DE GRUYTER OPEN

DOI 10.1515/pesd-2016-0027 PESD, VOL. 10, no. 2, 2016

ECONOMIC AND GEOGRAFICAL ASPECTS OF WATER USE IN THE PRUT RIVER BASIN (The sector of the Republic of Moldova)

Bacal Petru[1]

Keywords: water, use, management, economic, efficiency.

Abstract. The purpose of this research consists in the elucidation of spatial and economic aspects of the water use in the Prut river basin. The main topics presented in this paper are: 1) the dynamics of water use; 2) spatial and branch profile of water use and its dynamics: 3) existing problems in the evaluation and monitoring of water use; 5) efficiency of the implementation of economic instruments of water management. To achieve these objectives were used traditional methods of geographical and economic research. Also, the content of the present study is focused on the methodology to elaborate the management plans of hydrographical basins and their chapters on the status of water resources and water bodies and on economic analysis of water use in the Prut river basin.

1. Introduction

The legal framework of water management is stipulated in the Water Law no. 272 of 23.12.2011, Law no. 1102 of 06.02.1997 on Natural Resources, Law no. 272 of 10.02.1999 on Drinking Water, Law no. 303 of 12.13.2013 on public services of water supply and sewerage, Law no. 397 of 16.10.2003 on Local Public Finance, Title VIII of the Fiscal Code [4], Decision no. 164 of 29.11.2004 of National Agency for Energy Regulation (NAER) on Methodology for determination, approval and application of tariffs for public water supply services, sewerage systems and wastewater treatment. Water Low is elaborated in accordance with EU Directives on the water management, particularly the Water Framework Directive (2000/60/EC) and Urban Waste Water Treatment Directive (91/271/EEC). According to Articles 6 and 54 of this law, water resources management is based on the principles of "beneficiaries and polluters pays" and on the cost recovery of water use.

In the period under review, in the Prut river basin, were captured, on average, 24,6 million m³ (table 1), which represents only 3% of the total volume of water

[1] Institute of Ecology and Geography, Academy of Science of Moldova

abstracted in the republic and 15% – in the right bank of Dniester river [11]. Despite much lower share compared with the the Nistru river, the Prut river basin, has a primary role in water supply of many settlements in the west of country, especially for urban and industrial centers as Edineț, Fălești, Ungeni, Cahul.

The Prut river basin supplies water in most settlements in the districts Râşcani and Hânceşti, although the administrative centres of these districts are located outside of Prut river basin. Moreover, unlike the Dniester river (except Soroca and Chisinau), public utility enterprises in larger urban centers capture the necessary water directly from the Prut river bed. Outside suburban area, most of the water is captured by enterprises of food industry and by agriculture farms.

Table 1. Volume of captured water from Prut river basin

River basins	Total		Surface sources			Underground sources		
	million m³	%	million m³	%	%[2]	million m³	%	%
Prut	24,6	2,9	11,6	1,6	47	13,0	10	53
Prut riverbed	9,8	1,1	7,9	1,1	81	1,9	1,4	19
Nistru	819	96	714	98	87	107	83	13
Nistru riverbed	220	26	148	20	67	72	56	33
Republic of Moldova	854	100	726	100	85	128	100	15
without Transnistria	164	19	111	15	68	52,6	41	32

Sourse: table 1 and figure 1 are elaborated by author after data from „*Generalized Annual Reports on Water Management Indicators"* [11]

Over ½ or 13 million m^3 of captured water comes from underground sources (table 1). The underground sources predominate in most districts of the Prut river basin. In addition, the rapid increase of water supply networks in the rural space is based on the exploitation of underground sources. Compared with 1990, there is a reduction of about 15 times of the abstracted and used water volume (from about 350 million m^3 to only 20,2 million m^3). This is due mainly to the similar water use reduction in industrial branches, as well as in the irrigation and in other agricultural activities that are in deep crisis in the last two decades.

1. Theory and methodology:

This study has made by author under the EPIRB Project „Management Plan of the Prut river basin" (chapter Economic analysis of water use), which is at the stage of legislative approval. The present research is developed in accordance with the WATECO Guidelines on the methodology of economic assessment of water use

[2] Share of these sources from total volume of abstracted water

for the implementation of the Water Framework Directive 2000/60 /EC [7]. For the study, the author has focused on management plans, which are being implemented, such as the Danube River Basin Management Plan [5], Management Plan of River Space Prut-Bârlad [10]. Those plans must include detailed diagnosis of the status basins and of water bodies, recent trends of water consumption, and economical analysis of water use. Based on this diagnosis are established shortcomings and achievements of current water management and shall be drafted action plans to improve the status of water and increase the economic and environmental efficiency of its use. Very valuable, in particular for determining the status and economic analysis of water use are research methodology and study transboundary (international) rivers in the Black Sea Region and Belarus (EPIRB Program) [6]. Also, for the elucidation of spatial, economic and social aspects, of water use in Moldova were consulted various international publications in the field, especially studies carried out by I. Sîrodoiev [13] jointly with local and foreign researchers.

The main methods, which are used in this study are: statistical, analytical, comparative, analogical, as well as consultation with competent authorities in the field of assessing and managing of water resources. Statistical method was widely used in processing of statistical information on the capture and use of water in all administrative-territorial units from the Prut river basin. The analytical method was used for: a) to identify qualitative aspects of water supply system; b) diagnosis of situation in this area; c) establishment of problematic situations in regulating economic, legal and institutional system; c) elaboration of recommendations to prevent problematic situations; d) definition of priority directions of activity optimization of water resources management in the Prut river basin. The comparative method was applied for establishing the trends in the branch and spatial aspects of the use of water resources, the dynamics of tariffs for water supply and sanitation. This study included the implementation of economic and administrative tools for managing of water resources, but the version offered for publication are used only taxes and tariffs for water consumption.

