Definition of the Concept of "Competitiveness" and "Competitive Advantages" of Water Transport in the Conditions of Digital Transformation of Ukraine

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Abstract

One of the key points that determine the actuality of the study is that increasing the level of competitiveness of both individual business entities and sectors of the economy (task 8.2, SDG 8) is the basis for the sustainable economic development of Ukraine in the conditions of digitalization. Issues related to the definition of the competitiveness of water transport deserve special attention because water transport is a rather specific branch of the economy and provides the largest volume of international freight in the world. The authors of the article analyze modern approaches to the content of such categories as "competitiveness of water transport", "competitive advantages of water transport" and propose the author's definitions of these concepts taking into account the globalized processes of intellectualization of all types of economic activity, including transport. The results of the study suggest that in most cases, competitiveness can be defined as a complex indicator that covers a set of certain characteristics of the object under analysis, such as market share, productivity, and innovation capacity compared to an existing or imaginary benchmark. We propose to consider the competitiveness of water transport by separate types of water transport, each of which can be considered at one of four levels (international, sectoral, business entity level, and at the level of an individual transport service). This allows us to carefully examine the patterns of functioning and development in the face of rapid intellectualization processes of transport systems, identify gaps or inconsistencies with current global development trends at each level, and form an action algorithm for each of the four levels. Further research on competitiveness at the level of separate transport services, at business entities level, at sectoral and international levels, in general, can help to identify the competitive position of economic entities at the corresponding level and track changes in economic efficiency over time, will assess the competitiveness of water transport of Ukraine and develop recommendations for its integration into the European transport network. Such information is likely to be useful to CEOs, local governments, and public authorities in developing and implementing future policies to promote competitiveness increasing in the framework of Sustainable Development Goals for Ukraine, including tasks 8.2 (SDG 8) and task 9.1 (SDG 9).

Keywords

Competition, competitive advantages, approach, evolution, theories of competition

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1. Introduction

The results of the traditional competitiveness' theories evolution analysis suggest that those that have most influenced the development of economic thought, from our point of view, are: the theory of absolute advantages (A. Smith [1]); theory of comparative advantages (D. Ricardo [2]); theory of innovative development (J. Schumpeter [3]); theory of competitive advantages (M. Porter [4, 5, 6]); theory of disruptive innovations (C. Christensen [7]), theory of "blue ocean strategy" (W. Chan Kim [8]) and the theory of competitive advantages through collaboration (P. Gloor [9], A. MacCormac [10]).

Numerous scientific works of domestic and foreign authors are devoted to topical issues of sustainable economic development (B. Burkynskyi, N. Khumarova, M. Petrushenko, H. Shevchenko [11]), business development (O. Laiko, S. Kovalenko, O. Bilousov [12]), transport economics (P. Kelle, J. Song, M. Jin, H. Schneider, C. Claypool [13], S. Ilchenko, N. Khumarova, N. Maslii, M. Demianchuk, V. Skribans [14], S. Ilchenko [15], V. Gryshchenko and I. Gryshchenko [16], digitization of transport services (L. Ligonenko, A. Xripko, A. Domanskyj [17], M. Ustenko, A. Ruskyx [18], O. Gudz, S. Fedyunin, V. Shherbyna [19], M. Drashkovich, A. Dorokhov [20], V. Koval, G. Duginets, O. Plekhanova, A. Antonov, M. Petrova [21]) in the system of environmental and economic security (O. Dreval [22]). So, for example, I. Pereverzeva [23] notes that "to increase the competitiveness of transport enterprises…, in particular water transport, it is necessary to ensure the realization of the production potential of each enterprise and create a full-fledged transport infrastructure…". At the same time N. Fediai [24] notes that "in the road, maritime and aviation sectors, the Ukrainian transport system has a certain level of integration, while for inland water transport the integration process has not yet begun". It should be noted that N. Valiavska [25] emphasizes that "to increase competitiveness and unleash the potential of river transport, it is necessary to attract investment in its modernization and innovative development regularly". It is necessary to pay attention to the fact that «to most effectively disclose and use all the competitive advantages of inland water transport, and, accordingly, increase the volume of freight and passenger traffic by inland waterways, it is necessary, first of all, to have a clear action plan, to define specific strategic goals at the state level in the short and medium-term» [26]. Thus, "with this in mind, further research is needed to assess the impact of these factors on the functioning of the maritime complex of Ukraine, which positions itself as a maritime state, especially in the context of a comparative analysis of the competitiveness of Ukrainian water transport companies compared to major competitors in the world market." [27].

