“Economic development management in a water-capacious economy”

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ECONOMIC DEVELOPMENT MANAGEMENT IN A WATER-CAPACIOUS ECONOMY

Abstract

The world tendencies of spatial development, namely the availability of limited resources (primarily water) and the growth of the world's food needs focus on the resource specialization of the region. On this basis, the purpose of the article is to study the impact of the water-capacious economy on the economic development of the country and its regions. The study used the traditional and special methods, including: historical and logical method – to analyze the functioning of regional socio-economic systems under limited water resources; and system analysis methods – to evaluate the impact of the water-capacious economy on the economic development of the country and its regions. The research results have important implications for the management of the territories. The authors show that the production specialization of the regions of Ukraine on the export/import of water-capacious products is not determined by their water supply. They also suggest that stimulating the region's water-efficient activity should lead to a minimization of the water capacity of gross regional product and the reproduction of water capital, taking into account the water security of the regions. The authors also show that the water resources of the country and its regions and the natural water potential of the territories in the current situation become significant restriction to the economic development of territories, which allows to state the need to change the approaches to the regulation of regional development based on limited water resources.

Keywords region, water resources, water-capacious economy, water security, virtual water

JEL Classification P11, P25, Q56, Q57, G18

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INTRODUCTION

In recent years, food security, energy security and access to natural resources have been widely discussed in the world. In this regard, scientists recognize that the environment and security are interconnected. For example, in relation to water resources, the deficit of fresh water creates a dangerous situation and fraught with potential conflicts, which poses a threat to the national security of the country.

The problem of access to clean fresh water all over the world forces scientists to look at water not just as a resource, but as a factor affecting the global economy and the risk factor. With the growing water scarcity in a number of countries, a number of strategies have emerged recently to overcome the problem, as well as the notable concepts of "virtual water" and "water footprint". In 1993, the American scientist John Allan developed the concept of Virtual water, according to which, Virtual water is the term for calculating the amount of water needed to produce a product (Allan, 1998). Justification of the concept of virtual water in a convenient way represents the indirect consumption of water by human being. The economic dimension of this discovery is that John Allan has proposed countries where water is a scarce resource,

a mathematical formula for political water savings. Introduction of the concept of virtual water has allowed a new look at the issues of world trade policy, food production, research on problems associated with water shortages, efficient water use and water policy. The amount of virtual water can be calculated not only for individual products, but also for the person, enterprise, region and country as a whole.

Over time, in 2002, Arjen Y. Hoekstra, a Professor at the University of Twente in the Netherlands, offered the concept of Water footprint. According to the theory, the water footprint shows the total consumption of water by the region spent on the production of various goods or services, including virtual water. The use of the water footprint concept is due to the fact that not all goods are consumed and produced in one country.

The above facts make it possible to state the necessity of changing the approaches to regional development regulation, taking into account the limited water resources. The active development of various types of economic activity in the territorial aspect requires careful decisions regarding water capacity and water consumption under limited water resources.

1. LITERATURE REVIEW

Among Ukrainian researchers who are developing virtual water issues, the following scientists from the Institute of Natural Resources and Sustainable Development of the National Academy of Sciences of Ukraine can be mentioned: Khvesik, Levkovska, and Sunduk (2015), Melnyk, Matsenko, and Khyzhnyak (2011). Yakymchuk and Skrypchuk are also dealing with this issue.

By the definition of Khvesik and Sunduk (2016), being kept in the product and its value, the water moves through the chain from the place of production to the final consumer. In a global economy, the distances that goods overcome are thousands of kilometers. Given the trade turnover between countries and continents, trade performance is very high. No less significant are the volumes of water constituents, as well as their monetary expression. Export-import operations are the basis of the formation of virtual water flows.

Ukraine, according to the calculations of scientists of the Institute of Economics of Natural Resources and Sustainable Development of the National Academy of Sciences of Ukraine, forms large volumes of virtual water. The overall figure for virtual water exports is 19.5 billion m^3, it is a significant excess of water use in the country as a whole (Figure 1). The rate of import of virtual water is limited to 1.84 billion m^3 and is no longer so high (Khvesik, Levkovska, & Sunduk, 2015).

Source: According to the data of the Institute of Economics of Natural Resources and Sustainable Development of the National Academy of Sciences of Ukraine (as of January 1, 2013), Khvesik, Levkovska, and Sunduk (2015).

