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Geographical and Economic Aspects of Water Use in the Dniester Basin (The Sector of the Republic of Moldova)

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ABSTRACT

The purpose of our research was to elucidate the spatial and economic aspects of water use in the Dniester basin. The main topics under analysis were the dynamics of captured and used water in the Dniester basin, the demand on water resources, issues on assessment and monitoring of used water, and cost and efficiency of water supply services. To achieve these objectives we used traditional methods of geographical and economic research, especially focusing on the methodology used in the elaboration of management plans of hydrographical basins and their subsections on the status of water resources and water bodies and on the economic analysis of water use. The Dniester Basin holds over 90% of water consumption, most of which is captured from surface sources and used by industrial enterprises on the left bank of Dniester River, especially by the Thermoelectric Plant in Dnestrovsk. On the right bank of Dniester there are several communal enterprises, specialized in agricultural and food industry, and in most of the localities water is captured from groundwater sources. Irrevocable losses exceed 40% of captured water, due to the poor state of the equipment. The actual payment of water tax is very low, which allowed for the increase of water consumption and irrational use. The taxes for water supply services are below the primary costs and of negative profitability in the case of the majority of water supply enterprises.

1. INTRODUCTION

The present study represents an interdisciplinary approach on water management in the Dniester river basin. This basin holds almost 60% of the area, but provides more than 95% of water consumption of Moldova [1]. In the Dniester Basin there are concentrated most of the urban and industrial centres and agricultural farms. The purpose of this study is to supplement the necessary information support for drafting the Management Plan of Dniester Basin in accordance with EU Directive (2000/60/EC) on integrated management of river basins [2].

The main objectives of this research are: to establish trends and issues of water management in the Dniester basin; elucidate the spatial and branch aspects of capturing and using of water resources; analyse the recent dynamics of coverage degree and efficiency of water supply services; analyse the achievements and problems of implementation of water tax and tariffs; identify the key issues and elaborate recommendations on the optimization of water resources management in the Dniester basin.

According to the official statistics, currently the total volume of captured and used waters has decreased by 5 times compared to 1990. The main causes of this trend are: the decrease in the volume of industrial and agricultural production; the partial presentation of data on water management; the deplorable state of many water pumping stations and aqueducts; the superficial control of water use and wastewater discharge [3], [4, p. 66].

The Dniester basin covers about 60% of the surface of the country and contributes with over 90% of the total volume of captured and used waters, which is why the situation of this basin determines the general situation in Moldova. Over 80% of water is captured from surface sources and used by companies on the left bank of Dniester river. On the right bank of Dniester there are captured about 166 million m³ (fig. 1), including 80 million m³ in Chişinău. Only in Dnestrovsk Chişinău and Soroca towns over 90% of captured water is coming from surface sources. The main tributaries of the Dniester - Raut, Bâc and Botna (fig. 2) have a small share (4%) and more than 80% of the water is captured from underground sources.

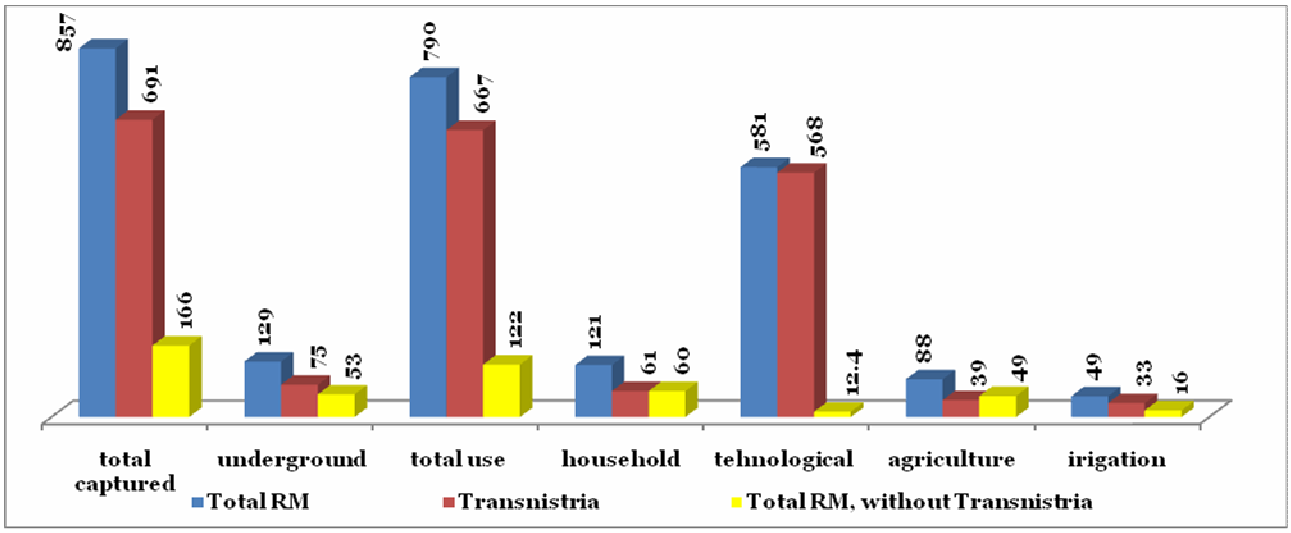

Fig. 1. Volume of captured and used water, in millions m³ (average 2007-2013). *Sources: Figures 1-2 and tables 1-3 are elaborated by author after data from [1].*

