EXPORT POTENTIAL ANALYSIS OF ECONOMIC ACTIVITIES IN UKRAINE IN THE CONTEXT OF KNOWLEDGE ECONOMY

АНАЛІЗ ЕКСПОРТНОГО ПОТЕНЦІАЛУ ВИДІВ ЕКОНОМІЧНОЇ ДІЯЛЬНОСІТ УКРАЇНИ В КОНТЕКСТІ ЕКОНОМІКИ ЗНАНЬ

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Олексів І.Б., Мірзоєва Д.Р. Аналіз експортного потенціалу видів економічної діяльності України в контексті економіки знань. Науково-методична стаття.

Метою даною статті є визначення експортного потенціалу видів економічної діяльності України в умовах розвитку економіки знань за допомогою проведення кластерного аналізу методом k-середніх та методом ієрархічного кластерного аналізу. Для цього було визначено три індикатори, які характеризуватимуть експортний потенціал видів економічної діяльності в умовах розвитку економіки знань: праценасиченість, частка доданої вартості у виробництві кожного виду та частку у загальному експорті України у 2019 році. У результаті проведення кластерного аналізу було виділено чотири кластери з різним експортним потенціалом та досліджено їхні відмінності. Для всіх кластерів були розроблені рекомендації щодо підвищення їх експортного потенціалу.

Ключові слова: економіка знань, праценасиченість, ВВП, відпрацьовані години

Oleksiv I.B., Mirzoieva D.R. Export potential analysis of economic activities in Ukraine in the context of knowledge economy. Scientific and methodical article.

The purpose of current article is to evaluate the export potential of economic activities of Ukraine in the conditions of development of the knowledge economy using the method of k-means cluster analysis and hierarchical clustering. To do this, three indicators were identified that will characterize the export potential of economic activities in the development of the knowledge economy: labor intensity, share of value added in the output of each activity and the share in total exports of Ukraine in 2019. As the result of the cluster analysis, four clusters with different export potential were identified and their differences were investigated. Recommendations for increasing their export potential were developed for all clusters.

Keywords: knowledge economy, labour intensity, GDP, working hours

Rapid development of information and communication technologies led to structural changes in global economy. In 2019 trade in services, which usually have high added value held 13,4% of world GDP [1]. Wide usage of modern innovative technologies stimulates reallocation of resources in national economies. Such tendencies are closely to establishment of knowledge economy, which focuses around domination of human capital and knowledge-based activities. According to European bank for reconstruction and development (EBRD) Ukraine is country with early developed knowledge economy, but highly developed human capital and efficient information and communication technologies (ICTs) adoption [2]. Moreover, export of ICTs in Ukraine during 2015-2019 significantly increased by 62,5% [3]. Export strategy of Ukraine developed in 2017 and oriented on improvements till 2023 includes road maps for development of following perspective activities: aircraft repair and maintenance, ICTs, creative industries (textile industry, services of program engineering, marketing services, arts, recreational services and other), manufacturing, specifically machine industry, food industry and process manufacturing [4]. At the same time in 2019 share of knowledge based activities was extremely low (fig.1).

Analysis of recent research

Export potential is widely discussed in scientific literature. Kaliuzhna N. H. investigates different approaches to define export potential. For instance, resource concept, potential as ability concept, potential as possibility concept and potential as socio-economic characteristic [5]. Finally author summarizes export potential as possibilities of country to create and realize volume of economic goods abroad, which is based on comparative advantages and are directed to maintenance of its robust international competiveness. Yatsenko O.M., Nevzgliad N.H., and Nevzgliad A.H. [6], Lapin O.V., and Horytska K.M. [7] Urba S.I. [8] investigate ways of development of export potential of agriculture and food industry. Zubrytskyi A. [9] investigates export basket of

Ukraine in 2007-2013 and underlines, that rapid transition to high-tech export is not possible in current conditions, so government should focus on elaboration of monetary and fiscal tools in order to stimulate development of different export groups. Dziubanovska N. employs cluster analysis in order to define the most perspective trade partners for Ukraine, but also considers only export commodity structure [10]. In conditions of knowledge economy development we consider export potential as combination of amount of human resources spent on production of good or service and value added in its output.
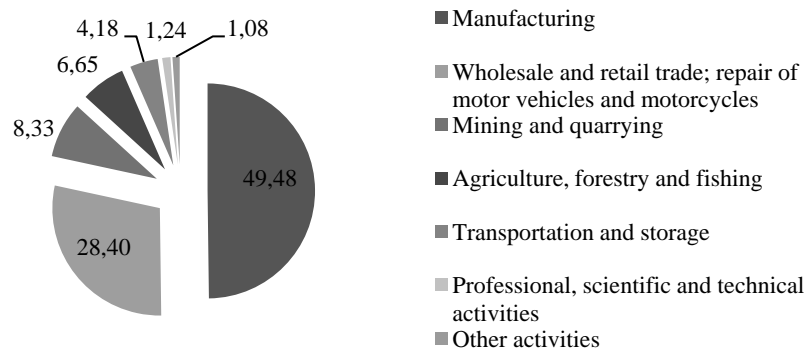

Figure 1. Structure of Ukrainian export in 2019
Source: compiled by autors on materials [3].

