyiv, Lviv and Kharkiv (Table 2).

Table 2

Regional structure of Ukraine's ICT services export, 2013

Region	Export of ICT services	Export of Information services	Export of Computer services	Export of telecommunication services	Share of ICT services export in Total export	Share of region in Total export of ICT services
Total	1442312	206934,8	942050	293310,4	10%	100%
Kyiv	1037544	152683,5	597028,1	287832,6	26%	72%
Lvivska oblast	101080,5	14350,1	86703,4	27	26%	7%
Kharkivska oblast	96350,2	7858,7	88474,5	-	28%	7%
Dnipropetrovska oblast	74818,3	12836,2	61975,4	6,7	14%	5%
Vinnytska oblast	33618,4	215,5	33403	-	57%	2%
Odeska oblast	16364,3	3252,4	11791,4	1320,5	1%	1%
Zaporizka oblast	14841,1	2219,8	12621,3	-	6%	1%

Source: author's calculations based on³.

¹ Menzel, M.-P. and Fornahl, D., (2007, October 30), Cluster Life Cycles - Dimensions and Rationales of Cluster Development. *Jena Economic Research Paper No. 2007-076*.

² Структура експорту-імпорту за видами послуг у 2014 році (2014), *Державна служба статистики України*. <<http://www.ukrstat.gov.ua/>>

³ Осауленко, О.Г. (2014). Статистичний збірник «Регіони України», 2014. *Державна служба статистики України*. К., Ч.2, 633-680.

Table 2 shows that the share of Kyiv in total exports is 72% (in total Kyiv exports 26%), Lviv region - 7% (the share of ICT exports in the region 26%) and Kharkiv - 7% (the share of ICT exports in the region - 28%). Kyiv, Lviv and Kharkiv oblasts are highly focused on producing ICT services constituting, on average, almost a third of all services rendered.

There is an emergent trend of clustering business entities from information, computer, and telecommunication services sector in these regions, developing enterprise associations and organizations and their relationships with research and municipal authorities on cluster basis. So in Lviv was founded a community that brings together leading companies from IT services in Lviv (30 companies), as well as universities and city authorities called “Lviv IT Cluster”. The declared goals of this association are¹³: promoting the city as a center of IT at the international and national level, participating of cluster companies in international exhibitions and conferences, institutional development of cluster by attracting additional funding, including funding from EU programs, organization of trade missions to various countries to establish partnerships and seek new clients.

The establishment of the IT cluster in Kharkiv “Kharkiv-IT” was declared at the beginning of 2014. “Kharkiv-IT” brings together leading IT companies in the region, representatives of the Department of Education and Science of Kharkiv Regional Administration and the Kharkiv Department of Innovation Development, Industry and RSA transport infrastructure. The plan for implementing cluster development strategy of “Kharkiv-IT” includes next areas¹⁴: development of the cluster innovative activity, cluster brand promotion, facilitation the information exchange among cluster participants, enhancement of staff professional growth and building an infrastructure necessary to cluster functioning. In general, newly established cluster activities aimed at establishing a system of interaction and relationships among cluster members and cluster promotion to attract new members.

An important aspect of the prerequisites for cluster formation is the potential demand for the final product. Changing conditions demand for final products of some enterprises will determine the demand for suppliers of these companies and changing demand for products throughout the value chain. In this case, you need to share domestic demand and demand in foreign markets.

Considering the structure of the Ukrainian ICT services market, we should outline that the internal market (excluding intermediate consumption of ICT services within the framework of the ICT sector - 25%) are estimated to be only 26% from the total sales in ICT services, 42% of services are exported (Figure 1).

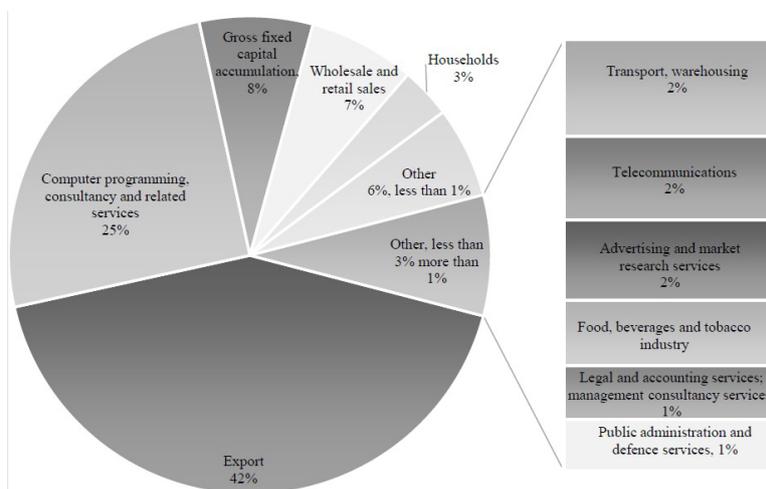


Figure 1. Structure of computer programming, consulting and information services consuming by the different industries of Ukraine, 2013

Source: compiled by the author based on¹⁵

The consumer market is not a considerable share of ICT services presenting only 3% of the services provided; the main customers of the ICT industry are business entities operating in industrial market, hence there is high dependence of ICT services on the industrial market trends.