Over ¾ (581 million m³) of the captured water from the Dniester river basin is used for technological purposes by the industrial enterprises, especially by the energetic plants [7]. The role of food and agriculture is much lower. In the basins of Raut, Bâc and Botna rivers, the share of water used for technological purposes is significantly lower than the share of water used for domestic and agricultural purposes.

One of the main topics approached in the present study is the economic regulation of water use. For this purpose we analyzed the current methodology of water consumption taxes, applied to primary users and tariffs for water supply, which are applied to secondary users. The applied water taxes and tariffs do not cover the full cost of restoration and protection of water resources, whilst the environmental and economic effects of these tools are insignificant.

2. THEORY AND METHODOLOGY

The present research is based on recent analytical studies on the implementation of the Management Plan of River Basin, which is stipulated in the EU Directive (2000/60 / EC) on integrated water management [2]. The authors focused on management plans, which are currently being implemented, such as the Danube River Basin Management Plan [6], the Management Plan of River Space Prut-Bârlad [7]. These plans must include a detailed diagnosis of the status of basins and water bodies, recent trends of water consumption and water use analysis and economic analysis. Based on this diagnosis shortcomings and achievements of current water management are established and action plans are drafted 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 the research methodology and study on cross-border (international) rivers in the Black Sea Region and Belarus (EPIRB Program) [5]. Also, for the elucidation of spatial, economic and social aspects, of water use in Moldova various international publications in the field were consulted, especially studies carried out by Sîrodoev and Knight (2008) jointly with local and foreign researchers.

The main methods 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 the statistical data on the capture and use of water in all administrative-territorial units from the Dniester basin. The analytical method was used: a) to identify qualitative aspects of water supply system; b) to diagnose the situation in this area; c) to establish the problematic situations in regulating economic, legal and institutional system; c) to elaborate recommendations to prevent problematic situations; d) to define the priority directions of activity optimization of water resources management in the Dniester basin. The comparative method was applied to establish 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 all economic and administrative tools for the water resources management, but the version offered for publication is used only for water consumption taxes and tariffs for the provision of water and sanitation.

