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DETERMINATION OF QUANTITATIVE AND COST CHARACTERISTICS OF UNPRODUCTIVE LOSSES OF FRESHWATER RESOURCES IN THE IMPLEMENTATION OF DOMESTIC, ECONOMIC AND INDUSTRIAL ACTIVITIES

V.H. Kovalev, Doctor of Economics, Professor

A.O. Volkova, PhD in Economics, Associate Professor

Odessa State Ecological University, Odessa, Ukraine

A.A. Chugunov, PhD in Economics, Associate Professor

Odessa National Polytechnic University, Odessa, Ukraine

Ковальов В.Г., Волкова А.О., Чугунов А.А. Визначення кількісних і вартісних характеристик непродуктивних втрат прісноводних ресурсів при здійсненні побутової, господарської і виробничої діяльності.

Проаналізовано стан непродуктивних втрат прісноводних ресурсів. Показано, що для забезпечення зазначеними ресурсами побутової, господарської і виробничої діяльності в економічному регіоні потрібно використовувати: пристрої, що забезпечують забір свіжої прісної води з відповідного джерела прісноводних ресурсів; пристрої первинної попередньої підготовки забраної з джерела свіжої води; пристрої спеціальної підготовки водних ресурсів для їхнього використання при здійсненні відповідного виду діяльності; здійснення побутового, господарського і виробничого видів діяльності з утворенням забруднених стічних вод; очисні природоохоронні спорудження, що забезпечують повне і часткове очищення стічних вод. Наведено результати досліджень особливості раціонального використання прісноводних ресурсів.

Ключові слова: прісноводні ресурси, втрати, водні басейни, побутова, господарська і виробнича діяльність

Kovalev V.H., Volkova A.O., Chugunov A.A. Determination of quantitative and cost characteristics of unproductive losses of freshwater resources in the implementation of the household and production activities.

It analyses the state of unproductive losses of freshwater resources. It is shown that for providing the said resources of the household and productive activities in the economic region should use: device that allows for the intake of fresh of fresh water from the respective freshwater source; the primary device prior training taken away from a source of fresh water; for special training of water resources for use in the implementation of the relevant activity; the implementation of the household and the production activities with the formation of contaminated waste water; treatment facilities environmental facilities, providing a full partial wastewater treatment. The results of studies of characteristics of rational use of freshwater resources.

Keywords: freshwater resources, loss of water pools, household, commercial and industrial activities

Nowadays about 600 km³ of water are taken from various sources of water or industrial and domestic needs annually on the globe. About 150 km³ of water per year is irrevocably spent. The total consumption of water for economic and domestic needs of our planet's population currently is more than 200 km³ per year. At the same time irretrievable losses of freshwater resources range from 5 to 20% depending on the region of planet [1].

Analysis of recent researches and publications

A significant contribution to the development of the main directions of use of freshwater resources in the basins made domestic and foreign scientists: O.F. Balatskiy, N.S. Bystritska, S.M. Bobylev, E.A. Veklich, I.L. Golovinskiy, A.A. Golub, V.A. Golyan, K.G. Hofman, E.G. Grigoriev, V.I. Danilov-Danilyan, B.M. Danylyshyn, S.I. Doroguntsov, S.O. Kondratiev, V.A. Lukyanyhin, L.G. Melnik, M.M. Palamarchuk, E.P. Ushakov, M.A. Hvesyuk, V.J. Shevchuk, A.V. Yarotska, A.V. Yatsyk and others.

At the same time, in our opinion, the questions concerning the system-structural construction of the organizational and economic mechanism for the rational use of freshwater resources are not sufficiently resolved.

The aim of the article is to study the system of quantitative and cost characteristics of non-productive losses of freshwater resources in the implementation of household, economic and production activities which is built on the basis of unit costs and unit costs.

The main part

The provision of the above-mentioned household, economic and production resources in the economic region consists of:

- devices that ensure fresh freshwater intake from a relevant source of freshwater resources;
- devices of primary preliminary preparation which is taken from a source of fresh water;

- devices for special preparation of water resources for their use in the implementation of the relevant type of activity;
- implementation of domestic, economic and production activities with the formation of contaminated sewage;
- purification environmental protection facilities that provide full and partial wastewater treatment [2].