The aim of the article is to define which economic activities of Ukraine have higher export potential efficient in terms of knowledge economy. In order to achieve the aim, k-means and hierarchical cluster analysis are going to be employed. Basing on the results, recommendations on how current situation can be improved in terms of chosen indicators will be elaborated.

The main part

As the measures of export potential of economic activities of Ukraine classified by NACE 2010 we are going to consider 3 key indicators for clustering: labour intensity, share of value added in output and share in total export. Under labour intensity we understand amount of time required to produce 1 money unit of value added. In current research latest available data is used for 2019 period. Usage of working time is considered better alternative to usage of simply number of employed persons in economy, it does not take into account specifics and intensity of labour input in different economic activities [11]. This indicator was calculated basing on mean weekly working hours provided by ILOSTAT database [12] and value added distribution by economic activities from State Statistics database by formula (1).

$$Li = \frac{Hwi}{AVi},\tag{1}$$

L_i – labour intensity of economic activity, hours/UAH;
H_{wi} – mean working hours per employed person in i-economic activity of Ukraine, hours;
AVi – added value in i-economic activity of Ukraine, UAH [11].

A lower value of suggested indicator is, a more efficient is economic activity and vice versa. Added value accordingly to State Statistics Service of Ukraine is an additional value created in the process of production and is a difference between value of output and value of intermediate consumption. Additionally, mining and quarrying, manufacturing, electricity, gas, steam and air conditioning supply and water supply, sewerage, waste management and remediation activities were combines into manufacturing activity in accordance with representation of data on employment. Results of calculation are displayed in tab. 1.

Table 1. Key indicators for each economic activity of Ukraine in 2019

Economic activities	Numbers	Labour intensity, hours/UAH	Share of value added in output	Share in total export
1	2	3	4	5
Agriculture, forestry and fishing	1	0,016	0,412	0,067
Manufacturing	2	0,006	0,261	0,584
Construction	3	0,014	0,188	0,001
Wholesale and retail trade; repair of motor vehicles and motorcycles	4	0,015	0,498	0,284
Transportation and storage	5	0,008	0,455	0,042
Accommodation and food service activities	6	0,019	0,500	0,000

Continuation of Table 1

1	2	3	4	5
Information and communication	7	0,003	0,488	0,001
Financial and insurance activities	8	0,004	0,626	0,002
Real estate activities	9	0,002	0,710	0,001
Professional, scientific and technical activities	10	0,006	0,492	0,013
Administrative and support service activities	11	0,011	0,503	0,001
Public administration and defence; compulsory social security	12	0,007	0,755	0,001
Education	13	0,015	0,712	0,000
Human health and social work activities	14	0,021	0,517	0,000
Arts, entertainment and recreation	15	0,016	0,608	0,000
Other service activities	16	0,019	0,643	0,001

Source: compiled by autors on materials [3; 12].

Before performance of cluster analysis variables were scaled by their standard deviation. In order to determine optimal number of clusters we used Elbow method introduced for the first time by Robert L. Thorndike [13]. Suggested method involves calculation of explained variance for each number of clusters to the optimal number, after which adding more clusters does not change explained variance significantly. As the result, the optimal number of clusters for built for data sample is 4, as change of variance between 4 clusters and 5 clusters is only 3,7 % comparing to 11,7% change between 3 clusters and 4 clusters (fig.2).
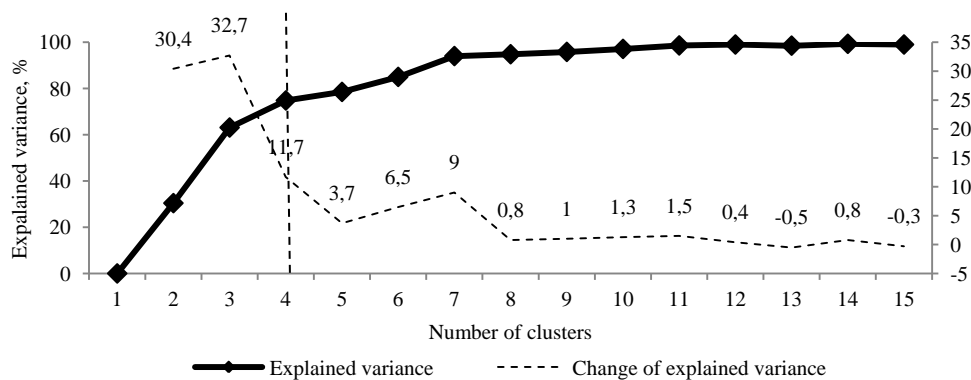