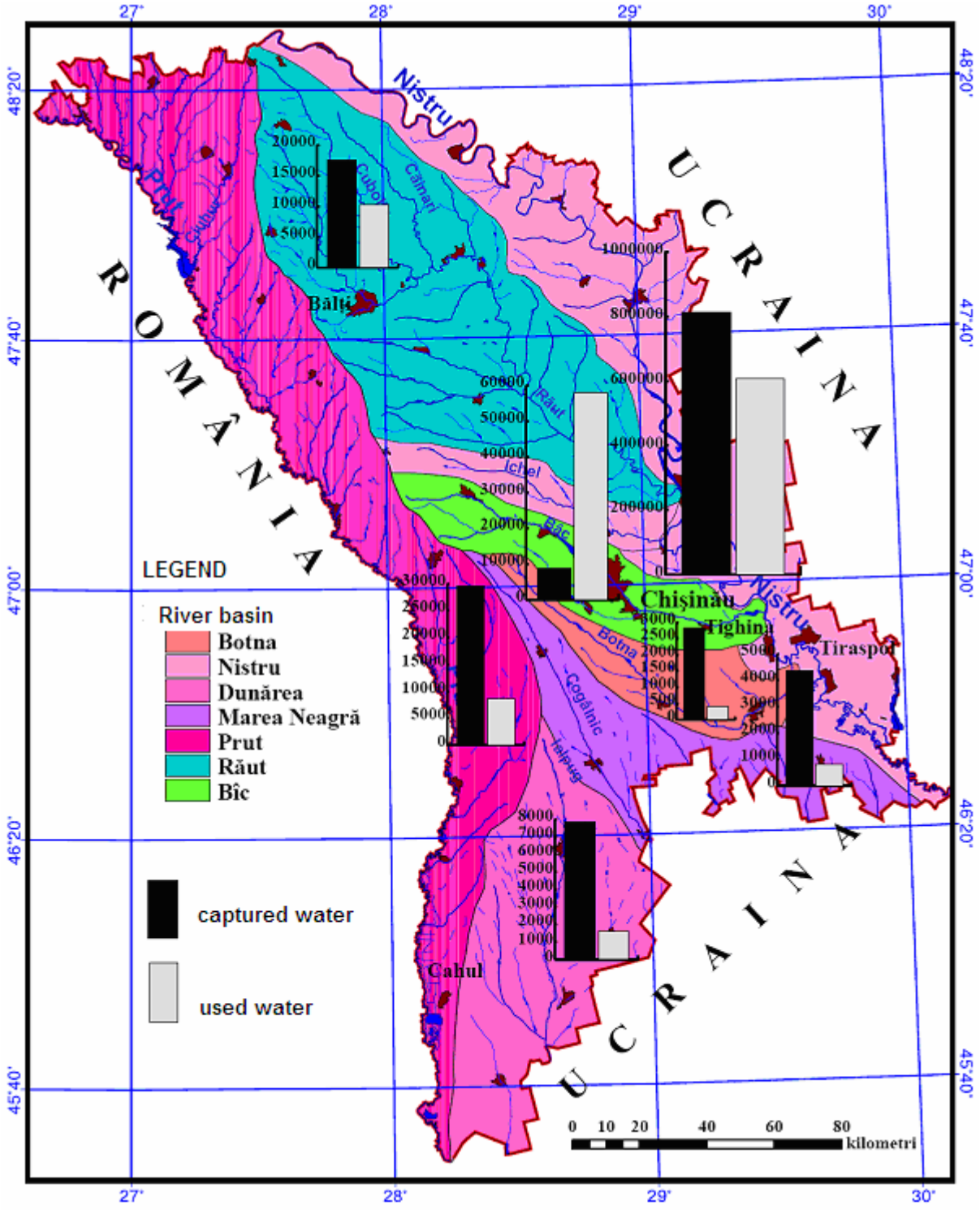

Fig. 2. The captured water and used wastewater in the hydrographical basins (thousand m³).

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

The study covers mostly the period of 2007-2013. The results of this study were used by the author in preparing Chapter 7 (economic analysis of water use) of the Management Plan of Dniester River Basin in the period February-July 2014.

3. RESULTS AND DISCUSSIONS

3.1. Water capturing

According to the water management indices by hydrographical basins, total volume of captured water is about 857 million m³, of which over 90% are captured in the Dniester basin and over ¼ from Dniester riverbed (table 1). Over 80% (691 million m³) of water is captured by enterprises on the left bank of Dniester (Transnistria), including over 70% (552 million m³) from Dnestrovsk TEP [1]. This energetic company determinates the general situation in the Republic of Moldova in case of most of the indices of water management, even though the situation is totally different in the rest of country, especially in case of wastewater purification. Also, a large volume of water is captured in the towns of Tiraspol (27 million m³), Bender (24 million m³) and Râbnița (16 million m³), but the absolute majority of used water in these towns is captured from underground sources. On the right bank of Dniester there are captured 166 million m³ (fig. 1), including 85 million m³ in Chișinău, in the districts of Soroca – 7.4 million m³, Orhei – 4.0 million m³, Anenii Noi– 3.7 million m³, Căuşeni – 3.5 million m³ and Ştefan-Vodă – 2.8 million m³.

Over 80% of water is captured from surface sources, but this share is conditioned almost exclusively by TEP from Dnestrovsc, and by Chișinău municipality, Soroca town, Ștefan-Vodă and Dubăsari districts. About 50% of water is captured from surface sources in the Râbnița town – for heavy industry and in the districts of Criuleni, Anenii-Noi and Căușeni– for irrigated agriculture, which are partially destroyed.

The Dniester riverbed contributes with over ¼ of the total captured water from the Dniester basin and about two thirds of captured groundwater from this hydrographical basin. Also, only in Chişinău and Soroca, over 90% of surface waters are captured through from Dniester riverbed. In the rest of localities of Dniester basin water is captured, almost exclusively, from the underground sources, and the Dniester River and its tributaries have only the function of natural receptors of the polluted wastewaters.

The implementation of the recent programs on water provision and sanitation will contribute to the increase of the role of Dniester riverbed, which is less polluted.

Table 1. Volume of captured water.

Hydrographical Basins	The captured waters				
	Total		Surface sources,	Underground sources	
	million m³	(%)	million m³	million m³	(%)
Dniester	821	96	716	107	13
Dniester riverbed	222	26	150	72	32
Răut	15.6	1.8	2.5	13.1	84
Răut riverbed	4.6	0.5	0.37	4.2	91
Bâc	8.3	1.0	0.20	8.0	96
Botna	2.4	0.3	0.46	1.9	79
Republic of Moldova	857	100	728	129	15
Whithout Transnistria	166	19	113	52.6	32
Transnistria	691	81	615	75.2	11

In spite of the surface and large number of crossed localities, Răut basin has a reduced share of 2 % of the captured waters. Over 80% of the captured water is provided by the underground sources. Also on the right bank, Raut basin contributes with about 40% of water used in irrigation and agriculture. The share of Bâc basin is of 1% of the total captured water and 5% of captured water on right bank of Dniester. Almost the entire water quantity (96%) is captured from underground sources. The Botna basin has the lowest share – of 0.3% and about 80% of water is captured from underground sources (table 1).