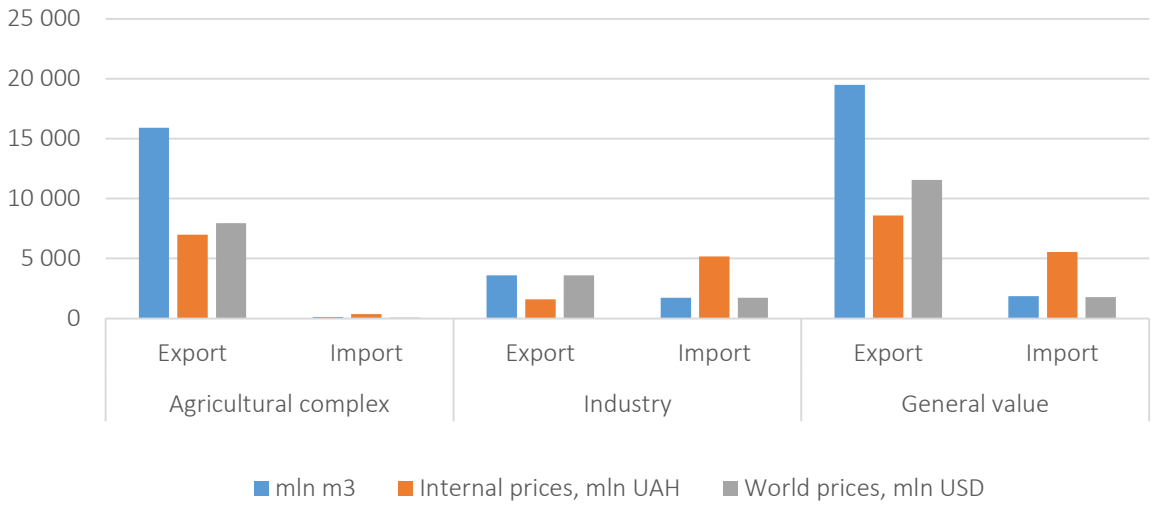

Figure 1. Export-import of virtual water and its characteristic for Ukraine

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Figure 1 demonstrates the predominance of virtual water exports in Ukraine over imports. 81.5% of this export is attributable to the agroindustrial complex, and only 18.5% belongs to the industry. Thus, Ukraine, supplies abroad with grain thereby fetching significant volumes of virtual water, which is not so much in imported goods. It should be noted that the main load on virtual water falls predominantly in the south-eastern regions of Ukraine (according to the Institute of Economics of Natural Resources and Sustainable Development of the National Academy of Sciences of Ukraine) (Khvesik, Levkovska, & Sunduk, 2015).

In 2017, researchers from the University of Leiden (the Netherlands) stated that Ukraine is the world's largest food exporter, sharing this place with countries such as the USA, Australia and Russia. But the main importers of food products are Western Europe, Asia and Africa and the Middle East (Bacon, 2017).

A group of scientists, Sang-Hyun Lee (USA), Rabi H. Mohtar (USA), Jin-Yong Choi (Korea) and Seung-Hwan Yoo (Korea) (Lee et al., 2016) stated that Ukraine plays a major role in ensuring the functioning of the world's virtual water market and included it in a group of influential countries. A top ten group of influential countries includes Argentina, Brazil, Canada, France, Pakistan, Paraguay, Russia, Thailand, Ukraine, and USA. According to their calculations, for export of grain crops in Ukraine, 19.4% of virtual water is used from the total water potential of the country, that is, the average annual resources of the river flow. Argentina (32.9%) and Pakistan (25.1%) are slightly more important. All other countries in their virtual water flow for grain exports use much less of their water potential: Brazil (1.7%), Canada (1.0%), France (8.0%), Paraguay (11.0%), Russia (0.8%), Thailand (12.6%), the United States (6.3%).

Ukraine is not a country with rich water potential, it is the poorest country in water resources among European states (52.4 km^3/year of average annual resources of river flow). The same can be said for Pakistan, which owns 55 km^3/year of average annual resources of river flow.

The same opinion is shared by researchers from the Institute of Natural Resources and Sustainable Development of the National Academy of Sciences of Ukraine, who claim that Ukraine is currently among the three world grain exporters (after the USA) and ranks high in the export of metallurgical products.

Water is usually not transported directly over long distances. Despite the fact that some cases of direct export of water are already fixed, there is neither the world market nor the standard global price of water. Instead, international trade in water-capacious goods, the so-called virtual water market, already exists (Oki et al., 2017; Wichelns, 2010; World Water Council, 2015; Perelet, 2010). As a rule, it is considered that trade in "real water" between territories with moisture is impossible due to long distances and associated costs, as well as because water as a production resource is required to a large extent (Oki et al., 2017). International water trade through the construction of canals and the redistribution of river flows is very limited due to huge capital expenditure.