The main informational and statistical support that formed the basis of this study included: 1) Generalized Annual Reports on Water Management Indicators elaborated by the Basins Department of Agency „Apele Moldovei" [11]; 2) Annual Reports of Ecological Agencies and Inspection [12]; 4) The Reports of water supply and sewage companies of Association „Moldova Apa-Canal" [9]; 5) analytical studies in this field [5, 10, 13], including of author of this article [2].

2. Result and discussions:

2.1. The dynamics of water consumption. In the period under review, total water use in the Prut river basin was on average 18,8 million m^3. Similar to captured water, the total used water volume shows a negative trend (figure1) which

is conditioned by the significant reduction (-15%) of the volume of water used in agriculture, especially for irrigation. For agricultural needs are used about 13 million m^3 or ≈70% of the water used in the basin, including ¼ for irrigation of those areas. The agricultural usage predominate in the all districts, except of Ungheni and Cahul districts, where predominates the household and industrial usages. The spread of irrigated agriculture has a pronounced azonal character. Thus, despite the fact that rainfall decreases relatively uniformly from north to south, the volume of water used for irrigation and other agricultural activities is higher in the northern districts. This is explained by the higher level of financial assurance and more pronounced marketability of agriculture in this region. The main sources of irrigation water catchment are: the Prut river bed, Costești-Stânca lake and the tributaries of the Middle Prut.

For domestic needs are used about 20% (3,7 million m^3) of the totally used water. Due to the rapid expansion of water supply networks, especially for rural households, recent dynamics of water used for domestic purposes does not show a decreasing trend, if compared to the total volume and other categories of water use. Moreover, in the near future it is expect a positive trend in the domestic water usage. At the same time, in rural areas and small and medium-sized urban centers, most of the volume of water assigned to domestic purposes is used for growing and processing crops in households. The volume of water used for domestic purposes depends on the number and size of urban centers and the rural areas, which have extensive centralized water supply systems and record water use.

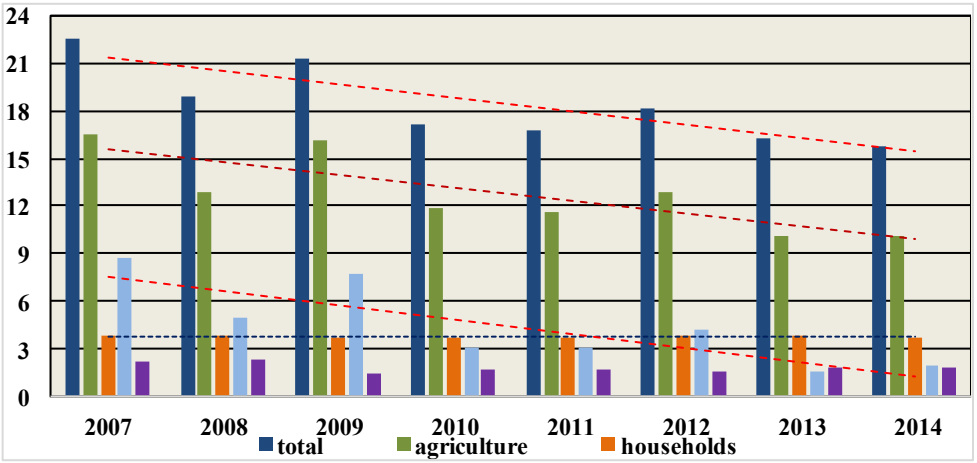

Fig. 1. Dynamics, by usage categories, of water used in the Prut river basin, in million m^3

Less than 10% of captured waters are used for the technological purposes. The amount of used process water recorded a multiple reduction in the 90's, marked by a similar decreasing in the agro industrial complex in that period. Subsequently, there is an oscillating evolution on the background of a general trend of decreasing. Because of geopolitical issues with the Russian Federation, the low capacity of the internal market and low promotion of domestic products on the EU market, the trend of reducing industrial water consumption will persist in the future. In the branch structure, predominate the food industry, health and education institutions, markets and car washes centers. In the same time, a large number of agricultural and mining companies keep incomplete evidence of water use.

2.2. The production indices of water supply services. The information regarding the services area of water supply and sewerage is fully recorded only by the enterprises of the Association„ Apă-Canal". These contribute with over 50% of water supply and with 80% of waste water discharge service. Due to the predominantly agrarian type, only ¼ of the water used in the Prut river basin is provided by the „Apă-Canal" companies.

Number of municipal water supply utility systems in the districts located within the Prut basin is 160 units (table 2, figure 2), of which 142 (90%) are functioning. Most water supply enterprises are registered in Cahul, Hâncesti Râşcani and Glodeni, and the least – in Făleşti, Ocniţa, Leova.

The total length of water supply networks is 2133 km, of which more than ¼ (555 km) belong to municipal enterprises „Apă-Canal" located in urban centers.

