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## INDICATORS OF UKRAINIAN INDUSTRIES' COMPETITIVENESS CONSIDERING FACTOR OF HUMAN CAPITAL

### ІНДИКАТОРИ КОНКУРЕНТОСПРОМОЖНОСТІ ГАЛУЗЕЙ УКРАЇНИ З УРАХУВАННЯМ ЛЮДСЬКОГО КАПІТАЛУ

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Метою статті є визначення видів економічної діяльності України з високою конкурентоспроможністю експорту враховуючи людський капітал. Також було наведено етапи створення експортного продукту, головним ресурсом у якому є людський капітал, індикатором ефективності його роботи – працenasиченість, результатами – обсяг випуску та частка доданої вартості у випуску, а зовнішньоекономічним результатом – частка експорту. У результаті проведення ієрархічного кластерного аналізу було отримано п'ять кластерів, поточний стан яких було охарактеризовано за допомогою статистичних даних. Зокрема було розраховано коефіцієнти випередження для кожного кластера. У результаті було надано рекомендації для кластерів та економіки України в цілому.

*Ключові слова:* види економічної діяльності, кластери, експорт, коефіцієнт випередження

*Oleksiv I.B., Mirzoieva D.R. Indicators of Ukrainian Industries' Competitiveness Considering Factor of Human Capital. Review article.*

The aim of the article is to determine the types of economic activity of Ukraine with high export competitiveness, taking into account human capital. The stages of creation of an export product were elaborated, the main resource of which is human capital, the indicator of its efficiency – labor intensity, the results – the volume of output and the share of value added in output, and the foreign economic result – the share of exports. As a result of hierarchical cluster analysis, five clusters were defined, the current state of which was characterized by statistical data. In particular, outpacing coefficients were calculated for each cluster. As the result, recommendations were provided for clusters and the Ukrainian economy as a whole.

*Keywords:* economic activities, clusters, export, outpacing coefficient

**E**xport activity is an essential part of international economic activity of country and its participation in international division of labour. During the history of independent Ukraine raw materials and intermediate goods (30.67% and 44.68% accordingly in 2018 [1]) remain the main components of national exports. Nevertheless, dynamic development of information and communication technologies and growth of IT-sector in Ukraine creates new opportunities for restructuring of national export. Moreover such tendencies are lined up with global rise of information and knowledge economy. Export strategy of Ukraine includes sector and cross-sector strategies in order to ensure development of perspective industries and enabling environment around them.

#### Analysis of recent researches and publications

A lot of scientists underlined that Ukraine is highly dependent on external environment caused by high share of export of raw and intermediate goods. For instance, Farion-Melnyk A. et al. included as one of main problems of Ukrainian economy low production of innovative products, what ensured independence for developed countries [2]. Also authors suggested that changes in strategic production, new markets and development of service creation policies will benefit Ukrainian export [2]. Onegina V. et al. by implementation of regression on labour productivity in agriculture sector of Ukraine demonstrated that investments in fixed capital per worker have positive impact on productivity [3]. Matyushenko I. et al. researched development of foreign trade in high-tech products of Ukraine in conditions of association with the EU and found that outdated structure of production, low level of research and development expenditures are main factors of declining innovative activity [4]. Zhygalo O. analyzed innovative capacity of enterprises and suggested to implement circular model for innovative process in order to ensure development of technological export [5]. Previously Oleksiv I. and Mirzoieva D. performed clustering of economic activities in conditions of knowledge economy development was

conducted basing on 3 indicators: share of value added, share of export and labour-intensity [6]. As the result, 4 clusters were formed, which showed main problems: low value added and/or high labour-intensity. But in order to cover more aspects of creation of export product is suggested to take into account human capital required for production of export goods and results of creation process.

*The aim of current research* is to investigate current state and competitiveness of economic activities in Ukraine. In order reach the aim we delineated next stages:

- Analysis of stages of creation of export product in knowledge economy;
- Implementation of hierarchical cluster analysis based on elaborated stages of creation of export product in knowledge economy;
- Analysis of outpacing temps of growth for each cluster relatively to growth rates of all activities;
- Elaboration of recommendations.