The world community is also extremely concerned about the problems of export-import of virtual water. The Food and Agriculture Organization of the United Nations (FAO, 2017), the World Water Institute (SIWI, 2017), the Institute of World Resources (WRI, 2017) and many European researchers deal with these issues. The quote of Ismail Serageldin, the Vice President of the World Bank (1992–2000), becomes very relevant (1995): "The wars of the 21st century will be on water…" (Dinar, 2007).

Imports of virtual water in the form of agricultural products, which account for up to 70-90% of water consumption, can be a good means of reducing domestic demand for water and mitigating the domestic water deficit for arid countries. At the same time, there are many factors that are significantly more important ones in water supply, affecting the flows of trade in water-capacious products.

Thus, the question arises as to how water availability determines the specialization of the region on the export or import of water-capacious products in the real practice of international trade.

A study conducted in 2003 by Yang and his coauthors (Yang et al., 2003), who analyzed data for countries in Africa and Asia, proves that for most countries, the degree of water availability is not a significant factor affecting international trade. However, after reaching a certain threshold for a shortage of water, the country begins to demand the import of cereals, which exponentially grows as water resources diminish. Later, researchers conclude that reducing water availability is an important factor in the growth of net virtual water imports by countries in the region (Yang et al., 2007). Yang's and his co-authors research allows us to trace the dynamics of the relationship between water resources supply and its trade specialization.

Levidov et al. (2016) confirm that eco-innovations will have an economic advantage in the future. They point out that some companies have reduced the consumption of resources in production by investing in eco-innovation, aimed at reducing energy consumption, utilizing components, and so on. Thus, the authors also confirm that there is a relationship between resources supply of the countries and their trade specialization (Levidow et al., 2016).

According to Muhanji, Ojah, and Soumaré (2019), many literary sources related to natural resources now describe the phenomenon of "natural resource curse", which manifests itself predominantly in developing countries and which is characterized by weak economic institutions and dependence on the main export goods. The expression "natural resource curse" was introduced by Auty (1994), which means that African rich resource countries are ineffective, while their colleagues are flourishing. Melina et al. (2014) also confirm that resource curse results from instability of commodity prices and unsuccessful management of economic debt and public investment. For a contrasting outcome with supportive evidence, Muhanji, Ojah, and Soumaré (2019) note that resource-rich advanced countries such as Canada and Norway historically report a good economic performance alongside an attendant enviable welfare status.

Also, scientists in their studies point to the close connection of the natural resource with natural capital and human capital (Bretschger & Vinogradova, 2018).

The complex of problems related to water resources management is multifaceted. Wehn and Montalvo (2018) distinguish the following interconnected factors in water management: social problems, technological problems, economic, environmental and political challenges. Important among the economic ones are such as ecosystem services, energy supply, aging infrastructure, virtual water, water footprint, adaptation to climate. Important among the ecological factors are: the risk of oil products, persistent drought, groundwater depletion, agricultural productivity and climate resilience, pollution of ecosystems, waste management. Important attention should be paid to political factors (Weerdmeester et al., 2017), which can include water stress, communal patterns of ownership, cooperation with watersheds, systemic vulnerability, and the right to water. In most developing countries, there is a lack of a solid knowledge base to address these challenges and to improve the water management system through changes and innovations.

There is a need to distinguish between different types of water, different water users and different (re) water use, value of water and value in water (Weerdmeester et al., 2017).

The need for water eco-innovation is becoming more and more relevant, which requires significant amounts of funding. Financial resources can be obtained both through private investors and various funds, including the "Horizon 2020" program (which provides funding for research on innovation), various structural funds, LIFE 2014–2020 (in which funds are allocated for environmental and climate research), as well as grants for individual researchers (Wehn & Montalvo, 2018).

It should be noted that the water supply sector is highly capital-intensive, and the return on investment in water projects is very long. At the same time, this sector demonstrates a low level of innovation with a relatively high cost of research and development. Such characteristics

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are those of infrastructure sectors, including the water sector, which lacks innovation dynamism (Moro et al., 2018).

Consequently, in the economic development of countries, the question is whether the water resources of the country and its regions and the natural water potential of these territories in the present situation become significant deterrent to the economic development of the territories.

2. THE PURPOSE

The purpose of the article is to study the impact of the water-capacious economy on the economic development of the country and its regions.

