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INVESTIGATING KEY TRENDS OF WATER RESOURCES ATTRACTION INTO ECONOMIC TURNOVER

ДОСЛІДЖЕННЯ ОСНОВНИХ ТЕНДЕНЦІЙ ЗАЛУЧЕННЯ ВОДНИХ РЕСУРСІВ У ГОСПОДАРСЬКИЙ ОБОРОТ

Urgency of the research. Saving water is the biggest problem of modern humanity. The water quality generates quality of life and health of everyone. Thus, there is a need to analyse water condition, to find the ways of effective water management and implement the measures for sustainable environmental management.

Target setting. Today water is extremely exposed to pollution, furthermore, issues around effective use of water resources are the number one problem worldwide.

Actual scientific researches and issues analysis. A number of well-known Ukrainian scientists R. H. Dubas, A. V. Yatsyk, L. H. Melnyk, O. I. Karintseva, S. M. Shevchenko, M. A. Khvesyuk, Y. M. Hryshchenko, as well as other researchers conducted investigations on salient and emerging trends in water resources' attraction into economic turnover.

Uninvestigated parts of general matters defining. The research objective. Water use in different sectors of economy still faces a number of issues which have to be organized, investigated and resolved. The purpose of this study is to establish guidelines of effective water use in line with sustainable development and environmental management principles by identifying salient trends of water use in modern Ukraine, as well as to reveal its issues in order to determine the ways to overcome existing deficiencies.

The statement of basic materials. In our study, we consider the impact of water use on the actual water bodies to be the most important criterion in the classification of water consumption. The impact may be focused on quantitative or qualitative characteristics of water bodies, or on none of them. The level of qualitative changes in water use is pretty high. Attraction of water resources to the economy should be based on sustainable development approach. Sustainable development of hydro-economic complexes is defined by the criterion of maintaining renewable water resources at acceptable levels and by water use efficiency.

Conclusions. The authors suggest taking measures in order to rationalize water use basing on existing hydro-economic systems and establishing cooperation with potential foreign institutions by creating a system of global national water complex through the institutionalization of water environment; the researchers offer to implement step-by-step decentralization and to create the interaction algorithm between the centralized and decentralized approaches to water supply in the municipal sector; they also recommend creating economic conditions for changeover to closed system in agriculture in order to save 1.8-2.5 thousand cubic meters of water per each hectare of irrigated, which will allow creating

Актуальність теми дослідження. Економія води є найбільшою проблемою сучасного суспільства. Якість води формує якість життя і здоров'я кожної людини. Таким чином, існує необхідність проаналізувати стан води, щоб знайти шляхи ефективного управління водними ресурсами та реалізації заходів щодо стійкого управління довкіллям.

Постановка проблеми. Сьогодні водні ресурси піддаються надзвичайному забрудненню та взагалі питання ефективного використання водних ресурсів є проблемою номер один у світі.

Аналіз останніх досліджень і публікацій. Чисельна кількість визнаних українських науковців, таких як Р. Г. Дубас, А. В. Яцик, Л. Г. Мельник, О. І. Карінцева, С. М. Шевченко, М. А. Хвесик, Ю. М. Грищенко зробили значний внесок у дослідження базових тенденцій залучення водних ресурсів у господарський оборот.

Виділення недосліджених частин загальної проблеми. Постановка завдання. До сьогодні водокористування у різних галузях економіки стикається з низкою проблем, які необхідно систематизувати, досліджувати та вирішувати. Мета дослідження полягає у формуванні напрямів ефективного водокористування відповідно до принципів сталого розвитку та раціонального природокористування шляхом визначення головних тенденцій водокористування в сучасній Україні та висвітлення його проблематики для визначення шляхів подолання існуючих недоліків.

Виклад основного матеріалу. У даному дослідженні розглянуто вплив використання води на реальних водних об'єктах, що є найважливішим критерієм у класифікації споживання води. Вплив зосереджено на кількісних й якісних характеристиках водних об'єктів. Виявлено, що рівень якісних змін у використанні води досить високий. Залучення водних ресурсів для економіки має ґрунтуватися на підході сталого розвитку. Сталий розвиток водогосподарських комплексів визначається критерієм збереження відновлюваних водних ресурсів на прийнятному рівні і ефективності використання водних ресурсів.