### The main part

According to the management theory creation of any product or service is impossible without resources (or factors of production), technology of their transformation into final good and final good [7]. In the context of current research taking into account knowledge economy we suggested to characterize resources by human capital, as it is central element in such economy. In order to characterize the stage of transformation skills and knowledge of human capital into final good is necessary to evaluate how effectively they are used. Accordingly a result of transformation should be reflected by volume of output and what is important for knowledge economy – volume of value added. In this case the result of production is characterized not only by volumes of output, but value of this product for consumer. A result of international trade is reflected by volumes of export. Finally we consider the following stages of the process of creation of export product in the knowledge economy (fig.1).

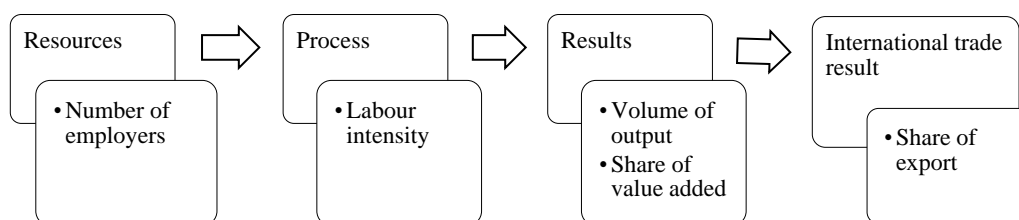


Figure 1. Stages of creation of export product in knowledge economy.

Source: compiled by autor on materials [7].

The main resource in knowledge economy is human capital, so we consider the number of employers in each economic activity as indicator for this stage. In order to evaluate the efficiency of information and communication technologies and innovations adoption we suggested using the labour-intensity indicator. The labour-intensity is reversed indicator to productivity and demonstrates how much time is spent to produce one money unit of value added in each economic activity and is calculated as suggested in previous research [6].

Such approach also allows to understand how effectively working hours are used. As the results of creation process we consider tangible side in form of volume of output and intangible side in form of value added. Value added indicates the ability of export product of country to create additional value for consumer. Additionally, value added can reflect the innovativeness of export product. Finally, result for international trade is share of export of each economic activity.

In case of Ukraine we extracted data on chosen indicators for each economic activity from ILOSTAT [8] and State Statistics Service of Ukraine databases for 2019 as the latest available time period [9]. In order to perform hierarchical cluster analysis extracted data was scaled it by its standard deviation. The optimal number of clusters is going to be determined by implication of Elbow-method [10]. As the result change in total variation between five and six clusters is 4.8% against 16.5% change between four and five clusters. Hierarchical clustering was based on method of Wards minimal variation [11]; as the result economic activities are distributed as following (tab.1).

In order to characterize current state and perspectives of development of determined clusters was suggested to calculate outpacing coefficients for each cluster by chosen indicators: number of employees in each economic activity, volumes of added value, output and export, and share of value added in output. Overall suggested outpacing coefficient demonstrates is growth rate of indicator of cluster greater or lesser than analogical indicator for all economic activities (1).

$$K_j - clust = \frac{T_{i-indicator\ of\ j-cluster}}{T_{i-indicator\ of\ activities\ overall}}, \quad (1)$$

where  $K_j - clust$  – outpacing coefficient of  $j$ -cluster;  $T_i - indicator\ of\ j - cluster$  – growth rate  $i$ -indicator of  $j$ -cluster;

$T_i - indicator$  – growth rate of all economic activities overall [12].