3. RESULTS

The largest consumers are energy, metallurgical, chemical and petrochemical industries among the economic sectors of Ukraine, which simultaneously belong to the main polluting industries in the industrial sector of the economy.

Dnipropetrovsk, Zaporizhzhia, Donetsk, Kherson and Kyiv regions (Table 1) belong to the top five water users in Ukraine (according to the State Agency of Water Resources and the State Committee of Statistics of Ukraine). This confirms the opinion that they are the main exporters of virtual water. The industrial needs of these five regions account for almost 63.3% of the total use of fresh water by region (Fedulova, 2016).

Thus, the conducted theoretical analysis of functioning of regional social and economic systems in the modern conditions allows us to ascertain the necessity of changing the approach to the regulation of regional development on the basis of considering the limited water resources and effective regional water use.

According to the data of European organizations of the Food and Agriculture Organization of the United Nations (FAO, 2017), The World Water Council, AQUASTAT data (World Water Council, 2016) and the World Bank (2015, 2016, 2017), the so-called "influential countries", the world's major exporters of cereals, have a much lower average of the water capacity of gross domestic product (GDP) indicator than Ukraine. It was examined what income the regions of Ukraine produce for each consumption of m^3 of water based on national statistical data, that is, what is the water return and the water capacity of the region (Table 2).

Table 3 shows the distribution of freshwater use in 2017, according to needs and regions. It is clear from the data that typical industrial regions include Dnipropetrovsk region (76.3% of the total consumed region of water), Donetsk (87.3%), Zaporizhzhia (85.1%), Kyiv (85.3%) and the city of Kyiv (68.8%), while Kherson region (94.3% of the total water consumption area) belongs to agrarian regions.

Table 1. Use of fresh water by regions of Ukraine, including freshwater and seawater, million m^3

Source: Created according to the State Statistics Service of Ukraine (2013–2017).

Years	Ukraine	Dnipropetrovsk	Donetsk	Zaporizhzhia	Kyiv	Kherson
1990	30,201	3,599	3,419	4,598	2,131	2,161
1995	20,338	2,752	2,548	2,635	1,496	1,131
2000	12,991	1,756	1,751	1,702	1,132	639
2005	10,188	1,579	1,508	1,076	812	610
2010	9,817	1,361	1,467	1,099	902	770
2011	10,086	1,407	1,479	944	925	963
2012	10,507	1,429	1,445	1,186	1,028	1,083
2013	10,092	1,349	1,354	1,237	866	1,074
2014	8,710	1,359	1,135	1,146	808	1,062
2015	7,125	881	936	1,150	706	1,037
2016	7,169	1,055	926	1,081	664	990
2017	6,853	802	912	1,226	307	1,276

Table 2. Specific weight of water use according to directions in 2017, %

Source: Created according to the State Statistics Service of Ukraine (2017).

Region	Water for needs		
	Drinking and sanitary hygiene	Production	Regular irrigation
Dnipropetrovsk	19.7	76.3	2.9
Donetsk	11.0	87.3	0.5
Zaporizhzhia	5.3	85.1	9.2
Kyiv	13.4	85.3	1.0
Kherson	3.1	2.4	94.3
The city of Kyiv	31.2	68.8	0.0

The water return of the gross regional product (GRP) was calculated by dividing the GRP by the volume of fresh water used. Also, the water content of the region was calculated, which is a reversed indicator for water efficiency (Table 3).

Table 3. Water capacity and water return of GRP in 2017

Source: Author's calculations.

Region	Water return	Water capacity
	UAH per 1 m^3	ths. m^3 per 1 UAH
Vinnutsia	943.13	1.06
Volyn	896.07	1.12
Dnipropetrovsk	391.31	2.56
Donetsk	182.46	5.48
Zhytomyr	917.46	1.09
Transcarpathian	1,956.50	0.51
Zaporizhzhia	106.34	9.40
Ivano-Frankivsk	851.33	1.17
Kyiv	511.54	1.95
Kirovohrad	982.06	1.02
Luhansk	605.70	1.65
Lviv	1,198.41	0.83
Mykolaiv	389.72	2.57
Odesa	600.52	1.67
Poltava	1,640.26	0.61
Rivne	498.33	2.01
Sumy	883.28	1.13
Ternopil	1,101.27	0.91
Kharkiv	888.41	1.13
Kherson	37.51	26.66
Khmelnytskyi	819.00	1.22
Cherkasy	511.72	1.95
Chernivtsi	571.82	1.75
Chernihiv	609.38	1.64
The city of Kyiv	1,426.91	0.70

It is clear from the calculations that the regions, which are the largest consumers of water, bring significantly less income from 1 m^3 of water than other regions engaged in other economic activities.