Table 2. Status of water supply systems in the Prut river basin (2014)

No.	Districts	**Water supply systems**, unit		**Aqueducts length**, km		**Consumption**, litters/ inhabitant		**Pumping stations (PS) and artesian wells (AW)**			
		Total	operated	total	Apă-Canal	total	Apă-Canal	Number PS	Number AW	Capacity, m³/day	Used degree, %
1	Ocniţa	3	3	50,0	36,6	2	*16,9*	7	6	3,5	10,2
2	Briceni	18	15	177	47,1	2,6	*30,3*	18	24	6,9	27,8
3	Edineț	5	5	138	118	3,6	*46,9*	9	8	12,3	34,3
4	Râșcani	19	17	196		4,8		*22*	*40*	5	
5	Glodeni	24	18	164	34,9	4,6	*26,2*	21	16	10,7	
6	Fălești	2	2	44,4	41,4	2,2	*38,7*	24	22	3,2	39,5
7	Ungheni	15	15	281	88,7	10,6	*88,4*	27	26	18,3	42,5
8	Nisporeni	13	13	193	19,5	2,8	*13,8*	16	6	6	15,5
9	Hâncești	16	16	237		2,9		14	20	4	
10	Leova	8	6	104	41,6	4,4	*38,2*	3	1	4,9	7,8
11	Cantemir	12	9	172	23	2,3	*49,6*	18	20	19,3	6,0
12	Cahul	25	20	375	104	8,8	*54,3*	47	46	25,4	32,3
	Prut basin	**160**	**139**	**2133**	**555**	**4,3**	***41***	**226**	**235**	**120**	**24**
	Total RM	**836**	**677**	**10484**	**4593**	**8,5**	***119***	***1341***	***1389***	**1323**	**43/14**

Sources: elaborated by the author according to the data from statistica.md, amac.md

The largest aqueducts are registered in the districts of Cahul (375 km), Ungheni (281 km), which is primarily conditioned by the number and size of urban centers in these districts. The minimum length aqueducts is found in the districts of Ocnița (50 km) and Fălești (44 km), where, in the recent years, major projects are being implemented to extend the network of water supply and sewarage. Such projects are implemented in the other districts of the Prut River basin, particularly in rural settlements. Also in Râșcani and Edineț districts, it takes place the supply network interconnection of the Prut River Basin with the Dniester one.

According to the National Bureau of Statistics, in the years 2007-2014, the number of centralized water supply systems in the Prut river basin increased from 100 to 160 units (+ 60%) and their length with km or over 2 times (Fig. 2) . In central and southern districts the growth rate of the number and length of water supply systems is higher than in the northern districts of the basin area, except Râșcani district, where the maximum increase is observed (4,8 and 6,5 times). Also, a maximum increase in the length of water supply networks is found in Cantemir district (7,3 times), Hâncești (5,9 times) and Ungheni (2,4 times). Furthermore, data provided by central statistical authorities does not contain full information in this regard, particularly in the districts of Fălești, Leova and Cahul. If we consider completed or nearing completion recent projects) supported by NEF, RDA and other important sources of funding, the pace of infrastructure rehabilitation and expansion of centralized water supply is significantly high. It is important to turn these plausible input indicators as quickly as possible into outcome indicators, such as increasing access to quality water and concerned services, condition improvement of water bodies and water resources.

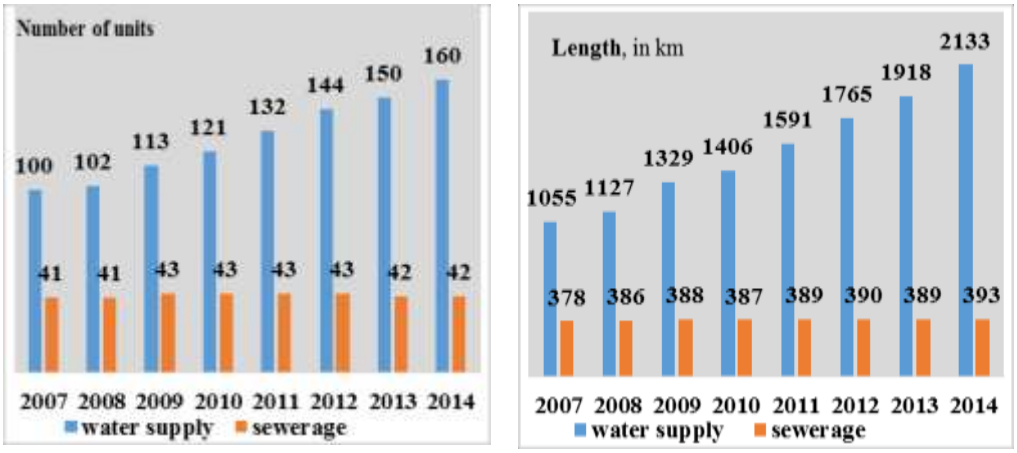

Fig. 2-3. Dynamics of water supply and sewerage systems in the Prut river Basin
Source: elaborated by author after NBS Reports on water supply and sewerage systems

In the Prut River basin water is supplied by 226 pumping stations and 235 artesian wells, with a total capacity of 120 thousand m^3. The enterprises of the Association „Moldova Apă-Canal" have 33 pumping stations, including 32 functional and 54 artesian wells, of which 32 (60%) are functional. The summary capacity of pumping stations and artesian wells at these enterprises is 82 400 m^3/day or 60% of total capacity in the Prut river basin. In the same time, it is being used only about ¼ of the project capabilities of existing stations, which is explained by the high degree of wear and damage and multiple reducing of water consumption in agriculture and industry in the last two decades.