Table 1. Clusters of economic activities in Ukraine

Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
— Manufacturing (including Mining and quarrying, Manufacturing industry, Supply of electricity, gas, steam and air conditioning, Water supply; sewage, waste management)	— Agriculture, Forestry and Fisheries — Wholesale and retail trade; repair of motor vehicles and motorcycles	— Construction	— Transport, warehousing, postal and courier activities — Information and telecommunications — Financial and insurance activities — Real estate operations — Professional, scientific and technical activities — Activity in the field of administrative and auxiliary services — Public administration and defense; compulsory social insurance	— Temporary placement and organization of food — Education — Health care and social assistance — Arts, sports, entertainment and recreation — Provision of other types of services

Source: compiled by autor on materials [11].

Accordingly to formula 2 outpacing coefficients were calculated for five clusters and results indicators in 2019. Volumes of output and added value were extracted from State Statistics Service of Ukraine in constant prices of 2016 [9] (tab. 2).

Table 2. Outpacing coefficients for clusters in 2019

Outpacing coefficients	Clusters				
	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Outpacing coefficient of output volumes	0.964	0.984	1.190	1.034	0.996
Outpacing coefficient of added value volumes	0.967	0.987	1.194	1.022	1.007
Outpacing coefficient of export volumes	0.560	1.899	0.724	1.002	1.140

Source: compiled by autor on materials [9].

Manufacturing, which is cluster 1, demonstrates the lowest values of the outpacing coefficients in terms of output, value added and exports. In particular, the commodity structure of Ukrainian industrial exports is dominated by ferrous metals (17.5%) and articles thereof (2.1%) [9]. In addition, 9.7% are exports of mineral products, of which 7.2% are ores, slag and ash [9]. Exports of mechanical engineering account for 8.9%, of which 5.5% are electric machines [9]. According to the forecasts of the National Bank of Ukraine, iron ore prices on the world market will decline, which may adversely affect the economy of Ukraine [13]. The predominance of raw material exports is due to the low level of modernization, research and development and innovation. In 2019 only 13.8% of domestic enterprises have introduced innovations, with the share of innovative products only 1.3% [9].

The growth rate of agricultural exports and trade, which are cluster 2, exceeds the growth rate of total exports almost 2 times, which indicates positive trends in the export potential of cluster 2. The efficiency of agricultural development is caused by stable growth of labor productivity per employee (928.6 thousand UAH per employee in 2019 compared to 867.7 thousand UAH per employee in 2018) despite the decrease in capital investment in recent years (decreased by 10.5% in 2019 compared to 2018) [9]. According to the results of the National Bank of Ukraine review of global trends, prices and demand for agricultural products on the world market will remain at the same level, which will contribute to the recovery of the Ukrainian economy [13]. The constant growth of domestic and foreign trade volumes contributes to the development of services related to this type of economic activity and their export. In particular, volumes of wholesale and retail trade in Ukraine has been growing in recent years. However, it should be noted that in the structure of trade in 2019 the largest share is occupied by non-food products, with the share of goods produced in Ukraine in the wholesale trade is 44.1%, of which 75.1% are food products [9]. This structure confirms the fact that Ukrainian industry produces a small amount of high value added goods. The volume of exports of repair services in Ukraine has also been growing in recent years, which enlarges their potential for development.

The rate of output and value added of construction (cluster 3) is growing faster than the growth rate of total output. According to the forecasts of the National Bank of Ukraine in 2021, construction volumes will continue to grow due to the construction of infrastructure [13]. Significant problems and reasons for the low added value of construction are the lack of a clear estimate and rationing of works [14], outdated technologies and equipment.

Cluster 4, which includes professional, transport, information and communication, financial services, real estate services, administrative and support services, as well as public administration, demonstrates greater

growth rates of output and value added than economic activities in Ukraine overall. Possibilities for development of export potential of this cluster are related to the growth of professional and consulting services and the rapid development of the IT sector in Ukraine. In particular, the total business services and information and communication services account for 24.7% of exports of services in 2019 [9]. In addition, an important component of this cluster is transport services, which account for 58.3% of total exports in 2019 and include maritime and pipeline transport, which in turn show the largest shares in transport services in Ukraine [9]. Also important direction of improvement for this cluster of services is standardization in accordance with world practices to increase exports. The other services which are included in cluster 5 are also potentially competitive despite the higher workload and the COVID-19 pandemic. In particular, the development of an online tourism and the provision of educational online services can improve the prospects for the development of this cluster. The digitalization of this cluster will primarily promote development within the country. It is worth to mention that Ukrainian higher education institutions are included in international rankings and demonstrate the improvement of the quality of educational services through the accreditation of educational programs.