The irrevocable losses exceed 20% of the total captured water and over half of the captured water outside of Transnistria (table 2). Technical and transport losses exceed over ¼ of the volume of captured water each. Also, water losses are conditioned by the poor state of technological installations and, in particular, by the networks of water supply and sewage disposal.

The major losses of captured water significantly reduce both the efficiency of water supply and sanitation enterprises, and of other social and economic activities, especially of tourism in the disadvantaged rural areas. The minimum losses of captured water are found at industrial enterprises from Transnistria whereas the maximum losses – at the agriculture companies from Dniester riverbed (75%) and from Botna basin (88%). Data regarding the irrevocable losses from Bâc and Raut basins are denaturized and compensated by water captured for Chişinău and Bălţi municipalities from the Dniester

riverbed. Over 60% of the irrevocable technological losses of water are coming from Transnistria, especially from Dnestrovsk TEP, but in relation to the total water captured they are only 10% and determine the average losses per country (14%). Overall, the irrevocable losses of water transport (7.1%) are conditioned to a large extent, by the situation in Dnestrovsk TEP (3%).

On the right bank of Dniester, transport losses exceed ¼ of captured water, being conditioned, especially by those losses from sanitation and agricultural companies. Also, water losses are conditioned by the deterioration level of equipment, technological installations, and in particular of water supply and sanitation networks.

Table 2. Irrevocable losses of captured water (average 2007-2013).

Hydrographical Basins	Irrevocable losses of captured water					
	Total		Technological		at transportation	
	million m³	(%)	million m³	(%)	million m³	(%)
Dniester	159	19,3	98.8	12	58.2	7.1
Dniesters riverbed	168	75	111	50	53.8	24
Răut	5,8	37	3.4	22	1.9	12
Răut riverbed	- 4.1	-	- 5.2	-	0.94	20
Bâc	- 46	-	- 47.1	-	1.41	17
Botna	2.2	88	2.0	80	0.18	7.7
Republic of Moldova	186	22	120	14	63.0	7.4
Without Transnistria	89.3	53	50.6	30	42.7	26
Transnistria	96.8	14	69.8	10	20.4	3

Table 3. Volume and share of water used by category of use and hydrographical basins.

Hydrographical basins	Total		Household		Technological (industry)		Agriculture		Irrigation	
	million (m³)	(%)	million (m³)	(%)	million (m³)	(%)	million (m³)	(%)	million (m³)	(%)
Dniester	763	96	115	15	579	76	67.2	8.8	42	5.5
Dniesters riverbed	167	21	105	63	21.2	13	40.7	24	35	21
Răut	13.8	1.7	2.3	16	1.2	8.7	10.3	75	2.2	16
Răut riverbed	3.7	0.5	1.2	34	0.7	19	1.7	47	0.36	10
Bâc	6.5	0.8	2.6	41	1.4	22	2.8	43	0.24	3.7
Botna	2.3	0.3	0.3	13	0.1	3.9	1.8	77	0.45	20
Republic of Moldova	790	100	121	15	581	74	87.5	11	48.5	6.1
Without Transnistria	122	15	60	50	12.4	10	48.5	40	15.7	13
Transnistria	667	84	61	9.1	568	86	39	6	32.5	5

3.2. Water use

The spatial and branch structure of used water is almost identical with that of captured water. Thus, in the Dniester basin are used over 90% from total used water in the Republic of Moldova (table 3). Also, over 80% (667 million m³) of total volume of water is used by the companies located on the left bank of Dniester, including 552 million m³ by Dnestrovsk TEP. The maximum consumption of water in Transnistria is conditioned by the high level of industrialization, development of productive and social infrastructure of the region and by the geopolitical factor [2, p. 69]. For example, the volume of water used by enterprises in Bălți city is over 4 times lower than that used in the Bender town and 2 times lower than those of the Râbnița town. At the same time, the total population of Bălți and Bender municipalities is almost identical (130,000 inhabitants) and 3 times higher than of the Râbnița town. This situation is a result of a significant geopolitical influence in the achievement of industrialization policy and socio-economic development during the Soviet period. Therefore, because of the Transnistrian conflict, most of the economic branches in this region, including tourism, have been in a long period of decline.

Overall, over ¾ of the water is used by industrial enterprises, especially by Dnestrovsk TEP. The role of food industry and agriculture is more reduced, compared to other basins, except for the Criuleni, Anenii-Noi and Ştefan-Vodă districts, with traditional irrigation agriculture, yet partially destroyed. At the same time, if we exclude this energy company, then on both banks, most of the water is used by communal and agri-food companies and by public educational and health organizations [8]. Also, in Criuleni, Dubasari, Anenii-Noi and Ştefan-Vodă districts up to ½ of the captured water is used for irrigation purposes. In the Dniester riverbed and in the river basins of Raut, Botna and Bâc, the share of water used for technological purposes is significantly lower than the share of water used for household needs and agriculture.