Висновки. Авторами запропоновано вжити комплекс заходів для раціоналізації водокористування на базі існуючих гідроекономічних комплексів, а також налагодити співпрацю з можливими іноземними інституціями, створивши систему глобального національного водного комплексу шляхом інституціоналізації середовища водокористування;

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a more effective mechanism of water management in Ukraine with the use of the best foreign experience.

покровоно запровадити децентралізацію і створити алгоритм взаємодії централізованого та децентралізованого підходів до водопостачання у комунальному секторі; створити економічні передумови для переходу на системи закритого типу у сільському господарстві для досягнення відповідно економії води 1,8-2,5 тис. м³ на кожному гектарі зрошуваних земель, що дозволить сформувати ефективніший механізм водокористування в Україні з застосуванням кращого закордонного досвіду.

Keywords: *water resources; hydro-economic complex; water consumption; economic turnover.*

Ключові слова: *водні ресурси; гідро економічний комплекс; водоспоживання; господарський оборот.*

Urgency of the research. Water is essential for maintaining all fields of the national economy: starting from production to consumption; it is extremely exposed to pollution, furthermore, issues around effective use of water resources are the number one problem worldwide. Thus, there is a need to analyse water condition, to find the ways of effective water management and implement the measures for sustainable environmental management. Nevertheless, limits to water use should not harm economic sectors; however they should also consider the environmental aspect. All those factors have determined the authors' choice of research relevance; moreover the noted issues have formed its idea, aim, and object.

Target setting. This article describes how to attract water into the system of national economy. However, substantial water withdrawals that are used to meet the needs of agriculture, industry, and private sector, are mostly directed towards unsustainable consumption. Today water is extremely exposed to pollution, furthermore, issues around effective use of water resources are the number one problem worldwide.

Actual scientific researches and issues analysis. A number of well-known Ukrainian scientists R. H. Dubas (2007), A. V. Yatsyk (1997), L. H. Melnyk, O. I. Karintseva, S. M. Shevchenko (2005), M. A. Khvesyk (2006), Y. M. Hryshchenko (1997), as well as other researchers conducted investigations on salient and emerging trends in water resources' attraction into economic turnover. However, water use in different sectors of economy still faces a number of issues which have to be organized, investigated and resolved. In this context, the use of foreign experience in the field of attracting water resources into the economic turnover is particularly important.

Uninvestigated parts of general matters defining. Water use in different sectors of economy still faces a number of issues which have to be organized, investigated and resolved.

The research objective. The purpose of the study is to establish guidelines of effective water use in line with sustainable development and environmental management principles by identifying salient trends of water use in modern Ukraine, as well as to reveal its issues in order to determine the ways to overcome existing deficiencies.

The statement of basic materials. The major trend in the modern water use is global consumption approach, resulting in environmental problems. The people consuming natural resources solve their current economic problems in the first place, consequently postponing the solution of environmental issues on the back burner. This approach does not solve such water use issues as excessive use of water resources, pollution, problems of access to resources and inadequate water management. During storage and infiltration water is exposed to significant losses at the level of river basins and groundwater. Irrigation is the most threatening process for groundwater as it can lead to pollution by nitrates, pesticides, etc. due to the use of insufficient technologies in agriculture. Failing to solve these problems will lead to the deepening crisis in environmental management (Dubas, 2007).

In order to systematize the water users by particular parameters, we will use the term 'hydro-economic complex'. The entities that use water from water bodies are the members or components of hydro-economic complex. They include water supply, water transport, reclamation, water rafting, fisheries, and water tourism. Hydraulic reclamations include irrigation and drainage, as well as wastewater management, water erosion prevention, and soil salinization. Depending on the location

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and scale, hydro-economic complexes are classified as global, basin and regional (basin part) ones. Global complexes include the projects using the resources of cross-border rivers. The state complexes are designed to develop the overall system of water use for a particular country. Such systems exist in the United States, Britain, France, but have no analogues in Ukraine. The authors of this research suggest creating a global Ukrainian water complex which shall operate as an agency to address global water issues and cooperate with liable foreign institutions at the level of international relations.