Basing on conducted analysis of current state recommendations can be elaborated for each cluster:

- Manufacturing (cluster 1): modernization and renovation of equipment, adoption of innovations, and redirection of production to goods with higher value added;
- Agriculture and trade (cluster 2): automation and optimization of working processes, information and communication technologies adoption;
- Construction (cluster 3): usage of modern equipment, tools and knowledge, improvement of government regulation of construction budgets, quality control of results;
- Cluster 4: adoption of international standards and practices, improvement of regulation, especially in export of services and creation of favorable conditions for development, development of human capital and science, creation of positive image of Ukrainian services;
- Cluster 5: digitalization of services, international cooperation for their sophistication, government support and creation of positive image.

But it is worth to mention that economy of Ukraine also requires systematic changes. The problem of insufficient innovations in the Ukrainian economy is structural and needs to be addressed at all levels. In the Global Innovation Ranking 2020 Ukraine ranked 45th out of 131 countries and 2nd out of 29 countries with countries with lower-middle level of income [15]. Experts note that Ukraine demonstrates a higher level of innovation results than the level of resources for innovations, but the quality of innovation results has deteriorated compared to 2018, although the quality of resources for innovation has improved during this period. Significant strengths of Ukraine are scientific and intellectual results, human capital, and creative results; in particular, Ukraine ranks first by number of utility models in the ranking.

However, significant weaknesses are the unstable political and economic situation, insufficient amount of accumulated capital, high energy intensity of GDP, low level of development of venture activity [15]. It is worth noting that in terms of exports of information and communication technologies, Ukraine ranks 9th in the ranking [15]. The deterioration of innovation results may be caused by low level of spending for research and development, as evidenced by the low percentage of R&D expenditures in GDP -0.5% in 2018 [17].

In addition, the efficiency of technology parks and business incubators in Ukraine is not sufficient to ensure the continuous development of innovation. The lack of links between universities and the economy contributes to the gap between the needs of the economy and the skills of graduates. Joint research and projects between university and business could stimulate both fundamental and applied research. Another important aspect is the improvement of the patenting procedure and the system of intellectual property protection.

As noted earlier, the unstable economic situation contributes to the deterioration of Ukraine's investment climate, which is reflected in a decrease in the volume of net foreign direct investment. In particular, in 2019 the volume of net foreign direct investments in the balance of payments of Ukraine reached -5.212 billion USD, compared with -4.460 billion USD in 2018 and -3.684 billion USD in 2017 [17]. To improve current situation, is necessary to stabilize the economic situation, improve the regulation of investment activities in Ukraine, ensure the development of venture business, create special economic zones.

Integration into global value chains will also facilitate the optimal allocation of resources within the economy and the implementation of international production standards. According to WITS, in 2018 Ukraine exported the most intermediate goods (44.68%) and imports consumer goods (42.11%) [1]. Accordingly, the development of modern and innovative industry is a necessary condition for the development of Ukraine's international competitiveness.

The problem of high labour-intensity is associated with outdated mechanistic management systems in enterprises and inefficient work processes. Such problems can be eliminated through the uniform adoption of information and communication technologies in various sectors of Ukraine. Modern and flexible organizational structures, additional training and retraining, flexible work schedules will contribute to more efficient work and decrease amount of time required to create added value.

To increase the volume of exports, government support of exporters is needed, as well as provision of information on export activities. Some services, such as financial and insurance, need to be brought up to international standards, as the volume of services provided is significant, but the share of their exports is small.