For household needs there are used about 115 million m^3, on average, or only 15% of the water consumption in the Dniester basin, which is conditioned by maximum consumption from Dnestrovsk TEP. However, from the Dniester riverbed over 60% of water is used for household needs, because it provides drinking water to the population of the major urban centres of the country, including Chişinău, Soroca, Bălţi, Bender, Tiraspol, Râbniţa. Moreover, communal enterprises predominate in most of the administrative-territorial units on both banks of Dniester River. Outside Transnistria, on the second position we find the agri-food companies, especially the sugar factories from the northern region and food companies in Chişinău. Along with the service companies, we also mention the medical institutions of Chişinău municipality, Dubasari and Călăraşi districts. In addition, about half of the water captured by building enterprises in the capital is used for domestic purposes.

Only 8.8% of the water used in the Dniester basin is employed in agriculture there (67 million m^3), including 1% in Transnistria. On the right bank of Dniester, the share of agriculture exceeds 40% of the water used. However, in the basins Botna and Raut, the share of agriculture is of over 70%. For irrigation and fisheries water is used only in the lower course of Bâc riverbed, for wish purposes artificial lakes and channels are built. For irrigation there are used 48,5 million m^3 (5,5%) on average, including 32,5 million m^3 on the left bank districts that have a more extensive and developed irrigation infrastructure. From Dniester riverbed is captured over 70% of the water used for irrigation. On the right bank of Dniester, 13% of captured water are used for irrigation purposes. The maximum volume of water used for irrigation is found in the districts of Ştefan Vodă (1.7 million m^3), Anenii-Noi (1.5 million m^3) and Dubăsari (920 thousand m^3). Also, over 20% of water captured in the Botna basin is used for irrigation, especially for the lakes along its riverbed in the Ialoveni district. In the case of Bâc river basin the minimum share of only 4% is explained by the higher water supply and by the priority consumption of the communal, industrial and agricultural enterprises.

Răut basin has a primordial role in the water provision for the communal and industrial enterprises, located in Bălţi town, Floreşti, Sângerei and Orhei districts. Also, over 3/4 of captured water is used in agriculture, including irrigation works, 16% for the households and 9% for technological purposes, employed especially by food and mining companies.

Several medium-sized urban centres are located in Bâc River Basin, such as: Călăraşi, Străşeni, Anenii-Noi, which is why the share of the communal sector is higher (41%) and irrigated agriculture is developed almost exclusively in lower course of the river, where artificial lakes and channels for water accumulation and distribution were constructed. Over ¾ of the captured water in the Botna river basin is used in agriculture, including 20% for irrigation.

3.3. Water supply services

Water supply services are offered by:

a). Local companies of Association "Moldova Apă-Canal" for household and technological use, which contributes with over 80% to water provision and 90% to sewerage and wastewater purification.

b). Irrigation District Associations, their infrastructure is mostly deteriorated and/or destroyed.

c). Industrial enterprises, especially sugar factories, mining, building and energetic companies.

d). Water users associations from rural areas – for household, agriculture and irrigation uses.

e). Small enterprises or individuals that provide water supply services in rural areas.

Due to reduced profitability and frequent conflicts with the local authorities and population, in many rural localities, especially in the central districts, we find multiple cases of abandonment of provision of such services on the entire perimeter of villages or in their problematic sectors [8].

To prevent these problems it is necessary that the regional and local projects for the expansion of infrastructure and centralized water supply services to ensure the sustainability of these activities. In addition, the expansion of water supply infrastructure must be accompanied by a similar expansion of the sewerage network. These requirements were recently included in both the draft regulation for this field, and in the regulations of the specialized companies of water supply and of environmental, social and regional funds that fund such projects. Despite their obligatory character, these requirements are frequently not followed in practice. In the years 2006-2013, the aqueducts' length increased by more than 2000 km (+ 54%) from 6847 km to 9901 km (fig. 3) and their number – from 540 to 779 (+44%). At the same time, the length of sewage networks increased by less than 100 km (+ 4%) – from 2540 km to 2633 km

[10], and their number decreased by 16%, from 182 to 156 units.