Table 3. Using of water supply systems at enterprises "Apa-Canal" in the Prut River Basin (2014)

Nr.	**District centers**	**Supplied water volume**, thousand m^3				**Loss of captured water**, %	**Wear degree of fixed funds**, %	**Usage degree of fixed fonds**, %
		Total	Population	Budg. organizations	Economic agents			
1	Ocnița	58,1	49,5	5,1	3,5	23	31	0,09
2	Briceni	109	95,1	8	6,3	33	33	0,24
3	Edineț	445	239	12,7	193	58	64	0,19
4	Glodeni	109	87,1	16,3	5,5	17	0,3	0,08
5	Fălești	239	206	8,5	24,1	45	32	0,16
6	Ungheni	1239	937	105	197	28	61	0,22
7	Nisporeni	72,6	54,1	15	3,5	43	29	0,08
8	Leova	152	116	31,3	5,1	20	45	0,27
9	Cantemir	105	76,2	25,7	3	18	51	0,16
10	Cahul	947	791	41,7	114	39	48	0,16
	Prut basin	**3476**	**2651**	**269**	**555**	**36**	**39**	**0,17**

The total water volume supplied by the „Apa-Canal" enterprises is, on average, about 3,5 million m^3. The maximum water volume is supplied by the utility enterprises of the larger towns, like Ungheni (1,2 million m^3), Cahul (947 thousand m^3) and Edinet (445 thousand m^3) and the minimum volume – by Ocnița (50 thousand m^3) and Nisporeni (54 thousand m^3). For population it is delivered 2,7 mln m^3 or ¾ of the total volume (table 3). This proportion is similar in all cities of the Prut river basin, except Edineț, where the share of the population does not exceed ½ of the total volume of water delivered. Second position is held by the economic agents that use more than 555 thousand m^3 per year or 16% of total water supplied by the enterprises of "Apă-Canal". The volume of water delivered to the economic agents is determined by the number and production capacity of the enterprises, which do not have their own sources of water supply, especially the commercial and service centers, as well as the agricultural and complex markets, service stations, car washes, petrol stations, etc. For budgetary organizations it is

delivered only 275,000 m^3 of water and only 8% of the total. In this category of water consumers are listed the medical and training centers, local and district governmental buildings.

Irrevocable losses exceed an average of 70% of the total volume of captured water, which is significantly lower than the country average share (21%). About 80% (57 million m^3) of total final losses of water represents technological losses. The large volume of technological losses is due to both advanced wear of water supply infrastructure in the area of the Prut river basin and technological peculiarities of water supply in agriculture, which predominates in the branch structure of this basin.

Final loss of captured and distributed water by the enterprises of „Apa-Canal" in the Prut river basin is about 36% (table 3) The „Apa-Canal" companies supplies water almost exclusively to all households in urban areas, industrial and service centers, budget organizations, where the technological loss is significantly lower compared to water loss in agriculture, particularly in irrigation. Another difficult issue is the w use of fixed funds (17%), which is conditioned both by multiple industrial consumption reducing, and by disproportionately quality-price ratio in the most „Apa-Canal" enterprises. The significant increase of tariffs for these services that is not accompanied by a corresponding increased quality and efficiency, which requires from economic agents and budgetary organizations to build their own water supply systems or look for other more convenient providers, even in the private sector.

2.3. Economic and financial analysis of water supply services

Despite significant tariff growth, in the majority of enterprises of "Apă-Canal" the expenses related to water supply and sewerage services exceed those incomes with 12% on average or with more than 8,2 million MDL (table 4). Maximum negative differences can be seen in Cahul (44% or 6,4 million MDL), where tariffs are the lowest, and in the enterprises with smaller capacities in Briceni (14%) and Nisporeni (12%). Thus, the significant negative differences are not conditioned only by the tariff level, but by the supplied and discharged water volume, increased network wear and the low level of use of the production funds and available work force, orographic peculiarities and local production, as well as the low management efficiency. However, despite the unfavorable situation, there is a faster increase in income over expenditure. This positive trend is observed in most enterprises in this basin. Besides this, these positive consequences were largely possible due to higher subsidies from the NEF, state budget and external sources contributing to the implementation of the Strategy for Water Supply and Sewerage[3]and other strategical documents in the field. It is necessary that these funds contribute not

[3]RM Government Decision no. 662 of 13.06.2007. In: Monitorul Oficial no. 86-89 of 13.06.2007

only to the increased access to accounted and centralized services of water supply and some current issue solving of the enterprises of „Apă-Canal", but to increase the access and quality of sewage and wastewater treatment and ensure operating sustainability of municipal public enterprises and others authorized operators to provide the services of water supply and sewerage.

On average, the expenditures for water supply service overcome the incomes with more than 11% (4,8 million MDL). Despite the substantial tariff increase in the recent years, in the majority of the enterprises of „Apa-Canal" the expenditures exceed income and the largest negative differences are found in the smaller enterprises from Nisporeni (17%), Briceni (15%) and those in Cahul (24%) and Ungheni (table 4), which have minimal tariffs.

Table 4. The income and expenditure of water supply and sewerage services, in thousand MDL (2014) [9].