¹³ “Напрямки проектної діяльності Львівського ІТ Кластеру”. Available at: <<http://itcluster.lviv.ua/>>

¹⁴ “Международный форум Kharkiv-IT”. Available at: <<http://kharkiv-it.com.ua/ru/>>

¹⁵ Нікітіна І. М. (2015), “Таблиця «витрати–випуск» України за 2013 рік в основних цінах”. Державна служба статистики України, 2015, 57 с.

The main countries of export of services in telecommunications, computer and information services are the United States, Russian Federation, Switzerland, United Kingdom, Malta, Germany, Sweden, Canada, Republic of Korea, Denmark and the Netherlands. Thus the majority of these countries Ukraine as imports of services sector. The growth of intra-trade ICT services took place with the Russian Federation (including in 2014-2015 years), Switzerland, Sweden and the Netherlands.

ICT services industry export orientation serve as a growth factor for Ukrainian ICT industry due to small capacity of internal market, but constitutes high dependence on external markets conditions.

Conclusions

There is a trend towards spatial concentration of exporters in the telecommunications, computer and IT-sector services of Ukraine, the main centers of which are Kyiv, Lviv and Kharkiv. There are emergent processes of clustering in these regions, which takes place in the form of geographical concentration of business entities exporting ICT services together with establishing formal and informal interfirm agreements among them to provide cluster growth and development. Cluster initiatives focus on building internal relationship between the participants mostly for promotion on the national scene, and still less focused on the development and expansion of international cluster relations.

Growth of ICT services shows a positive trend, but its development is at the embryonic stage and largely focused on exports, with sufficiently narrow domestic market of ICT services in Ukraine. Thus, the ways of the increasing international competitiveness and development of the international relations of the emerging clusters in the international environment should be further *examined*.

References

1. Porter, M. (1990). *The Competitive Advantage of Nations*. New York: Free Press, 152.
2. Kamath, S. (2012). Explaining Geographic Cluster Success-The GEMS Model. *American Journal of Economics & Sociology*. Jan. 2012, Vol. 71, Issue 1, 184-214.
3. Nieminen, J. (2012). The emergence of innovation-based wireless clusters: quality and timing matter. *International Journal of Innovation Management*. Dec. 2011, Vol. 15, Issue 6, 1271-1295.
4. Sokolenko, S.I. (2004). *Klastery v hlobalnii ekonomitsi*. Kyiv, 250-320.
5. Kuibida, V.S., Tkachuk, A.F., Tolokovanov, V.V. (2009). *Transkordonne spivrobotnytstvo ta rozvytok transkordonnykh klasteriv*. K., «Kramar», 142.
6. Voinarenko, M.P. (2008). Formyrovanye ynvestytsyonnoi polytyky na osnove ynnovatsyonnykh rehyonalnykh klasterov. *Byznes-partner; Vyp. # 2 (101)*, 9-10.
7. Trofymova, O.M. (2011). Teoretycheskye aspekty formyrovanyia ynnovatsyonnykh klasterov v staropromyshlennykh rehyonakh. *Vestnyk Yuzhno-Uralskoho hosudarstvennoho unyversyteta. Seryia ekonomyka y menedzhment, Vypusk # 8 (225)*.
8. Kasabov, E. (2012). Towards a Theory of Peripheral, Early-stage Clusters, *Regional Studies*. Jun. 2011, Vol. 45, Issue 6, 827-842.
9. Kamath, S. (2012). Explaining Geographic Cluster Success-The GEMS Model, *American Journal of Economics & Sociology*. Jan. 2012, Vol. 71, Issue 1, 184-214.
10. Menzel, M.-P. and Fornahl, D., (2007, October 30), Cluster Life Cycles - Dimensions and Rationales of Cluster Development. *Jena Economic Research Paper No. 2007-076*.
11. Struktura eksportu-importu za vydamy posluh u 2014 rotsi (2014). *Derzhavna sluzhba statystyky Ukrainy*. <<http://www.ukrstat.gov.ua/>>
12. Osaulenko, O.H. (2014). Statystychnyi zbirnyk «Rehiony Ukrainy», 2014. *Derzhavna sluzhba statystyky Ukrainy. K., Ch.2, 633-680*.
13. Napriamky proektnoi diialnosti Lvivskoho IT-Klasteru. <<http://itcluster.lviv.ua/>>
14. Mezhdunarodnyi forum Kharkiv-IT. <<http://kharkiv-it.com.ua/ru/>>