Most researchers theoretically describe competitiveness as a multidimensional relative concept and often associate it with market mechanisms. Domestic and foreign scientists often consider this concept at the level of separate goods and services, at business entities level, at sectoral and international levels very close to such concepts as ability, system, relative characteristics, opportunity, competitive advantage, result, and goal.

At the same time, further research is needed to analyze modern approaches to the content of the categories "competitiveness of water transport" and "competitive advantages of water transport".

Given the above, the article aims to offer our definitions of the concepts of "competitiveness of water transport", "competitive advantages of water transport", and the approach to their grouping in terms of the dissemination of the processes of intellectualization of transport operations and informatization of the transport community.

2. Results

Of particular note are the issues related to the definition of the competitiveness of water transport, as water transport is a rather specific sector of the economy and provides the largest volume of international freight in the world.

The analysis of domestic and foreign literature sources suggests that there is no definition of such concepts as "competitiveness of water transport" and "competitive advantages of water transport" in the scientific literature.

In our opinion, the competitiveness of water transport can be considered at such four levels as the international level, the sectoral level, the level of the business entities, and the level of individual products or services. (Figure 1).

Competitiveness of water transport at the international level can be defined as the ability of the national transport industry to provide an adequate level of satisfaction of national needs for transportation of goods and passengers by sea and inland waterways compared to competitors, to maintain and improve its position in the international globalized transport market, and to provide the high economic efficiency in compliance with environmental standards, current legislation, and international agreements.

The competitiveness of water transport at the sectoral level is the ability of water transport to provide services, price, and non-price characteristics that are more favorable for the customer than other types of transport.

TYPES OF WATER TRANSPORT	LEVELS OF COMPETITIVENESS	TYPES OF TRANSPORT						TYPES OF COMPETITIVENESS
		MT	IWT	AT	RWT	RT	PLT	
MT	INTERNATIONAL	+	+	+	+	+	+	
	SECTORAL	×	+	+	+	+	+	
	BUSINESS ENTITY	+	+	+	+	+	+	
	SERVICE	+	+	+	+	+	+	TSC, BEC, SCWT, ICWT
IWT	INTERNATIONAL	+	+	+	+	+	+	
	SECTORAL	+	×	+	+	+	+	
	BUSINESS ENTITY	+	+	+	+	+	+	
	SERVICE	+	+	+	+	+	+	

LEGEND:
MT – maritime transport; IWT – inland water transport; AT – air transport; RWT – railway transport; RT – road transport; PLT – pipeline transport; TSC – competitiveness of individual transport service; BEC – competitiveness of business entity; SCWT – sectoral competitiveness of water transport; ICWT – international competitiveness of water transport.

Figure 1: Levels of the definition of the concept of "competitiveness of water transport"

The competitiveness of water transport at the level of the business entity can be understood as its ability to provide a better offer than competitors in the market of transport services, in the segment of freight and passenger transport by sea and inland waterways, subject to environmental standards and current legislation.

Competitiveness of water transport at the level of individual products or services is the ability of the transport service to meet a certain need of the customer (consumers) in the transport services market better than similar services of other business entities in the segment of transportation of goods and passengers by sea and inland waterways.

Competitiveness of water transport can be characterized by a set of technical (dimensional and weight parameters, compliance with the purpose, and environmental standards); organizational (frequency of shipments, speed of delivery, timeliness of services, average delay of services, delay or acceleration of delivery of goods at the request of the customer, the ability to provide the customer, if necessary, additional services, the ability to redirect delivery, the ability to complete delivery in case unforeseen changes in the conditions of transportation of goods and/or passengers, storage of goods and safety of transportation); cost (level of tariffs and total cost of transportation, availability of a discount system, profitability) and other parameters that meet a certain need. Closely related to this category is the definition of "competitive advantages" (Figure 2).