The Kherson region, which consumes water in the same volume as the industrial regions, almost does not bring income on consumed water. Compared to Dnipropetrovsk oblast, which brings UAH 391.31 of income per 1 m^3 of water consumption and Donetsk (182.46 UAH/m^3), Kherson brings only 37.51 UAH/m^3. The biggest income per unit of water resource comes from the Transcarpathian region (Fedulova et al., 2018). At low water consumption, water return is the largest amounting to 1,956.5 UAH/m^3. The city of Kyiv also has a great water return, though it also consumes a lot of water which is equal to 1,426.91 UAH/m^3 (Figure 2).

The water capacity of the region is a reversed indicator of water return. But it is very eloquent. It is clear from Figure 3 that the Kherson region is one region in Ukraine, which has a very high water capacity in comparison with others. In order to earn in the agricultural sector (and almost all the consumed water is used in the region for irrigation – 94.3% (Table 2)), 26.66 thousand m^3 of water shall be spent for UAH 1 of income (Figure 3).

There is no region in Ukraine that would spend so much water resources and so little income for 1 m^3 of consumed resource. It is quite a confusing situation in the modern agrarian vector of Ukraine. And will there be enough water resources in Ukraine for productive activities and domestic consumption, and what will be the income compared with alternative productions?

The Kherson region is one of all regions in Ukraine, which drops only 7.14% of used water (Figure 4). Most areas dispose consumed water in the amount of 90-75% in average from the supplied.

That is, the water used for irrigation is used irreversibly. If from industrial production waste water resources are purified and are disposed for subsequent use cycles, the water which goes to irrigation goes irrevocably. Rather low return of water resources in the Mykolaiv region (44.77%). It is believed that it is due to irrigation. Only water consumption in the Mykolaiv region is about 2.5% of the total in Ukraine.

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Source: Author's calculations.

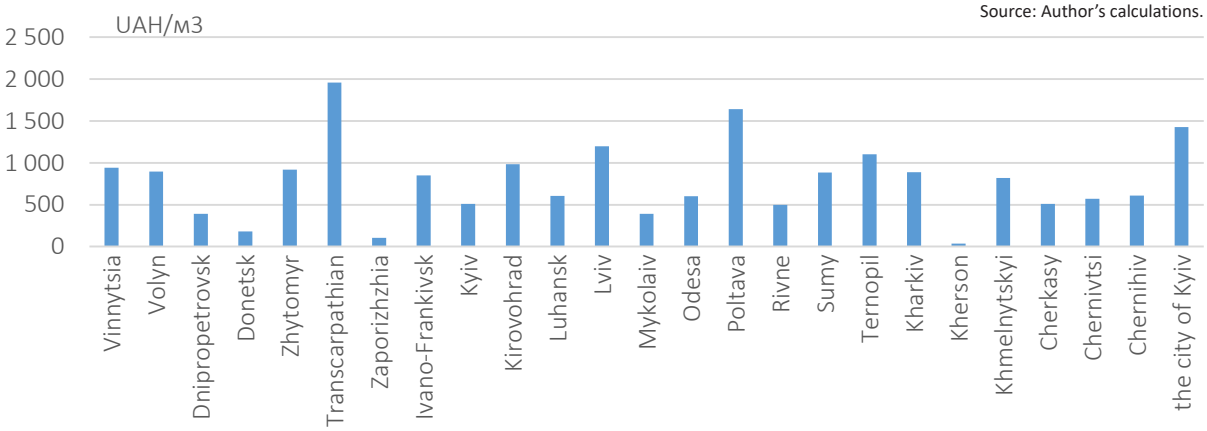

Figure 2. Water return of GRP in 2017, UAH per 1 m³

Source: Author's calculations.