Water supply mains are very important in the delivery of the necessary amount of water resources to the relevant facilities, however, it must be considered that during transportation of water resources, their quantity is lost as unproductive losses.

So, when water resources V_1, V_2, V_3, V_4 are delivered to tackles of its preliminary and special overture, amount of water resources (P_1, P_2, P_3, P_4 , that are determined by formulas) is irretrievably lost:

$$P_1 = a_1 \cdot v_1, \quad (1)$$

$$P_2 = a_2 \cdot v_2, \quad (2)$$

$$P_3 = a_3 \cdot v_3, \quad (3)$$

$$P_4 = a_4 \cdot v_4, \quad (4)$$

where $\alpha_1, \alpha_2, \alpha_3, \alpha_4$ – specific losses in water transport systems in water supplying with previous devices and their specific water treatment.

When water resources are ducted to technological processes for implementation of household, economic and production activities, some of them are irretrievably lost (P_5, P_6 , and P_7 according to formulas 5, 6, 7):

$$P_5 = a_5 \cdot v_5, \quad (5)$$

$$P_6 = a_6 \cdot v_6, \quad (6)$$

$$P_7 = a_7 \cdot v_7, \quad (7)$$

where $\alpha_5, \alpha_6, \alpha_7$ – specific losses of water resources when they are fed to the technological processes of domestic, economic and production use.

Freshwater resources V_8, V_9, V_{10} when they are passing through technological processes, form polluted sewage, that are entering the system of treatment facilities, however, the amount of water resources is irrecoverably losing (P_8, P_9, P_{10} that are determined by formulas 8, 9, 10):

$$P_8 = a_8 \cdot v_8, \quad (8)$$

$$P_9 = a_9 \cdot v_9, \quad (9)$$

$$P_{10} = a_{10} \cdot v_{10}, \quad (10)$$

where $\alpha_8, \alpha_9, \alpha_{10}$ – specific losses of water resources when contaminated water resources are transported from places of origin to places of their cleaning.

When preliminary preparation of water $V_{VV}, V_{sp}, V_{spc}, V_{pr}$ resources is carried out and their subsequent special training, their irretrievable loss in quantity ($P_{VV}, P_{sp}, P_{spc}, P_{pr}$) is calculated by formulas (11-14):

$$P_{pr} = B_1 \cdot v_{pr}, \quad (11)$$

$$P_{spc} = B_2 \cdot v_{spc}, \quad (12)$$

$$P_{sp} = B_3 \cdot v_{sp}, \quad (13)$$

$$P_{VV} = B_4 \cdot v_{VV}, \quad (14)$$

where B_1, B_2, B_3, B_4 – respectively, specific losses of water resources in the implementation of preliminary water treatment and subsequent special water treatment;

$V_{VV}, V_{sp}, V_{spc}, V_{pr}$ – amount of water resources, that pass in accordance with the preliminary and special water treatment. It must also be taken into account that in the implementation of preliminary and appropriate special preparation of water resources, their part is irretrievably lost ($P_{VV}, P_{sp}, P_{spc}, P_{pr}$).

When household, economic and production activities are performed, a certain amount of water resources is irretrievably lost (P_p, P_h, P_v , that are determined by formulas (15, 16, 17):

$$P_p = a_{19} \cdot P_p, \quad (15)$$

$$P_{farm} = a_{20} \cdot P_{farm}, \quad (16)$$

$$P_v = \alpha_{20} \cdot P_{\text{farm}}, \quad (17)$$

where α_{19} , α_{20} , α_{21} – specific losses of freshwater resources in the implementation of household, economic and production activities;

P_p , P_{farm} , P_v – runs according to household, commercial and industrial activities.

When polluted sewage enters sewage treatment facilities, some of them are also irretrievably lost.

Thus, water resources are irretrievably and unproductively lost during their transportation (P_{tec}) from places of their intake to places of their use and to treatment facilities for the appropriate treatment of polluted water, that was generated, and also during the necessary preparation (preliminary and special), during the implementation of technologies and work during the implementation of household, economic and production activities.

Quantification of the above listed depends on the entire transport system and the state of used technology, work's culture, staff experience.