Basin complexes include major river basins. Basing on the number of participants, they may be sectional or composite. Thus, composite systems include several participants, such as utilities, hydroelectric engineering, irrigation, transport and so on. For instance, there are six hydro-economic systems in the Dnieper River basin (Hryshchenko, 1997).

Given that, we can classify water resources use by its purpose as follows:

1. Provision of drinking water.
2. Municipal needs.
3. Medical and recreation purposes.
4. Agriculture (without irrigation).
5. Irrigation.
6. Industrial needs.
7. Hydroelectric engineering.
8. Water transport and water rafting.
9. The needs of fishing industry.
10. Sewerage.
11. Environmental protection.
12. Sanitary needs.
13. Multipurpose use etc.

According to water use objects we can classify water consumption as the use of surface waters, groundwater and inland marine waters. Basing on technical characteristics of water use, water resources can be withdrawn either with the use of technical structures or directly, without them (Hryshchenko, 1997). In our study, we consider the impact of water use on the actual water bodies to be the most important criterion in the classification of water consumption. The impact may be focused on quantitative or qualitative characteristics of water bodies, or on none of them. The level of qualitative changes in water use is pretty high. Attraction of water resources to the economy should be based on sustainable development approach. Sustainable development of hydro-economic complexes is defined by the criterion of maintaining renewable water resources at acceptable levels and by water use efficiency.

Under the conditions of sustainable development, water inflow should increase due to water recycling and the use of alternative sources. We believe that the increase in water consumption due to population growth and the sanitation level should be compensated by the technological reduction of water use. This process should include the reduction of transport and technological losses and redundant waste (Ukrainian Hydro-Economic Complex Provided Sustainable Development, 2005). Defining the same criteria for each type of hydro-economic complex shall boost water use trends to sustainable development concept.

Nowadays the quality of life significantly depends not only on water availability but also on its quality which deteriorates due to human activity. Furthermore, the quality of water depends on the environmental situation in the country in general. While investigating the attraction of water resources in economic turnover, we distinguish between water use and water consumption as a portion of water resources' use. Thus, water consumers such as agriculture, industry and public utilities, waste water and, therefore, are more dangerous in environmental sense. Table 1 shows an example of water consumption in Ukraine in 2015; the case study is based on the city of Lviv.

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Table 1

**Water Consumption in Lviv Oblast (Ukraine) Throughout 2015
Divided by Major Consumers**

Freshwater Withdrawal, million cubic meters			Consumed, million cubic meters					Transport Losses, million cubic meters
total	from surface waters	from internal sources	total	industry	agriculture	municipal	others	
Lviv Oblast								
181.9	30.2	151.7	119.7	41.08	23.33	55.0	0.29	60.68
Western Bug River basin								
56.58	6.47	50.11	35.70	12.10	5.69	17.64	0.29	
Dniester River basin								
115.17	21.76	93.41	74.05	26.29	13.27	34.49	0.00	
Styr River basin								
3.23	0.73	2.5	3.18	1.07	1.12	0.99	0.00	
San River basin								
6.92	1.24	5.68	6.47	1.6	3.25	1.88	-	

Source: State Agency of Water Resources, Department of Water Resources, Lviv Oblast

Statistical data demonstrate regional peculiarities of water consumption, as municipal needs rank first basing on the water demand, followed by industry and agriculture.

Nonetheless in the world agriculture consumes about 70% of freshwater; for instance, producing one kilogram (1 kg) of grain requires about 1,000 gallons (litres) of water and 1 kg of beef some 43,000 litres. It is more appropriate to receive new water reserves by conservation, reuse and use efficiency improvement than the introduction of large-scale development projects. Due to the chemical processes that occur in plants, the water used by plants becomes a non-renewable resource. The required soil dampness varies depending on the crop. The volume of water required for eatable crops ranges from 300 to 2,000 litres per kilogram of the crop. A hectare of high-yield rice requires about 11 million litres of water in order to receive an average yield of 7 tonnes per hectare. On average, soy crops require about 6 million litres of water per hectare in order to receive a yield of 3 tonnes per hectare. Quite the opposite, wheat, producing less plant biomass than corn or rice, requires only some 2.4 million litres of water per hectare in order to receive a yield of 2.7 tonnes per hectare. Irrigation is an exceptional agricultural need. Under the same conditions, harvests of non-irrigated crops, such as corn, remain low even in case of applying plentiful amounts of fertilizers (Water Resources: Agricultural and Environmental Issues, 2004).