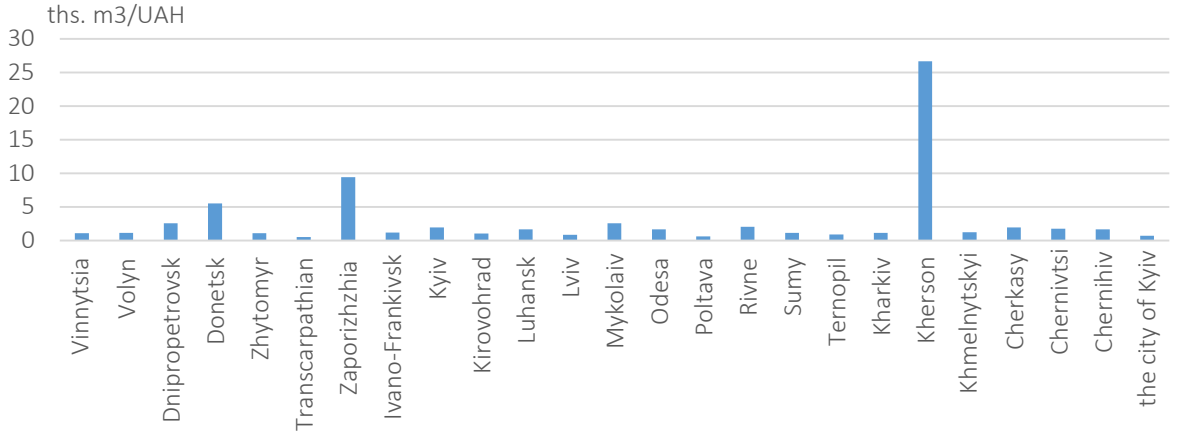

Figure 3. Water capacity of GRP in 2017, ths. m³ per 1 UAH

Source: Created according to the State Statistics Service of Ukraine (2017).

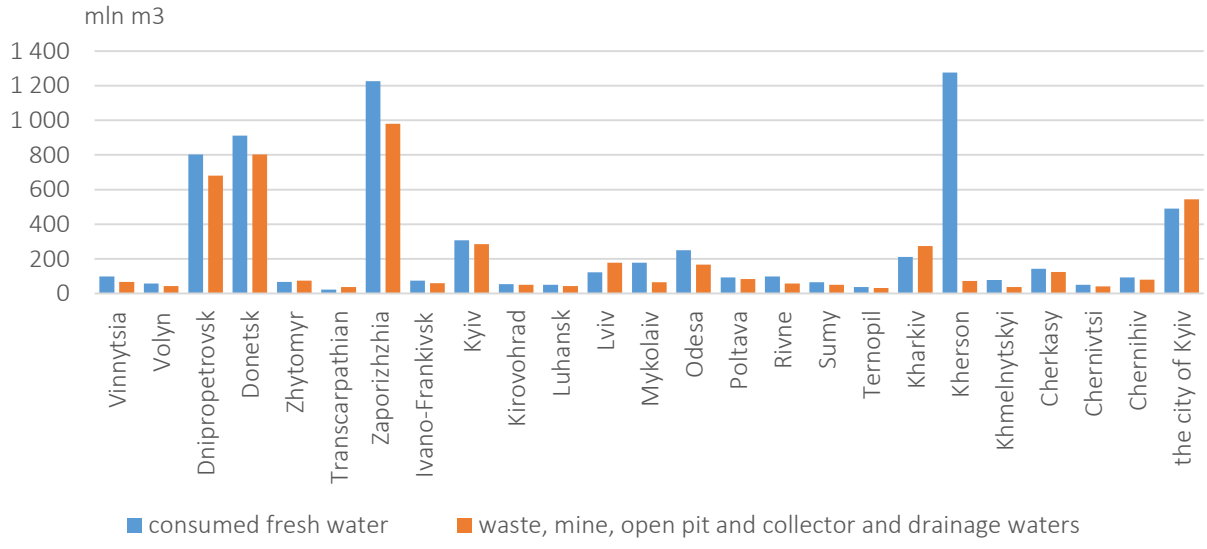

Figure 4. Total water consumption and drainage in 2017, mln m³

4. DISCUSSION

On average, water capacity in Ukraine in 2015 amounted to 6.48 ths m^3 per 1 UAH and in 2017 amounted to 2.87 ths m^3 per 1 UAH, in dollars. According to by the average NBU annual rate in 2015, it is amounted to 148.39 ths m^3 per 1 USD and in 2017 amounted to 71.75 ths m^3 per 1 USD. This calculation almost coincides with the data of the European organizations of the Food and Agriculture Organization of the United Nations (FAO, 2017), World Water Council, AQUASTAT data (World Water Council, 2016) and World Bank (2015, 2016, 2017).

According by this data, the so-called "influential countries", which are the world's major exporters of grain, have a much lower average water capacity of gross domestic product (GDP's water capacity) indicator than Ukraine (Figure 5).

Thus, in Australia this indicator is 17.634 ths m^3/USD; in France it amounts to 15.056 ths m^3/USD; Brazil has 32.996 ths m^3/USD; Canada – 33.531 ths m^3/USD; USA – 40.065 ths m^3/USD; Russia – 50.094 ths m^3/USD; Paraguay – 54.786 ths m^3/USD; Argentina – 106.186 ths m^3/USD; and Ukraine – 137.112 ths m^3/USD. And only Thailand and Pakistan have significantly higher figures, 182.485 ths m^3/USD and 1,698.272 ths m^3/USD respectively.