No.	District centers	Total			Water supply			Sewerage and treatment		
		Income	Expenditure	Difference	ncome	Expenditure	Difference	Income	Expenditure	Difference
1	Ocnița	1900	2023	-123	1055	1120	-66	846	903	-57
2	Briceni	3279	3730	-451	1527	1751	-224	1752	1979	-227
3	Edineț	12894	13689	-795	7604	8855	-1251	5290	4834	456
4	Glodeni	4380	4240	140	2329	2190	139	2051	2049	2
5	Fălești	6025	5461	564	3322	3322	0	2703	2139	564
6	Ungheni	18265	18572	-307	11261	11455	-194	7005	7117	-113
7	Nisporeni	2867	3212	-345	1291	1508	-217	1576	1704	-128
8	Leova	4156	4465	-309	3008	3277	-269	1148	1188	-40
9	Cantemir	1864	2068	-203	1442	1512	-70	423	556	-133
10	Cahul	14584	20941	-6358	10827	13439	-2612	3757	7502	-3745
	Prut basin	**70215**	**78401**	**-8186**	**43664**	**48429**	**-4765**	**26551**	**29972**	**-3421**

Despite the considerable increase of tariffs, expenditures for sewerage service exceed, on average with 13% (3,4 million MDL), the incomes. In addition, this difference is slightly higher (5%) than in water supply service. However, in the Prut river basin, that difference is low than the country average of 49%, which is conditioned by the situation in the Chisinau municipality. The most overrun is found in Cahul, where expenses for sewerage service 2 times exceed these incomes, which is due to minimal tariffs for sewerage service in this town. Also, the maximum expenditure overrun on income is seen in the small enterprises in Cantemir (32%), Ocniţa (13%) and Nisporeni (8%), while in Ungheni and Leova is found an insignificant overshoot. At the same time, revenue from sewage services exceeds the costs for these services with 20% in Falesti and with 9% in Glodeni.

2.4. Taxes for water consumption

In the Republic of Moldova, the tax system for water use is regulated byTitle VIII of the Tax Code. According to *the Law on Natural Resources*, payments for the use of natural resources reflect the beneficiary's monetary compensation of public spending on exploration, conservation and restoration of water resources. Taxes for water consumption are applied to primary users, who collect surface water or groundwater, for the purpose of their production activities, work and provision services [4]. Water tax is calculated by the payer on the basis of volume of water use. According to recent changes , water tax is levied at the following rates: a) for 1 m3 of water extracted from water fund – 0,3 MDL; b) for each 1 m3 of extracted bottling intended natural mineral water – 16 MDL; c) for every 10 m 3 of water used for hydropower stations – 0,06 MDL. Therefore, the current methodology of tax calculation for water consumption can be easily applied by beneficiaries. Despite its simplicity, the current methodology of tax calculation for water use contains a number of gaps: a) the equal tax to 1 m^3 of water from surface and groundwater sources; b) poorly reflected water supply provision of the territory; c) tax quotas are not subjected to water value and price, but to reduced financial assurance; d) it is not taken into account the ecological status of surface water and groundwater; e) it does not stimulate recycling and water saving.

The tax revenues for water use in the Prut river basin are about 20-25 million MDL, of which about ¼ (5-6 million MDL) are collected in the area of the Prut river basin. Maximum receipts are found at mineral water bottling enterprises, followed by the irrigation, food and agricultural ones. Application of these taxes is aimed to obtaining almost exclusively fiscal effects for district budgets and the economic and environmental effects are greatly reduced. These taxes do not stimulate water saving measurements and are insufficient to achieve the necessary public measures related to restoration and improvement of water resources as required by national and European legislation. The current mechanism of fees for water consumption is focused only on getting the fiscal effects and the economic and environmental effects are insignificant. That tax rates need to be adjusted to the inflation rate, the cost of maintenance and restoration of water sources, to the complex value: economic, environmental and social of water resources.

A difficult and widespread problem is the superficial and even the lack of recording at many mining and agricultural enterprises, which coniderably reduces water consumption data and tax receipts for water. Also, due to free use of water by households that are not connected to centralized networks, a large part of users in that category are not involved in the direct bearing of the cost of supervision and restoration of water sources. Moreover, due to low coverage of sewerage and treatment systems, most of sewage from rural areas is not monitored, but is subject of an increased impact of household noxious discharge.

2.5. Tariffs for water supply services

Tariffs for public water supply services are applied to secondary users which are supplied by public or private enterprises authorized to provide these services. They are intended for main 3 categories of consumers, which are assigned separate tariff quotas: 1) population and households, including nutrition and sanitation, irrigation of the lots nearby the house, and maintaining livestock; 2) budgetary organizations; 3) economic agents performing various entrepreneurial activities and request the purchase of such services. The amount and procedure of charging for public water supply, sewage and treatment are set out in Decision no. 741.of National Agency for Energy Regulation (NAER) from 18.12.2014 on „Methodology of determination, approval and application of tariffs for public water supply, sewerage and waste water treatment". This methodology is developed in accordance with the provisions of the Law on public utility service no. 1402-XV of 24.10.2002, on Drinking Water Act no.272-XIV of 10.02.1999, Law no. 303 of 12.13.2013 on public water supply and sewerage, Law no. 397 of 16.10.2003 on local public finance. Also, recent methodology amendments is adjusted to Article 9 of the Water Framework Directive 2060/EC and focuses on the "beneficiary and polluter pays" and water supply and sewerage cost recovery from the service tariffs. Meanwhile, tariff shares for water supply and sewerage services are set only on categories of users and their ability to pay, but not on the complex value (economic, recreational and ecological) of the water objectives and sources, the cost–efficiency analysis in accordance with the WATECO Guidelines [7] on the methodology of economic evaluation of water use and restoration of water status.