The total number of unproductive losses of freshwater resources (P_{tec}) at their use in household technology (P_{hou}) commercial (P_{farm}) and production (P_v) activity is determined by formula 18:

$$P_{\text{tec}} = P_{\text{hou}} + P_{\text{farm}} + P_{\text{prod}} + P_{\text{tr}}, \quad (18)$$

Wasteful spendings for preparing and implementing of freshwater resources use consist of costs for initial training freshwater resources, the cost for these resources was prepared depending on the nature of the activity and the number of necessary water resources for this type of activity in full required amount.

Above listed losses are determined in terms of values of corresponding consumable unit (C_t , C_p , C_{hoe} , C_v) indicators and the volume of performed work (V_p , V_{hou} , V_v , V_t) during household activities.

$$C_{\text{hou}} = C_{\text{hou}} \cdot V_{\text{hou}}, \quad (19)$$

during business activity

$$C_{\text{farm}} = C_{\text{farm}} \cdot V_{\text{hou}}, \quad (20)$$

during production activity

$$C_{\text{prod}} = C_{\text{prod}} \cdot V_{\text{prod}}, \quad (21)$$

during transportation of resources

$$C_{\text{tr}} = C_{\text{tr}} \cdot V_{\text{tr}}, \quad (22)$$

Total costs for providing freshwater resources of all these types of activities are determined by formula:

$$C_{\text{wh.}} = C_{\text{hou}} + C_{\text{farm}} + C_{\text{prod}} + C_{\text{tr}}, \quad (23)$$

As is seen from the results of research, use of financial costs of freshwater resources for domestic, commercial and industrial activities depend on volume of work and unit cost for each activity.

Unit costs for securing domestic, commercial and industrial activities by freshwater and contaminated sewage which is formed wherein depends on the respective unit costs.

The quantitative characteristics of the above-mentioned losses and corresponding costs depends on the transport system estate, and also on the state of used technologies, work culture, staff experience.

One of the most important factors that works on reduction of the above-mentioned losses is to ensure the economic, environmental and social efficiency means usage that are directed at solving the above-mentioned problem of natural areas protection from the negative impact by domestic, commercial and industrial facilities that are located on the watersheds territory.

The methodology of this activity on the territory of Ukraine basins should provide widespread use in the relevant residential, commercial, industrial and water protection systems of science and technology in their respective fields. It is necessary to ensure an optimal use of limited funds, that hit for unproductive losses of freshwater resources reducing works.

Unproductive losses' reducing should be developed on the comprehensive implementation of relevant programs' basis, that involve reducing of negative impact from the industrial and commercial facilities for all natural areas.

In the methodology plan it is necessary to execute a number of preliminary researches in the formation of the above-mentioned complex programs:

— about the study and analysis of existing stocks of freshwater resources and identify of opportunities for their use in industrial, economic and household activities;

- about development of energy-saving technologies and methods of work;
- in terms of science and technology achievements development and implementation in industrial, commercial and domestic activities of technological methods, that reduce emissions and discharges of pollutants into natural areas;
- about freshwater quality indicators restore methods development;
- to develop technologies and methods of providing recycling of freshwater resources for industrial, commercial and household activities;
- to improve the efficiency of household, industrial and business financial, material and human resources;
- to raise the interest of domestic and foreign investors to invest in the development of all components of the economic and ecological systems;
- to create favorable conditions for development of small and medium businesses.

Methodology of environmental activities should take into account that at present we are witnesses and participants of dangerous weather events that affect the stability, security and balanced development of economic and freshwater ecological and social systems [4].

The reasons for the emergence and development of hazardous weather and climate events like the warming, increasing the number of earthquakes, volcanic activity activation, sudden floods, etc. has not yet been established, although currently conducted extensive research in this area.

Methodological approaches in the development of main directions of development of freshwater resources should consider restrictions on compliance requirements to avoid exceeding limits the possibilities for recovery processes in aquatic areas. It should not aggravate the negative contradictions in these fields induce industrial, commercial and domestic activities in watersheds with natural laws and natural balance so as not to contribute to the emergence and development of irreversible processes in the environment. In developing areas of freshwater systems to prevent various conflicts must have predictions that would enable to predict the effects of the nature of developed areas of development. Also note that to achieve optimal development and use of these systems plays a crucial role in the proper use of science and technology, as technological progress is closely linked to the gradual development of science and technology with constant exposure to freshwater systems. The use of scientific and technological progress ensures the development and transformation of labor relations of people in the industrial and economic activities. Must while also aware that scientific progress is the most important means of solving social problems, contributes to changing conditions, contributes to productivity growth, reducing negative impacts on the environment [5].