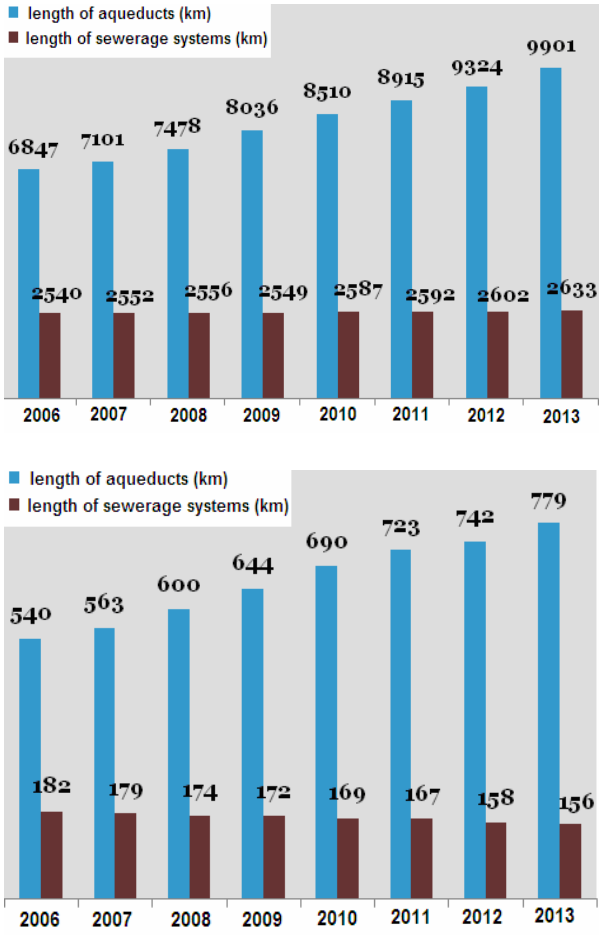

Fig. 3. The dynamics of aqueducts and sewerage systems.

The coverage of water supply networks sewers decreased from 34% to only 20% in the respective period. More than that, the abandonment of sewage networks is observed, in most cases, in rural areas and mono-specialized small towns, which went through a process of intense ruralisation in the last two decades. Despite the very active promotion of centralized water supply projects only 1% of the rural population and only 16 villages out of over 1500 currently benefit from centralized water systems. This critical situation stimulates the massive depopulation of rural areas in the Republic of Moldova and significantly limits the development of rural space [3], especially affecting the incoming tourism in this area.

The total length of aqueducts and water supply networks of "Apă-Canal" enterprises located in the Dniester basin is of about 3393 km (table 5), including 1877 km in Chişinău (55%), 265 km in Bălţi, in Orhei – 204 km and in Floreşti – 141 km. In the Dniester's Basin, water supply services are provided by 318 pumping stations and 358 artesian fountains, with a total capacity of 682,000 m³/day [9, p. 15-26]. The company of "Apă-Canal Chişinău" has 184 pumping stations (34%) and 72 artesian wells, which can pump up to 440 thousand m³/day. Bălţi Municipality has 28 pumps and 67 artesian fountains with a total capacity of 47,000 m³/day. However, water supply in Bălţi and Soroca and other several localities (Floreşti, Drochia and Râşcani) is provided by the company "Aqua-North" Soroca, which captures water from Dniester riverbed and its capacity is up to 100,000 m³/day. In other localities (except for Orhei and Soroca) the capacity of pumping stations does not exceed 10,000 m³/day. Because of the massive economic decline during the transition period, only 30% of the capacity specified in the project documentation is currently used. For example, only 46% of the capacity is used in Chişinău and up to 30% in most of the other localities.

Tabel 4. Development level of aqueducts and sewerage systems, (%).

Type of beneficiary	Total		Urban areas		Rural areas	
	Aqueducts	Sewerage	Aqueducts	Sewerage	Aqueducts	Sewerage
Localities	39	10	77	67	36	1
Population	42	21	69	50	23	1

The enterprises of "Moldova Apă-Canal" Association annually provides over 60 million m³ of water or about 50% of the total water used in the country and 80% of the Dniester basin. Over 45 million m³ (75%) of water are supplied by the company "Apa-Canal Chişinău", 7.5 million m³ (12%) – by Soroca „Aqua-North" and 3.7 million m³ – by "Apa-Canal Bălţi". For the needs of the population there are used 42 million m³ or 68% of the total water supplied, including in Chişinău – 35.2 million m³ (78%) and Bălţi – 2.6 million m³ (71%). To economic agents are provided with about 17 million m³ or 27% of the total water supplied, including by "Apa-Canal Chişinău" – 7.8 million m³ (78%), Soroca "Aqua-North" – 7.5 million m³ (99%) and "Apa-Canal Bălţi" – 803 thousand m³ (22%). The budgetary organizations are provided with about 3 million m³ or 5% of total water supplied, including in Chişinău – 2.3 million m³ (5%) and Bălţi – 255 thousand m³ (7%).

The summary losses of captured water are on average of 41% and are directly conditioned by similar deterioration degree (37%) of water supply networks and sewerage. The maximum share of losses is registered in Rezina, Drochia and Străşeni. Also, the deterioration of fixed assets exceeds 60% in Chişinău, Drochia, Donduşeni, Teleneşti, Straseni [9, p. 46].

Table 5. Water supply services provided by enterprises of the Association "Moldova Apă-Canal" in the Dniester basin.