The central problems of water use in agriculture are the following: insufficient number of centralized water systems and wastewater treatment thereof; inadequate technical conditions of agricultural water supply systems due to their inconsistency with the standards. Solving these problems requires reducing water losses during its transportation to the fields. Likewise, there is a need to reduce water losses by raising yields via taking into account area-based factors, by using a set of measures to regulate the run-off, and purity of water distribution, by taking into account environmental factors and water availability factor (Yatsyk, 1997). Attraction of water resources in agricultural turnover should consider the trend of non-recoverable water use decrease in general. In order to do that, we suggest crossing over to intelligent closed control systems which allow automating water distribution and irrigation, as well as introducing adjustments to irrigation standards.

Municipal (or public) water consumption has got a number of drawbacks. In particular, they include

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the poor state of sewerage systems; critical condition of drainage systems; lack of consumption limits at the points of entry and lack of pressure regulators. This situation is the outcome of inadequacy of economic instruments and environmental problems caused by poor provision of sewerage systems (Melnyk et al., 2005). Municipal water consumption sector has a number of attributes that define its funding: there is a great number of decision-makers in the consumer sector. Due to the large number of institutions included in the process, the comprehensive picture of the sector funding is not transparent (An Investigation into the Water Infrastructure Development Financial Allocation Pathways in Municipalities, 2011).

The way to solve these issues is creating a private water supply which is a common case in Europe. Their experience offers decentralized water supply systems and alternative water sources: rainwater, re-used water. Water supply through a decentralized system suggests the use of local water sources (wells). Water use is also local: rainwater can be used at any scale, as well as re-used water – according to the place of treatment. Centralized and decentralized approaches are not mutually exclusive. The main idea lies in the degree of decentralization that would allow communities to use both approaches simultaneously (Alternative Ways of Providing Water. Emerging Options and Their Policy Implications, 2009).

Nevertheless, institutionalization of water use environment should precede the decentralization procedures. The noted institutionalization means transformation of existing institutions in the field of water management and creation of new ones, hence it's the institutionalization of commercialization forms of water resources.

Numerous industries use radically different water resources in their manufacturing processes while producing and discharging large variety of wastewater. The central issues of industrial water use include the use of outdated technology that requires the intervention of a rational state policy in the field of water management. The trend is that water resources are not used efficiently in periods of industrial collapses. The use of new technologies is possible in the case of loan schemes and investment opportunities. Then the industry which uses less water can become a priority (Khvesyuk, 2006).

We would like to emphasize the need to create conditions for investment in water-saving technologies.

Conclusions. Water resources management and protection is one of the key elements of environmental protection and strategic direction in shaping sustainable environmental engineering.

1. The conducted study leads to the following conclusions and recommendations:
2. Inadequate water management causes a series of issues, the main of which are pollution and a lack of resources.
3. Agriculture, industry and municipal sector are the main consumers of water. Among industries, manufacturing is the largest water polluter in most of the countries (water use in industry). Agriculture consumes about 70% of freshwater in the world (Water Resources: Agricultural and Environmental Issues, 2004).
4. Efficient water use is based on water preservation. The system includes the selection of rational environmental management types and optimal production structures; combining industries; provision of technical conditions; the use of resource-saving technologies.
5. Tax policy and environmental governance which involves the institutionalization of water use environment is an important component of the noted system.
6. Sustainable development as the planetary ideology with a new system of values is a long-term objective of water use policy.
7. Driven by the conducted research, the authors suggest taking measures in order to rationalize water use basing on existing hydro-economic systems and establishing cooperation with potential foreign institutions by creating a system of global national water complex through the institutionalization of water environment; the researchers offer to implement step-by-step decentralization and to create the interaction algorithm between the centralized and decentralized approaches to water supply in the municipal sector; they also recommend creating economic

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conditions for changeover to closed system in agriculture in order to save 1.8-2.5 thousand cubic meters of water per each hectare of irrigated land (Water Use in Agriculture, 2013), which will allow creating a more effective mechanism of water management in Ukraine with the use of the best foreign experience.

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