Table 5. General tariff for water supply services by the enterprises of the Asociation " Apă-Canal" in the Prut river basin, MDL/m3 (without VAT) [2], [9]

No.	TAU	2007	2008	2009	2010	2011	2012	2013	2014	average	growth%
1	Ocnita	9,5	9,5	9,5	14,2	15,5	19,2	19,2	9,2	14,5	202
2	Briceni	12,5	12,5	12,5	12,8	12,8	12,8	12,8	12,8	12,7	103
3	Edinet	9,1	13,5	21,4	21,4	21,4	21,4	21,4	21,4	18,8	234
4	Glodeni	14,6	14,6	14,6	19,5	23,6	23,6	23,6	23,6	19,7	162
5	Fălesti	10,2	10,2	10,2	10,2	12,4	12,4	14,5	14,5	11,9	142
6	Ungheni	4,0	6,2	6,2	6,2	7,7	7,7	9,0	9,0	7,0	224
7	Nisporeni	10,2	10,8	15,1	15,1	21,9	13,7	16,9	16,9	15,2	156
8	Leova	6,3	8,3	8,3	8,3	13,7	13,7	21,0	21,0	12,6	334
9	Cantemir	8,8	8,8	13,3	13,3	14,1	14,1	14,1	14,1	12,5	160
10	Cahul	9,0	9,0	11,3	11,3	11,3	11,3	11,3	1135	10,7	125
	Totally	**10,1**	**10,3**	**12,2**	**13,2**	**15,4**	**15,0**	**16,4**	**16,4**	**13,6**	**173**

The amount of general tariff for water supply service in the Prut river basin is nearly 13,6 MDL/m^3, and in 2014 it was 16,4 MDL/m^3, which is more than the

country average (Table 5). In the period under review, due to faster growth of tariffs in the Prut river basin, the difference was doubled. General tariff increase for water supply service is 73% on average, from 9,5 MDL/m^3 to 16,4 MDL/m^3. Triple tariffs are registered in Leova and double ones in Edineţ, Ungheni and Ocniţa.

Minimum quotas are set at enterprises in Ungheni (8,98 MDL/m^3) and Cahul (11,3 MDL/m^3), which capture water at lower prices directly from the Prut river and the higher volume of supplied water allows them to achieve scale economies compared to small enterprises. Peak (over 20 MDL/m^3) of the general tariffis is set in Glodeni, Edineț and Leova, exceeding about 2 times the minimum quotas. A similar ratio is stated about the tariffs for the established categories of consumers. At the same time, this difference in the Dniester basin is about 6 times.

Overall, the tariff for water supply to population and economic agents records an increase of over 50%, while the tariff for budgetary organizations increases with only 37% (Table 6). Unlike the Dniester basin, the growth rate of tariffs for population insignificantly overcomes the growth rate in the other categories of consumers and cross-subsidization of tariffs is preserved. In most enterprises in the Prut river basin water supply tariff for the population has increased with 50% - 70%, in Leova were tripled and doubled in Edineț (Fig. 4).

Table 6. Tariffs for public water supply services for the enterprises of the Asociation „Apă-Canal" in the Prut river basin per categories of consumers, lei/m^3 (without VAT)

Category	2007	2008	2009	2010	2011	2012	2013	2014	Average	Growth,%
Average tariff	9,5	10,3	12,2	13,2	15,4	15,0	16,4	16,4	13,6	173
Population	7,3	7,9	8,9	9,5	11,4	10,9	11,8	11,8	9,9	160
Budgetary organization	21,6	21,6	22,3	26,2	27,8	28,4	29,4	29,4	25,8	137
Economic agents	22,0	22,0	25,7	28,4	30,8	30,5	33,2	33,2	28,2	151

The smallest increase (up to 20%) is stated in Briceni and Făleşti. Like general tatiff, the minimum quotas are registered at larger enterprises in Ungheni (5,8 MDL/m^3) and Cahul (9,0 MDL/m^3) and the maximum ones at the smaller enterprises in Leova (16,0 MDL/m^3), Ocniţa (15,1 MDL/m^3) and Nisporeni (14,0 MDL/m^3). Unlike the other categories of consumers, the difference between the established tariffs is much smaller (up to 10 MDL/m^3). Tariffs for the economic agents' water supply service were increased 5 times in Ocniţa and 2 times in Edinet and Glodeni and remained virtually unchanged in Cahul and Făleşti (Fig 5). A similar dynamics, but slightly slower, is stated for water supply tariffs for budgetary organizations. In addition, the Nisporeni's tariffs for budgetary organizations were even reduced both for water supply service and sewerage with 36%. For these categories of consumers, the maximum tariffs of over 40 lei/m^3 are

set out in Glodeni and Nisporeni and the lowest in Ungheni and Cahul. Despite the existant differences, there is a tendency of levelling the tariffs.

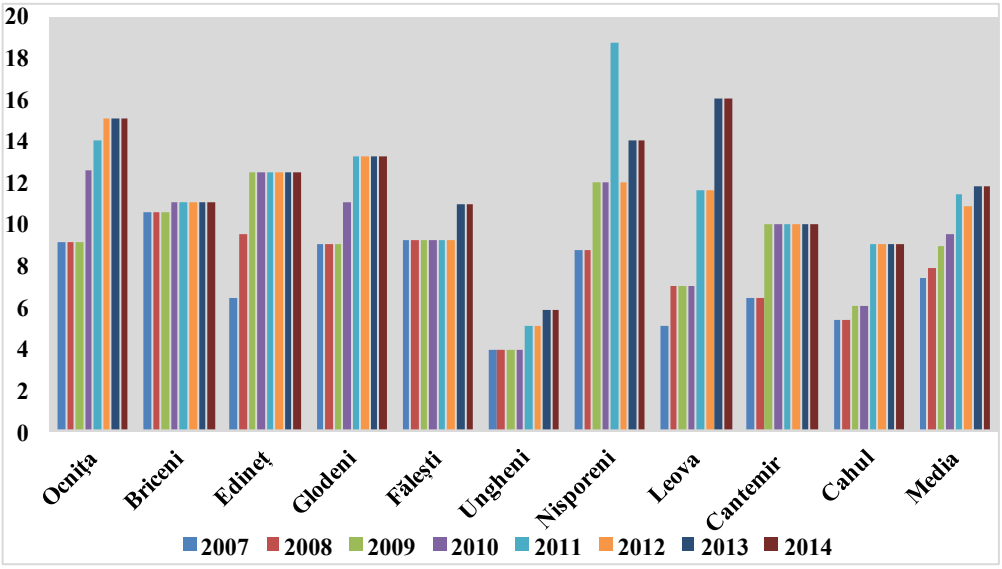

Fig. 4 Tariff dynamics for water supply of population, MDL/m^3 [3], [9]