Figure 2 Elbow curve for investigated data sample
Source: authors' own development

Then we perform k-means clustering using J. Hartigan and M. Wong methodology [14]. Overall k-clustering aims to part observations in k-clusters minimizing sum of squares of distance between each observation and randomly chosen center of cluster it belongs to. Also we provide hierarchical clustering for better interpretation of results (fig.3).
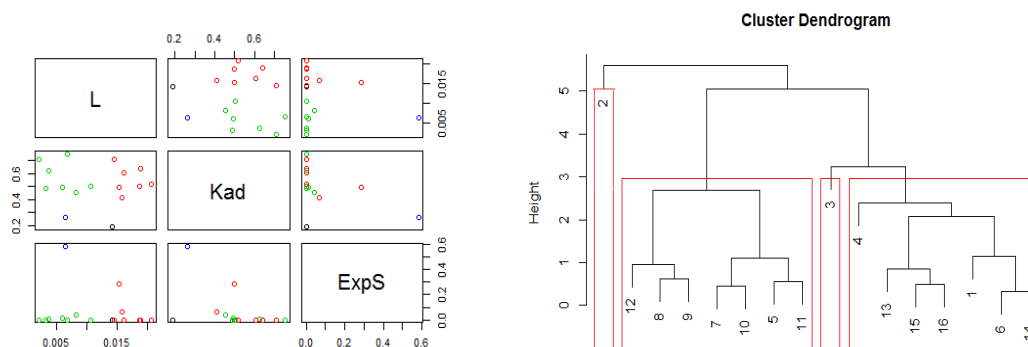
L – labour intensity; Kad – share of value added in output; ExpS – share in total export.

Figure 3. K-means clusters and hierarchical clustering dendrogram for economic activities in Ukraine
Source: authors' own development

Regarding the two indicators: labour intensity and share of value added in output, clusters are obviously defined. Relatively to export share clusters are mixed because of poor diversification of export: almost 85% of export consists of only 3 activities (fig.1). In order to define distinctions between received clusters we are going to calculate average values by each indicator and for each identified cluster (tab.2).

Table 2. Distinctions between defined clusters

Clusters	Average labour intensity	Average share of value added in output	Total share in total export, %
Cluster 1: Manufacturing	0,0064	0,261	58,4
Cluster 2: Transportation and storage, Information and communication, Financial and insurance activities, Real estate activities, Professional, scientific and technical activities, Administrative and support service activities, Public administration and defence; compulsory social security	0,006	0,575	6,1
Cluster 3: Construction	0,014	0,188	0,12
Cluster 4: Agriculture, forestry and fishing, Wholesale and retail trade; repair of motor vehicles and motorcycles, Accommodation and food service activities, Education, Human health and social work activities, Arts, entertainment and recreation, Other service activities	0,017	0,556	35,4

Source: authors' own development

Manufacturing stands as cluster 1 itself and is characterized by lower labour intensity, lowest share of value added, but high share in export, what makes it core economic activity in Ukraine with low export potential in knowledge economics. Cluster 2 includes services with the greatest export potential, as includes information and communication, financial and insurance, professional and scientific services and real estate activities as these economic activities demonstrate the lowest labour intensity and the highest value added among all clusters. Cluster 3 represent construction, which creates extremely low value added, which indicates low export potential in knowledge economy. Cluster 4 covers agriculture, trade and services with high labour intensity and high value added, what makes this cluster potentially competitiveness in knowledge economy.

To improve current export competiveness of economic activities in terms of transition to knowledge-based economy next steps should be implemented:

— In order to make manufacturing in Ukraine more competitive in terms of knowledge economy is essential to ensure research and development of goods with high value added;

— Cluster 2 represents activities with the highest export potential in knowledge economy, so in order to increase export share is advisable to standardize these services according to international standards and creative incentives for their further development;

— For construction modern technologies must be implemented in order to increase value added;

— For agriculture and other activities from cluster 4 two directions of improvement are relevant: optimization of processes by ICT adoption, which will lower labour intensity and R&D activities, which will increase value added.

Conclusions

Basing on results of current research, strategy of Ukrainian export will be improved and will facilitate transition to knowledge economy from development of information and communication, financial and insurance,

professional, research and scientific services and real estate activities as the highest export potential in knowledge economy. Also activities with high labour intensity will benefit greatly from ICTs adoption, which will optimize working process and number of working hours. Activities with low added value should be concerned with research and development and implementation of modern technologies, especially into development of new innovative products, for instance in manufacturing. Peculiarities of each economic activity in terms of export and optimal export structure should be investigated more profoundly in future research.

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