## Conclusions

Conducted research demonstrated that all clusters have different export potential. The highest export potential is demonstrated by clusters of services, especially financial, information and communication, professional, scientific and transport. Manufacturing demonstrates the lowest outpacing coefficients of output volumes and value added which are related to low level of innovative activity in Ukraine. Construction requires improvements in regulation in order to evaluate expenditures correctly. Overall, national economy of Ukraine requires facilitation and enhancement of innovation activity, what is main cause of exports of low value added goods. Low levels of innovative activities are also related to Another issue is low level of domestic and foreign investment activities, what can be improved by better regulation of venture activities. In future research analysis of investment activity and technological readiness levels of clusters and regions of Ukraine should be conducted.

## Список літератури:

1. Торговельна статистика WITS: за даними World Integrated Trade Solution. [Електронний ресурс] – Режим доступу: <https://wits.worldbank.org/>.
2. The Global Trade Competition: Challenge for Ukraine / A. Farion-Melnyk, L. Marushchak, O. Pavlykivska, N. Moskaliuk, M. Farion, T. Slipchenko // 2020 10th International Conference on Advanced Computer Information Technologies (ACIT), September 2020. – P. 549-554.
3. Onegina V. Outcome of capital investment on labor productivity in agriculture sector of Ukraine / V. Onegina, N. Megits, V. Antoshchenkova, O. Boblovskiy // Journal of Eastern European and Central Asian Research (JEECAR). – № 2020. –7. –V. 1. – P. 12-25.
4. Assessment of the development of foreign trade in high-tech production of Ukraine under the association with the EU / I. Matyushenko, S. Hlibko, M. M. Petrova, M. S. Pasmor, M. Loktionova // Business, Management and Education. – 2020. –№18. –V.1. – P.157-182.
5. Zhyhalo O.Yu. Circular model of interaction of enterprise innovation capacity and exports / O. Yu. Zhyhalo // Menedzhment ta pidpriemnytstvo v Ukraini: etapy stanovlennia ta problemy rozvytku. — Lviv : Lviv Politechnic Publishing House, 2020. – Vol 2. – No 1. – P. 46-58.
6. Oleksiv I.B. Export potential analysis of economic activities in Ukraine in the context of knowledge economy / I. B. Oleksiv, D. R. Mirzoieva // Economic journal Odessa polytechnic university. – 2020. – № 4 (14). – P. 70-75. [Електронний ресурс] – Режим доступу: <https://economics.opu.ua/ejoru/2020/No4/70.pdf>.
7. Кузьмін О.Є. Теоретичні та прикладні засади менеджменту / О. Є. Кузьмін, О. Г. Мельник. – Львів: Інтелект-Захід, 2007. – 384 с.
8. Статистика праці ILOSTAT: за даними Міжнародної організації праці. [Електронний ресурс]– Режим доступу: <https://ilostat.ilo.org/data/>.
9. Макроекономічна статистка України: за даними Державної Служби Статистики України. [Електронний ресурс] – Режим доступу: <http://www.ukrstat.gov.ua/>.
10. Thorndike R.L. Who belongs in the family? / R. L. Thorndike // Psychometrika. – 1953. – № 18. – V.4. – P. 267-276.
11. Murtagh F. Algorithms for hierarchical clustering: an overview / F. Murtagh, P. Conteras // Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery. – 2012. – Vol. 2. – № 1. – P. 86-97.
12. Бойчик І. М. Економіка підприємств: навчальний посібник / І. М. Бойчик, П. С. Харів, М. І. Хопчан. – Львів: Видавництво «СПОЛЮМ», 2000. – С.212.
13. Інфляційний звіт НБУ. Січень 2021 року: Національний банк України. [Електронний ресурс] – Режим доступу: <https://bank.gov.ua/ua/news/all/inflyatsiyniy-zvit-sichen-2021-roku>.
14. Машошина Т.В. Актуальні проблеми економічної діяльності підприємств будівельної галузі / Т. В. Машошина // Ефективна економіка. – 2014. – № 9. [Електронний ресурс] – Режим доступу: <http://www.economy.nayka.com.ua/?op=1&z=3343>.
15. Global Innovation Index 2020: Who Will Finance Innovation? Всесвітня організація інтелектуальної власності. [Електронний ресурс] – Режим доступу: [https://www.wipo.int/global\\_innovation\\_index/en/2020/](https://www.wipo.int/global_innovation_index/en/2020/).
16. Показники світового розвитку (World Development Indicators) за даними Світового банку. [Електронний ресурс] – Режим доступу: <https://databank.worldbank.org/source/world-development-indicators>.