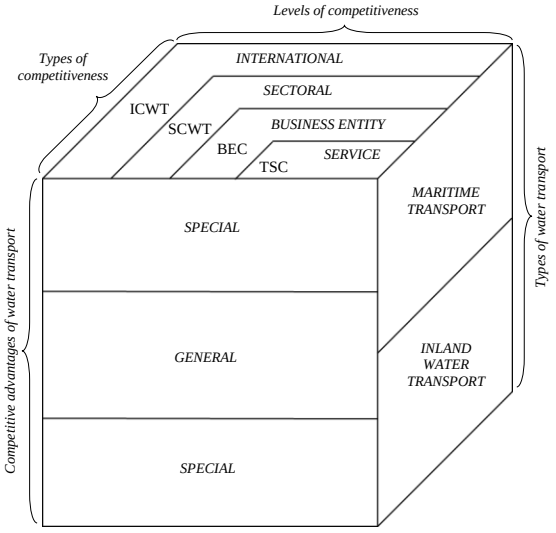

Figure 2: Grouping of competitive advantages of water transport

Competitive advantages of water transport are the unique combination of using the existing production capabilities of economic entities with their current reputation in the market, which contributes to the provision of competitive transport services to customers, allowing businesses to ensure their presence in the transport services market in the long-run perspective.

Among the general competitive advantages of water transport, which are inherent in both maritime and inland water transport, we can mention such as a rather high carrying capacity; relatively low cost of transporting a large number of goods and passengers over long distances; low tariffs for transportation of a large number of cargoes and passengers; higher environmental friendliness (compared to other types of transport); the lower level of accidents (compared to other types of transport); much lower share of investment needs (compared to other types of transport); the lower costs of ways maintenance (compared to other types of transport). Among the specific competitive advantages of internal water transport, it is necessary to underline, for example,

such a competitive advantage, as the simplicity of connection with maritime transport. At the same time, the specific competitive advantages of maritime transport include the possibility of transcontinental transportation of goods and passengers; waterways capacity is almost unlimited; dimensional restrictions of cargo are practically absent; high mobility; practically unlimited scope.

Competitive advantages are the main factors in ensuring the competitiveness of business entities. In the fierce competition for consumer loyalty, these factors change depending on the processes taking place in sectors of the economy, separate segments of the transport services market, etc.

It should be noted that drivers of competitiveness of business entities in the field of water transport may have the appropriate classification features, which are usually based on: a high level of training and qualification of personnel; talented management and professional marketing; proper innovation, technical and organizational levels of transport services; sufficient economic and financial support for the functioning of economic entities in the field of water transport, compliance with international agreements in its activities and, in case of legal conflicts, ensuring the compatibility of digital interaction of transport operations, and access to information resources of the transport process participants, etc.

The impact of digitalization on the competitiveness of inland waterways transport can be seen in the example of Germany, which has a strong economy, a high level of digitalization, and developed water transport.

After systematizing the data [28; 29] obtained as a result of studying the dynamics of changes in the volume of goods transported by inland water transport in Germany, its Digital Competitiveness Ranking and their analysis, we were able to build the dependence model of changes in the volume of goods transported by inland water transport in Germany (Y, million tons) on the Digital Competitiveness Ranking (X, points), and record it mathematically (Figure 3).

We have established that for Germany the dependence of changes in the volume of goods transported by inland water transport in Germany on the Digital Competitiveness Ranking may be as follows (Figure 4):