No.	Localities	The length of aqueducts (km)	Pumping station (PS) and artesian fountains (AF)				The volume of water supplied, thousand m^3				Water use, lit. per capita	Losses from captured water, (%)	The degree of wear of fixed assets, (%)
			Number		Capacity, thousand m^3 /day)	Degree of use, (%)	Total	Population	Public organization	Enter-prises			
			PS	AF									
1	Ocnița	36.6	2	5	2.5	10	33.8	30.7	0.5	2.6	17	30	33
2	Dondușeni	40.5	2	7	1.2	36	94.1	75.9	4	14.2	24	40	61
3	Drochia	70.5	2	7	3.9	47	291	259	13.9	17.2	39	56	66
4	Soroca	75	3	10	10.6		619	471	63.9	83.7	45	40	10
	Acva Nord	72	4	0	96	22	7546	31.2	0	7515	-		61
5	Florești	141	5	12	6	33	369	281	17.5	70.9	52	37	43
6	Râșcani	41.8	19	19	2	35	170	153	9.9	7.5	35	33	51
7	Bălți	265	28	67	49.8	0.7	3681	2624	255	803	67	33	46
8	Sângerei	50.5	15	15	2.3	50	239	193	37.8	8.4	45	43	49
9	Șoldănești	23	2	6	1.8	12	67.1	54.7	12.4	0.5	25	17	1
10	Rezina	27	11	9	3.6	42	207	163	29	14.6	43	62	21
11	Telenești	22.6	16	15	2.6	19	79.9	65.7	9.2	5	27	55	60
12	Orhei	207	8	27	18.9	19	693	535	38.9	119	57	42	51
13	Criuleni	53	3	9	2.7	30	134	119	10.3	4.8	44	55	18
14	Anenii Noi	69.9	1	15	6.5	23	259	233	9.6	15.8	42	53	37
15	Strășeni	74	3	16	15	8,1	192	170	14,5	7,2	26	57	60
16	Călărași	64	2	12	1,4	82	237	190	27,8	19,3	40	47	32
17	**Chișinău**	**1877**	184	72	**440**	**46**	**45271**	**35166**	**2304**	**7801**	**161**	**34**	**63**
18	Cricova	19,7	1	4	2,4	47	230	210	2,7	16,8	74	43	2
19	Ciorescu	2,6	0	4	2,9	27	178	161	9,3	8,3	70	36	2
20	Floreni	14	2		0,6	63	118	103	3,1	11,3	81	14	15
21	Căușeni	93	3	9	4,8	21	207	180	13,4	13,3	29	41	51
22	Ștefan Vodă	45,8	1	17	4,7	10	123	110	7,2	6,2	39	30	20
	Dniester basin	**3393**	**318**	**358**	**682**	**36**	**61037**	**41579**	**2894**	**16565**	**50**	**41**	**37**
	Total Apă-Canal	**4415**	**400**	**516**	**780**	**35**	**65939**	**45417**	**3241**	**17281**	**119**	**33**	**48**

Source: elaborated by author after data from [9, p. 14-23, 46]

3.4. The tax for water use

According to Title VI of the Fiscal Code, the tax for water consumption is applied to primary users, who capture surface water or groundwater in order to conduct their activities in manufacturing production and services. Also, it is calculated by the payer, depending on the volume of water used, according to meters data, or failing that, under the norms of water consumption [11]. Therefore, the current methodology for calculating the payments for water consumption is very simple and can easily be applied by beneficiaries.

However, this methodology contains a number of gaps [4, p. 114]:

- the amount equal to 1 m^3 of surface sources and of underground sources;
- the assurance of territory with water is not directly reflected in the rates of water tax;
- tax rates for water are not adjusted to inflation rate;
- water tax rates are not conditioned by the value and price of water, but by small financial assurance in the republic;
- it does not take into account the ecological status of surface water and groundwater;
- the amount of tax for water does not express the costs for capturing, transporting and treatment of water;
- it does not stimulate recirculation and saving of water;
- water taxes are not applied on the hydrographical basin, but on the administrative-territorial units;
- the application of this tax has only fiscal effects, but economic and ecological effects is very small.

In majority of the economic branches of the economy, particularly in agriculture and food industry, the very low amount of payments for water use triggers the overcoming of level of common consumption and the increase of the volume of waste water discharge.

Taxes for water consumption should also include the costs of research on cost/benefit analysis, to determine a fair price and optimal variants and norms of use of drinking water, the water-courses and watersheds.
The annual water consumption receives more than 20 million MDL. The maximum tax revenues are found in mineral water bottling companies, followed by irrigation, food and agricultural companies.

3.5. Tariffs for providing of water supply services

Tariffs for water supply are applied to secondary users, who are supplied by specialized public enterprises, especially of Association "Moldova Apă-Canal" or by other operators authorized to provide its services. The scope of service of water supply contains several key sectors: 1) population and households; 2) budgetary organizations; 3) economic agents, which perform various entrepreneurial activities and require a fee purchase of these services. The amount and application procedure of tariffs for public water supply are provided in Decision no. 164 of National Agency for Energy Regulatory from 29.11.2004 on the "Methodology of determination, approval and implementation of tariffs for public water supply, sewerage and wastewater treatment." Rates are calculated separately for providing with drinking and technological water, according to the spending necessary to deliver those services expressly stipulated in this Methodology [11]. The tariffs quotas for water supply are established by enterprises that provide services and submitted for approval to the local public authorities.