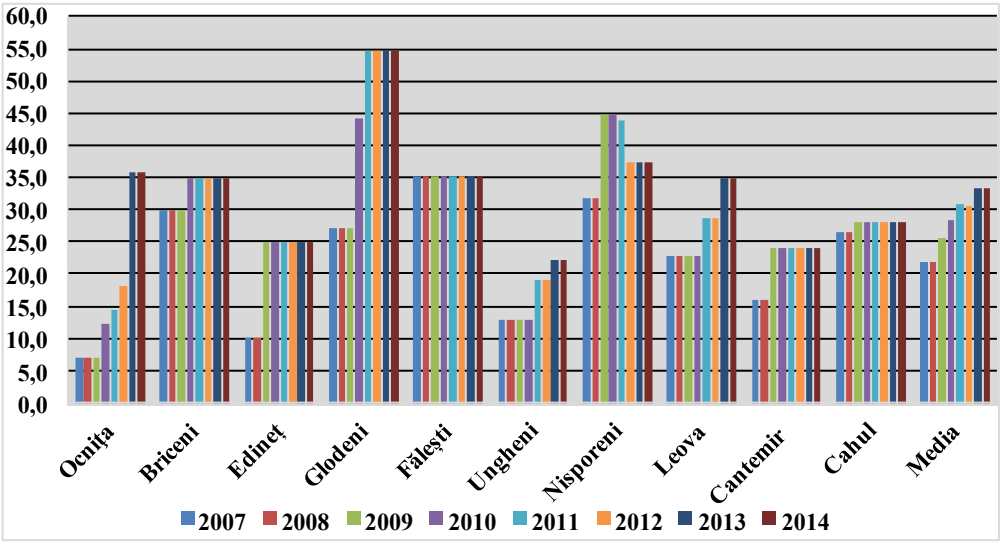

Fig. 5. Tariff dynamics for economic agents' water supply, MDL/m^3 [3], [9]

Overall, the enterprises of the Association "Moldova Apă-Canal" in the Prut river basin, register an insignificant negative difference (-0,13 MDL) between tariffs and prime-costs of water supply services (Table 21). At the same time, this difference is less than the Republic's average of the association (-0,63 MDL). Also, in the the Prut and Dniester river basins, there is a significant decrease in the negative difference, which is due to a greater extent to considerable tariff increase (>60%), as well as to a more efficient use of electricity, labour and other significant production factors. This fact proves the start of a trend to increase the efficiency of the enterprises of "Apa-Canal" after nearly two decades of decline and decay. As mentioned above, it is necessary that these positive results to generate increasing profitability of the enterprises and the services, as well as saving and improving water quality, ecological improvement of water resources, basins and water bodies.

Table 7. The tariff and prime-cost of water supply and sewerage services, in thousand MDL (2014)

	Localities	Total			Water supply			sewerage		
		Tarif	Prime-cost	Dife-rence	Tarif	Prime-cost	Dife-rence	Tarif	Prime-cost	Dife-rence
1	Ocnița	37,3	37,1	0,19	19,19	19,1	0,1	18,1	18	0,1
2	Briceni	27,2	35	-7,84	12,82	16	-3,2	14,34	19	-4,7
3	Edineț	39,2	34,5	4,74	21,35	19,9	1,5	17,89	14,6	3,3
4	Glodeni	48,6	44,2	4,39	23,61	20,1	3,5	24,98	24,1	0,9
5	Fălești	31,2	27,6	3,62	14,51	13,9	0,6	16,71	13,7	3,0
6	Ungheni	17,6	17,8	-0,24	8,98	9,2	-0,2	8,58	8,6	0,0
7	Nisporeni	36,6	43,6	-6,96	16,92	20,8	-3,9	19,72	22,8	-3,1
8	Leova	42,2	37,6	4,6	21,03	21,5	-0,5	21,17	16,1	5,1
9	Cantemir	20,5	22,7	-2,17	14,05	14,4	-0,4	6,48	8,3	-1,8
10	Cahul	15,8	24,4	-8,58	11,25	14,2	-3,0	4,57	10,2	-5,6
	Total	**31,6**	32,45	**-0,83**	**16,4**	**16,9**	**-0,5**	**15,3**	**15,5**	**-0,3**

Charges for water pollution.