From all the above it follows that reducing unproductive water should improve the relevant transport system, taking into account a number of factors specific indicators affecting the value as expenditure and value character.

Research shows the most effective will be included directly in the processes relevant environmental components and systems as well as systems reuse of freshwater resources and emerging in the implementation of industrial and economic activities of various waste products, and the need to provide support to the relevant systems and components in working condition their service and high qualified personnel.

The use of science and technology in key areas using freshwater provides the conditions to overcome the distinction between mental and physical labor, helps to change the role of man in the production process, ensures shift from extensive to intensive type of household, industrial and economic activities.

Our studies show that the development of freshwater systems in watersheds should be aware that:

- expansion of domestic, industrial and economic activity leading to cost increases freshwater resources, increasing the variety of waste household, industrial and commercial activities;
- is the growth of pollution of freshwater resources, the emergence of a new resource systems artificial pollutants;
- an increase in the number of heated freshwater resources, which leads to more heat to the atmosphere;
- increased pollution of freshwater all modes of transport;
- the use of large quantities of fertilizer and various agricultural pesticide;
- there is growing urbanization, out-migration from rural areas to cities;
- there are trends in tourism and recreational activities.

The development of freshwater resources should strengthen the existing interconnection of individual ecosystems, thereby preventing the emergence and development of the crisis. In developing the main areas of use of freshwater resources in the basins should provide a stable, secure and sustainable development of their economic and environmental aspects at the same time be aware that it is mandatory systematic and comprehensive approach to environmental, economic, demographic, social and organizational problems.

Conclusions

The above-mentioned research results lead to the following conclusions:

1. Not less than 20% loss of freshwater resources in the form of non-production losses during their transportation and participation in certain technological operations.
2. Reducing unproductive losses of freshwater resources can only be achieved with perfection of transporting these resources and their subsequent use in residential, industrial and technological purposes based on science and technology and culture while improving their use.

3. Reducing unproductive losses of freshwater resources at their use in residential, commercial and industrial purposes will reduce the cost of relevant costs.
4. Work on improving water use should be of systematic and comprehensive character.

Abstract

Currently on the globe for industrial and domestic needs annually taken from various sources of supply around 600 km³. Of them permanently consumed by about 150 km³ of water per year. Total water consumption for economic and household needs of the world's population currently is more than 200 km³ per year. This deadweight loss of freshwater resources range from 5 to 20% depending on the region of the planet.

Be aware that the process of consumption of freshwater resources ensures the development of an indigenous positive shift in consciousness associated with the pace and forms of development and the vital interests of the entire population that relate to this economic region, it is necessary to consider the complexity and dynamism in the management of freshwater.

A major role in the delivery of the required amount of water to the corresponding objects play a main water supply, it is necessary to consider that during the transportation of water resources determined their number is lost as waste.

One of the most important factors that influences the reduction of the above losses is to ensure economic, environmental and social efficiency of use of funds allocated for the solution of the above tasks, the protection of natural areas from negative impacts from household and industrial objects located on the territory of water basin.

As the results of the research, the most effective is the inclusion directly in technological processes of relevant environmental components and systems, and reuse systems and freshwater resources arising from the implementation of production and business activities of various types of waste, it is necessary to provide for the maintenance of appropriate systems and components in working condition and their high maintenance by qualified personnel.

The results of the research allow to make following conclusions:

1. At least 20% of freshwater is lost in nonproductive losses during transportation and participation in various technological operations.
2. Reduction of unproductive losses of freshwater resources can only be achieved when improving the systems of transportation of these resources and their subsequent use in household, industrial and industrial purposes on the basis of achievements of science and technology, as well as with the improvement of culture of their use.
3. Reduced unproductive losses of freshwater resources when they are used in domestic, commercial and industrial purposes will reduce the relevant cost expenses.
4. The work to improve water management should be systematic and comprehensive.

JEL Classification: Q01, Q32, Q57.

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Ковальов Володимир Георгійович / Volodymyr H. Kovalev

Волкова Алла Олександрівна / Alla O. Volkova
alchenochek10@mail.ru

Чугунов Анатолій Анатолійович / Anatoly A. Chugunov

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