$$Y = 315602.6 - 6012.688\ X \qquad (1)$$

We investigated the bond density between changes in the volume of goods transported by inland water transport in Germany and the Digital Competitiveness Ranking that affect it. To check the quality of the built model we calculated the key indicators, and conducted some special tests.

```
                                          Number of obs     =          7
                                          F(1, 5)           =       7.45
                                          Prob > F          =     0.0413
                                          R-squared         =     0.5139
                                          Root MSE          =     8840.8
------------------------------------------------------------------------------
             |               Robust
           Y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           X |  -6012.688   2203.108    -2.73   0.041    -11675.96   -349.4191
       _cons |   315602.6   33964.27     9.29   0.000     228294.7    402910.6
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Figure 3: Determining the dependence of changes in the volume of goods transported by inland water transport on Digital Competitiveness Ranking in Germany

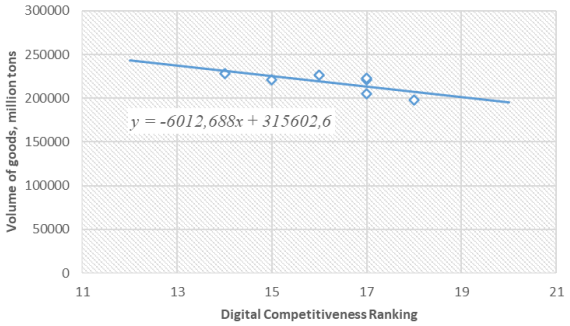

Figure 4: Digital Competitiveness Ranking and changes in the volume of goods transported by inland water transport in Germany

First of all, the coefficient of determination, R^2, which is a measure of bond density, was determined. The closer R^2 is to 1, the tighter the relationship between the features. $R^2 = 0.5139$. The bond density is noticeable.

An empirical correlation, R in our case, shows which part of Y is related to influencing factors (coincides with the correlation index). The closer this figure is to one, the closer the relationship between the signs. R = 0.7168 - bond density is high.

Fisher's criterion (F-criterion) of our model is equal to 7.45 > 6.61. The actual F-criterion must be greater than the theoretical F_T-criterion (with a probability of 0.95 and $k_1=1$ та $k_2=5$ F_T =6.61).

Next, we calculate the p-value of the model. The smaller p-value, the more significant the expected value of the result. In our case, this indicator is equal to $0.0413 \leq 0{,}05$ – the relationship density is statistically significant.

The model specification was checked by "Linktest" for the absence of a model

specification error. According to the results of the calculations, p_{hatsq} = 0.229> 0.05 – the specification of the model is correct.

To test the model for the heterogeneity of observations, which is expressed in the unequal variance of the random error of the regression model, we performed the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity. According to the results of the calculations p_{chi2} = 0.3408 > 0.05 – heteroskedasticity is absent.

Verification of the model for the presence of a linear relationship between the explanatory variables (multicollinearity) was performed using the calculation of variance inflation factor (VIF). According to the results of calculations Mean VIF = 1.0 < 10; VIF_X = 1.0 < 10 ($1/VIF_X$ = 1.0 > 0.1) – multicollinearity is absent.

The procedure for checking the autocorrelation of an arbitrary order in random errors of the regression model was performed using the Cumby-Huizinga test for autocorrelation (Breusch-Godfrey). According to the results of the calculations p_1 = 0,1063 > 0.05 – autocorrelation is absent.

To test the null hypothesis that the data of the analyzed time series are stationary around the deterministic trend against the single root alternative, a stationarity test (Kwiatkowski–Phillips–Schmidt–Shin test) was performed. According to the results of the calculations: 0.183 = TS_Y < $CV_{Y1\%}$ = 0.216; 0.199 = TS_X < $CV_{X1\%}$ = 0.216 – the data of the time series under analysis are stationary.

The results of the analysis of the relationship density between the changes in the volume of goods transported by inland water transport in Germany, and the Digital Competitiveness Ranking show that the regression model is qualitative.

A completely different situation is typical for Ukraine in this area. According to our calculations, the dependence of changes in the volume of goods transported by inland water transport in Ukraine on the Digital Competitiveness Ranking may be as follows (Figure 5 and Figure 6):

$$Y = -839.6871+75.58187\ X, \qquad (2)$$

where: Y – changes in the volume of goods transported by inland water transport in Ukraine, million tons; X – Digital Competitiveness Ranking, points.

Due to the low bond density between the variables proves the results of the calculation of such indicators as the coefficient of determination, R^2 = 0.4520; an empirical correlation, R = 0.6720.

The statistical significance of the dependence of changes in the volume of goods transported by inland water transport in Ukraine on the Digital Competitiveness Ranking can be questioned. This is evidenced by the results of the calculation of such indicators as Fisher's criterion (F-criterion = 5,89 < F_T = 5,99), the p-value of the model (p-value = 0,0513 ≥ 0,05) and Root Mean Square Error (Root MSE) characterizes how densely the data is concentrated around the regression line – the standard deviation of the balances, forecast errors. Root MSE = 314,18 (Root MSE → 0).

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                                Number of obs     =         8
                                F(1, 6)           =      5.89
                                Prob > F          =    0.0513
                                R-squared         =    0.4520
                                Root MSE          =    314.18
------------------------------------------------------------------------------
             |               Robust
           Y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           X |   75.58187   31.1304     2.43   0.051    -.5914733    151.7552
       _cons |  -839.6871   1794.661    -0.47   0.656    -5231.063    3551.689
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Figure 5: Determining the dependence of changes in the volume of goods transported by inland water transport on Digital Competitiveness Ranking in Ukraine

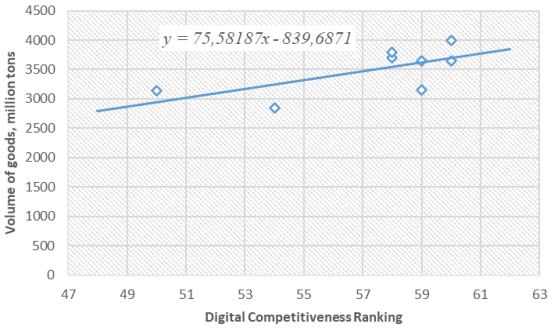

Figure 6: Digital Competitiveness Ranking and changes in the volume of goods transported by inland water transport in Ukraine