Figure 6 shows the average GDP's water capacity of the countries with the highest water resources in the world and those importing virtual water.

Consequently, the vast majority of countries with the largest reserves of water resources in the world have a much lower GDP's water capacity than Ukraine except for Indonesia, the Philippines, India and Mayanmar, but it should be noted that the water potential of these countries is many times higher than in Ukraine.

Among the countries that import virtual water, the indicator of GDP's water capacity is generally low, although in some countries water potential is higher than in Ukraine (except Denmark, Switzerland, Belgium, the United Arab Emirates and Singapore).

Thus, the situation has arisen that Ukraine, which does not have enough water resources, is now the so-called influential country, which is the main world exporter of grain. All influential countries (see Figure 5) (except Pakistan) have water potential that is at least 2 or 5 times higher than Ukrainian (Paraguay, Thailand and France, respectively), and even 70 times higher than in Ukraine. Only Pakistan has the same water potential (55 ths km^3/year), like in Ukraine and much higher than average calculated water capacity of GDP.

Source: Created according to the World Water Council (2016).

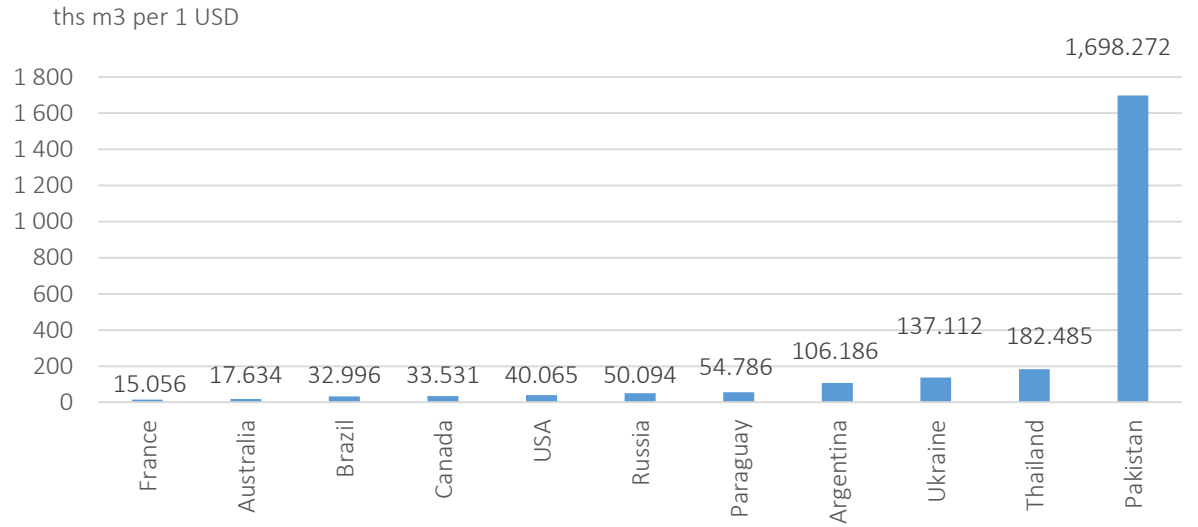

Figure 5. Average calculated water capacity of GDP of influential countries, which are the main world exporters of grain for the period 1975–2015, ths m^3 per 1 USD

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Table 4. Average calculated water capacity of GDP of the countries with the largest water resources in the world and those importing virtual water for the period 1975–2015, ths m^3 per 1 USD

Source: Created according to the World Water Council (2016).

Average calculated water capacity of GDP of the countries with the largest reserves of water resources in the world, ths m^3 per 1 USD		Average calculated water capacity of GDP of the countries-importers of virtual water, ths m^3 per 1 USD	
Japan	17.204	Denmark	3.233
Australia	17.634	Ireland	5.335
Papua New Guinea	31.913	Switzerland	5.433
Brazil	32.996	England	5.621
Canada	33.531	Norway	7.499
USA	40.065	Sweden	8.229
Venezuela (Bolivia Republic)	40.640	Singapore	8.938
Colombia	41.733	United Arab Emirates	10.091
Democratic Republic of the Congo	42.128	Germany	12.116
Russia	50.094	Austria	12.411
Malaysia	57.433	Belgium	16.840
Mexico	78.522	Finland	19.703
Peru	100.664	Italy	23.032
China	177.885		
Ecuador	183.530		
Chile	197.750		
Indonesia	244.779		
Philippines	458.071		
India	885.499		
Myanmar	2,560.820		

Water supply index of influential countries is important per 1 person, ths m^3/year (Table 5).