According to Article 9 and Annex 5 of Law on Environmental Pollution , water pollution payment shall be applied for: 1) discharges of waste water pollutants into water bodies and sewerage systems; 2) discharges of pollutants into receiver-tanks, fields of filtration, drainage collectors; 3) water discharges from fishery ponds; 4) the rain leaks from the territory of enterprises; 5) the heat exchange water release. These payments are charged from polluters for the normative and over-normative discharges. The calculation formula includes the produce of: a) payment norm; b) aggression coefficient; c) the actual mass of discharges Payment for the discharge of pollutants is mandatory for all water consumers. According to Article 2 of this law, payments for discharges of pollutants are collected only from the water supply beneficiaries who carry on an

economic activity that generates pollutants. Usually, this payment shall be paid only by large and medium capacity enterprises and the majority of budgetary organizations are not included in the list of payers. Frequently there are not applied discharge payments for the manures pollutants from animal breeding complexes, especially from the sheep ones, many of which are located in the immediate proximity of rural settlements and do not meet environmental and sanitary norms.

Overall, in the Prut river basin, the amount of payments calculated for the discharge of waste water pollutants is about 1 mln MDL or 20% of the country amount [12]. Thus, in spite of predominantly agrarian and small number of industrial enterprises, the share of this basin in the amount of pollution taxes (20%) is double if compared to the share of discharged water volume (10%) on the right bank of the Dniester river.

In the period under review, there is a variable evolution of the amounts paid for the Prut river basin water pollution. At the same time, this variable evolution is marked by an overall positive trend in most of its districts. Overall, there was a doubling of the amount of those payments, and the highest increase is observed in Nisporeni, Cantemir and Râşcani. About half of the amount of payments for pollution originates from the enterprises in agriculture and food industry, followed by fuel marketing and service and transport companies. In the northern districts of the basin, the mining industry lies among the top positions.

Conclusions

The Prut river basin has an essential contribution to population and agricultural water supply in the west of the country. For agricultural needs are used about 70% of water use in the basin, including ¼ - for irrigation. For household needs is used about 20% of abstracted water. Less than 10% of captured waters are used for the technological purposes. A difficult and widespread problem is the superficial and even the lack of recording at many mining and agricultural enterprises, which coniderably reduces water consumption data and tax receipts for water.

In the analyzed period, the total water used show a negative trend. This is due to a significant reduction (-15%) of the volume of water used in agriculture, particularly for irrigation. The volume of water used for domestic neads does not records an negative dynamics and the rapid expanding of water supply networks will contribute to increase the consumption of household waters.

Major irrevocable losses (40%) in transportation and technological and drinking water use are conditioned by similar degree (40%) of the wear of fixed assets in this field. In addition, there are used only about 20% of fixed assets,

which is conditioned both by multiple reducing of industrial consumption and disproportionate ratio between quality-price of these services.

Despite multiple increase (3 times) of tariffs and sales revenue, total expenditure and consumption exceeds income in the majority of enterprises „Apa-Canal" in the Prut river basin. Thus, the average profitability is only 10% and in some companies it is observed even a negative profitability (Cahul, Nisporeni). This situation requires urgent actions to modernize the equipment, professional development of employees and of technical and managerial staff.

The current mechanism of water tax is focused only on getting the fiscal effects and the economic and environmental effects are insignificant. That tax rates need to be adjusted to the inflation rate, the cost of maintenance and restoration of water sources

Tariff quotas for water supply services are set only on categories of users and their ability to pay, but not on complex value of water resources and cost-effectiveness analysis and on restore the ecological status of water sources. It is necessary that the tariff increase and difference towards the prime-cost to contribute not only to the profitability increase of these companies, improvement of the quality of water supply and sewerage service optimizing the ratio quality-price, but also to the more economical use, diminished harmful impact and improved water resources quality.

References

1. Activitatea sistemelor de alimentare cu apă şi de canalizare în anii 2007-2014. In: statistica.md.
2. **Bacal P.** (2010). Gestiunea protecţiei mediului înconjurător în Republica Moldova. Aspecte teoretice şi aplicative. Chişinău: ASEM, 2010, 240 p.
3. Buletinul informativ privind tarifele pentru serviciile de aprovizionare cu apă şi canalizare. In: amac.md.
4. **Codul Fiscal al Republicii Moldova** (nr. 67 din 05.05.2005). Titlul VIII. Taxele pentru resursele naturale. In: Monitorul Oficial nr. 080 from 10.06.2005.
5. **Danube River Basin Management Plan**. In: icpdr.org/main/publications/danube-river-basin-management-plan.
6. **Environmental protection of international river basins** (EPIRB). In: www.enpi-info.eu
7. **Guidance document no. 1.** Economics and the Environment. The Implementation Challenge of the Water Framework Directive.Luxembourg: Office for Official Publications of the European Communities, 2003.
8. **Hotărârea nr. 164 a Agenţiei Naţionale pentru Reglementare Energetică din** 29.11.2004 privind Metodologia determinării, aprobării şi aplicării tarifelor pentru

serviciile publice de alimentare cu apă, de canalizare şi epurare a apelor uzate. In: Monitorul Oficial nr. 218-223 from 03.12.2004

9. (2014). Indicii financiari şi de producţie ai activităţii întreprinderilor de alimentare cu apă şi canalizare ale Asociaţiei „Moldova Apă-Canal". Chişinău, 2015. 106 p.

10. Planul de management al spațiului hidrografic Prut Bârlad. In: www.rowater.ro

11. Rapoartele anuale generalizate privind Indicii de gospodărire a apelor în Republica Moldova. Direcţia bazinieră a Agenţiei„Apele Moldovei". (2007-2014).

12. (2003-2014) Rapoartele anuale privind calitatea factorilor de mediu şi activitatea Agenţiilor şi Inspecţiilor Ecologice.

13. Sîrodoev I. G., Knight Gr. Vulnerability to water scarcity in Moldova: likely threats for future development. In. Present Environment and sustanaible development. No. 2, 2008, p. 6-14.