## References:

1. Trade statistics WITS (2021). World Bank, World Integrated Trade Solution. Retrieved from <https://wits.worldbank.org/>.
2. Farion-Melnyk, A., Marushchak, L., Pavlykivska, O., Moskaliuk, N., Farion, M., and Slipchenko, T. (2020, September). The Global Trade Competition: Challenge for Ukraine. In 2020 10th International Conference on Advanced Computer Information Technologies (ACIT). IEEE.

3. Onegina, V., Megits, N., Antoshchenkova, V., and Boblovskiy, O. (2020). Outcome of capital investment on labor productivity in agriculture sector of Ukraine. *Journal of Eastern European and Central Asian Research (JEECAR)*, 7(1), 12-25.
4. Matyushenko, I., Hlibko, S., Petrova, M. M., Pasmor, M. S., and Loktionova, M. (2020). Assessment of the development of foreign trade in high-tech production of Ukraine under the association with the EU. *Business, Management and Education*, 18(1), 157-182.
5. Zhyhalo O.Yu. (2020). Circular model of interaction of enterprise innovation capacity and exports. *Menedzhment ta pidpriemnytstvo v Ukraini: etapy stanovlennia ta problemy rozvytku*, 2(1), 46-58.
6. Oleksiv I.B. and Mirzoieva D.R. (2020). Export potential analysis of economic activities in Ukraine in the context of knowledge economy. *Economic journal Odessa polytechnic university*, 4 (14), 70-75. Retrieved from <https://economics.opu.ua/ejopu/2020/No4/70.pdf>.
7. Kuzmin O.Ye. and Melnyk O. H. (2007) *Teoretychni ta prykladni zasady menedzhmentu*, Intel'ekt-Zakhid.
8. Labour Statistics (2021). ILOSTAT, International Labour Organization. Retrieved from <https://ilostat.ilo.org/>.
9. Macroeconomic data on Ukraine (2021). State Statistics Service of Ukraine. Retrieved from <http://www.ukrstat.gov.ua/>.
10. Thorndike, R.L. (1953). Who belongs in the family? *Psychometrika*, 18(4), 267-276.
11. Murtagh, F., & Contreras, P. (2012). Algorithms for hierarchical clustering: an overview. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, 2(1), 86-97.
12. Boichyk I.M., Khariv P.S., Khopchan M.I. (2000). *Ekonomika pidpryyemstv: navchal'nyy posibnyk*. Vydavnytstvo "SPOLOM".
13. Inflation report, January 2021 (January, 2021). National Bank of Ukraine. Retrieved from <https://bank.gov.ua/ua/news/all/inflyatsiyniy-zvit-sichen-2021-roku>.
14. Mashoshyna, T.V. (2014). Aktual'ni problemy ekonomichnoyi diyal'nosti pidpryyemstv budivel'noyi haluzi. *Efektivna ekonomika*, 9. Retrieved from <http://www.economy.nayka.com.ua/?op=1&z=3343>.
15. Global Innovation Index 2020: Who Will Finance Innovation? World Intellectual Property Organization. Retrieved from [https://www.wipo.int/global\\_innovation\\_index/en/2020/](https://www.wipo.int/global_innovation_index/en/2020/).
16. World Bank. (2020). World Development Indicators. World Bank. Retrieved from <https://databank.worldbank.org/source/world-development-indicators>.

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