Table 5. Water supply index for influential countries

No.	Country	m^3/year
1	Canada	80,746.0
2	Paraguay	58,412.0
3	Brazil	41,603.0
4	Russia	31,543.0
5	Australia	20,527.0
6	Argentina	20,181.0
7	USA	9,538.0
8	Thailand	6,454.0
9	Ukraine	3,911.0
10	France	3,277.0
11	Pakistan	1,306.0

From the data provided, it is clear that water supply per capita in France is almost the same as in Ukraine (while, according to national estimates, water supply per capita is 1,240 m^3/year in Ukraine), even lower water supply per capita is in Pakistan, but practically the same, if to compare with the national calculations in Ukraine.

While transferring the water capacity of individual regions of Ukraine in 2015 into dollar equivalent, then one can see that Kherson region itself has a slightly smaller water capacity than Pakistan on average (Table 6).

Table 6. Water supply index for individual regions of Ukraine

No.	Region	ths. m^3 per 1 UAH	ths. m^3 per 1 USD
1	Dnipropetrovsk	2.56	176.33
2	Donetsk	5.48	216.63
3	Zaporizhzhia	9.40	397.77
4	Kyiv	1.95	232.66
5	Kherson	26.66	1,046.07

Donetsk, Zaporizhzhia and Kyiv regions exceed the average value of GDP's water capacity of Thailand. But if in Pakistan the industry does not occupy a significant place in the specific weight of GDP, then there is a significant industrial complex in Ukraine that could partially decrease the agrarian sector and reduce the GDP's water capacity of Ukraine and the GRP's water capacity by regions.

In 2017, there is somewhat better situation in terms of GRP's water capacity, but this is due to more reduced production in the country and decreased water consumption for production needs than significant economic growth.

CONCLUSION

Thus, Ukraine's water resources are increasingly becoming a major component of national security. Ukraine belongs to the least water-supplied countries of Europe, since the stock of local resources of river runoff per person is about 1.0 thousand cubic meters per year. For European countries this indicator is the following: Norway – 96.9; Sweden – 24.1; Finland – 22.5; France – 4.6; Italy – 3.9; Great Britain – 2.7; Poland – 1.7; Germany – 1.3; Hungary – 0.8 thousand m^3 per year. The area of Ukraine in relation to the total world land area is less than 0.5%, and according to the latest data, almost 5% of the world's volume of mineral resources is processed and extracted from Ukraine (Tomiltseva et al., 2017).

Thus, Ukraine, supplying grain abroad, thus, displays significant volumes of virtual water beyond its borders. An overview of world literary sources made it clear that Ukraine is the world's leading exporter of food products, along with the USA (mainly South America), Australia and Russia, and plays a major role in ensuring the functioning of the world's virtual water market and is part of a group of so-called influential countries. At the same time, influential countries, which are the main world exporters of cereals, have a much lower average of GDP's water capacity than Ukraine. But almost the vast majority of countries with the largest reserves of water resources in the world have a much lower GDP's water capacity than Ukraine except Indonesia, the Philippines, India and Myanmar. It should be noted, however, that the water potential of these countries is dozens of times higher than in Ukraine. Among countries that import virtual water, the indicator of GDP's water capacity is generally very low, although in some countries water potential is higher than in Ukraine.

All influential countries (except Pakistan) have water potential, which is at least 2 or 5 times higher than Ukrainian (Paraguay, Thailand and France, respectively), and even 70 times higher than Ukrainian.

The conducted research proves that the water supply of the territories does not determine the specialization of the regions of Ukraine in the export/import of water-capacious products. The main reason for this is the presence of significant land resources (chernozems) on the territory of Ukraine, which is the basis of the agrarian sector. The indicated gradual reduction of water consumption in Ukraine is confirmed that stimulation of the water-efficient activity of the region should lead to a minimization of the GRP's water capacity, and in certain regions, at least to the average in Ukraine and to the restoration of water capital, taking into account the water security of the regions.

Thus, the conducted analysis of the functioning of regional systems in modern conditions allows us to state the need to change the approaches to the regulation of regional development based on the consideration of water resources scarcity and effective regional water consumption.

The water capacity of the country and its regions and the natural water potential of the territories become nowadays a significant restriction to the economic development of territories.

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