This situation may be due to the weak competitive position of Ukraine's inland waterway transport and the destructive impact of economic threats and dangers, which can be considered in many areas, such as financial and economic, technological, environmental, socio-economic, and geopolitical. From this point of view, the main factors of destructive impact on the digitalization of inland water transport in Ukraine include elements, such as: socio-economic and political instability; sharp fluctuations in energy prices; the criminalization of the economy; shadow economy; fiscal crisis; uncontrolled

inflation; unemployment; interstate conflicts; forced migration; failure of critical infrastructure; failures in the public administration system, etc.

Digitalization will increase the competitiveness of inland water transport of Ukraine by creating an intelligent infrastructure (adaptive traffic management provides timely real-time information to all users of inland waterway transport and its infrastructure; ensuring continuous and smooth traffic on waterways; complete equipping of inland waterways with fast mobile broadband coverage; constant monitoring and diagnostics of the condition of infrastructure and fleet facilities), using a smart fleet (innovative ships can interact effectively with intelligent infrastructure and ports. This connectivity will allow you to process large amounts of data. Such interaction will gradually and safely increase the autonomy of the fleet and the level of automation of inland waterway transport services. Digitization processes increase the productivity of inland water transport, energy efficiency, and safety), developing multimodal connections (digitization allows inland water transport to operate without the use of paper documents. Such paperless provides interoperability between different modes of transportation on a one-stop-shop basis, making transporting goods and passengers by inland waterway easy to use in multimodal operations, integrating the fleet and infrastructure into interconnected logistics systems).

That is, for the sake of their development, transport companies must move forward by intellectualizing their work, which will give them additional competitive advantages and increase the overall level of competitiveness by providing added value to services; establishing a high level of communication with customers and target audience; improving the image of your company through fast communication with customers; increasing customer loyalty to the company; transparency of internal and external production and communication processes; price reduction through process automation and digitization of business processes, etc. [17].

Agreeing with the results of M. Porter's research, we can identify four main levels of competitive advantages of the business entity in the field of water transport. The first level of competitive advantage is based on the availability of raw materials, labor costs, the scale of services. The second level is characterized by the investment attractiveness of the business entity, its image, business reputation, and the establishment of effective relationships with suppliers and consumers, etc. The third level is determined by the training and qualifications of the staff, scientific and technical potential, the degree of informatization, the ability to ensure cybersecurity, the availability of their own licenses and patents. The fourth level is based on the effectiveness of the management and marketing system, their ability to respond quickly to changes in the business environment and ensure their own economic security, etc.

In our opinion, we should add to the presented four levels the fifth critical level, which takes into account the state and prospects of digitalization in transport processes and communication between its participants, creating an information environment and infrastructure that supports information processes, and information technologies, which determine how to implement these processes.

3. Conclusions

The results of the study suggest that in most cases, competitiveness can be defined as a complex indicator that covers a set of certain characteristics of the object under analysis, such as market share, productivity, and innovation capacity compared to an existing or imaginary benchmark.

We propose to consider the competitiveness of water transport by separate types of water transport, each of which can be considered at one of four levels (international, sectoral, business entity level, and at the level of separate transport services). At each of these levels, the competitiveness of water transport can be compared to the competitiveness of other facilities at the same level. For example, the competitiveness of maritime transport at the international level can be compared with the competitiveness of both maritime transports of other countries and with the competitiveness of other types of transport of foreign countries. At the sectoral level, the competitiveness of maritime transport can be compared with the competitiveness of other types of transport in Ukraine, etc. It should be noted that the competitiveness of transport services is a unique central element of the competitiveness of water transport at all other levels. That is, the competitiveness of an entity in the field of water transport is based on the competitiveness of transport services that it can provide to its

customers and, in turn, is the basis for the competitiveness of water transport at the industry and international levels.

Further research on competitiveness at the level of separate transport services, at business entities level, at sectoral and international levels, in general, can help to identify the competitive position of economic entities at the corresponding level and track changes in economic efficiency over time, will assess the competitiveness of water transport of Ukraine and develop recommendations for its integration into the European transport network. Such information is likely to be useful to CEOs, local governments, and public authorities in developing and implementing future policies to promote competitiveness increasing in the framework of Sustainable Development Goals for Ukraine, including tasks 8.2 (SDG 8) and task 9.1 (SDG 9).

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