The average amount of general tariff for water supply services in the Dniester basin is of 11.8 MDL[1]/m³.

The maximum rates of over 17 MDL/m³ are registered at the enterprises located, mostly in the Dniester riverbed and Răut basin, including Ocniţa, Floreşti, Donduşeni, Drochia, Rezina Căuşeni and Ştefan-Vodă (Figure 5) and minimum rates – at the Şoldăneşti (6,0 MDL/m³), Soroca Aqua-North (3,7 MDL/m³), Chişinău (8,86/m³) and its suburbs (Floreni, Cricova and Ciorescu), which are supplied, at low prices, with water captured from Dniester riverbed from Vadul lui Vodă station.

The values of lower general tariff in Chişinău and Bălţi is explained by the "economies of scale" much superior to those services, and cross-subsidization of tariffs for the population on account of higher revenues (about 3 times) from agencies, economic and budgetary organizations (figure 5) located here in much higher numbers and that have water consumption superior to the other towns.

The maximum tariff in some regional centres such as Floreşti, Căuşeni, Ştefan-Vodă or Teleneşti [13], [9, p. 70-71] can be explained by the fact that municipal enterprises localities, besides water supply services and sewerage renders and sanitation and waste disposal households, pay only a small share of the population. To offset expenses and lost revenues from these services and the maintenance of green spaces, these enterprises set higher tariffs for services of water supply and sanitation, which is a much higher subscriber of the local population. For this reason, some companies of the Association "Moldova Apă-Canal" had a negative return, despite the fact that tariffs s set covers almost all costs of water supply services and sanitation.

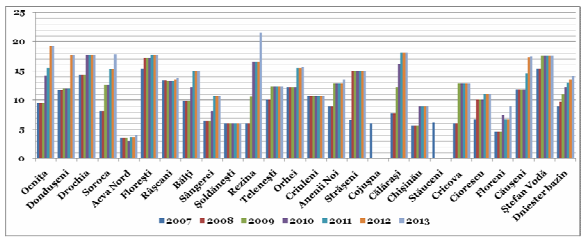

Fig. 5. The dynamics of tariffs for providing of water supply services by companies of Association "Moldova Apă-Canal" from Dniester Basin (average rate) in MDL/m³ (excluding VAT). *Source: figure 5 and table 6 are elaborated by author after data from [13], [9, p.70-71].*

The growth of tariffs for water supply of population and households is higher (67%) than for budgetary organizations (37%) and businesses (39%) (table 6). Thus, in the most communal enterprises from the Dniester basin tariffs for water supply of economic agents recorded a slight increase (up to 15%) and significantly lower than those for the population, which demonstrates once again the promotion of uniform tariff policy for all categories of water consumers and the abolition of cross-subsidization.

Despite the recent significant increase of tariffs for water supply, its level is lower than those prime cost at about half of enterprises, which work in this domain (table 7), and the average difference is about 0.85 MDL/m³ (14.1 MDL/m³ towards 14.9 MDL/m³). In 2012-2013, due to higher growth rates of tariffs it is observed a removal of this difference at enterprises from Donduşeni, Soroca, Rezina, Orhei, Călăraşi, Anenii-Noi and Căuşeni.

Starting with the second half of 2013, due to the rapid depreciation of the national currency, the rapid growth of expenditures for materials, especially for fuel, reducing the difference between the tariff rate and prime costs decreased considerably. In addition, any increase of electricity tariff, will condition faster growth of prime costs and will even increase those differences. Moreover, the increase in electricity tariffs and fuel price that is not within the competence of local authorities is accepted more easily than the increase of tariffs for public utilities, including water

[1] in this period, 1 euro varied between 14 and 19 MDL

supply and sanitation. For this reason, the application (from 14.09.2014) of the new provisions of Law no. 303 of 12.13.2013 on the public water supply and sanitation on the compulsory cover of the expenditures from tariff of these service will be very difficult, especially right before the election period.

Table 6. The average tariffs for providing of water supply services by companies of Association "Moldova Apă-Canal" from Dniester Basin in MDL/m³ (excluding VAT).

Categories	2007	2008	2009	2010	2011	2012	2013	Average	Increase (%)
Average tariff	8.91	9.74	11.01	12.21	13	13.57	13.93	11.79	158
Household	6.95	7.45	8.56	9.62	10.81	11.43	11.63	9.49	167
Budgetary organizations	20.9	21.6	24.8	28.2	27.4	28.3	28.6	25.69	137
Economic agents	21.3	21.6	24.1	26.5	27.3	29.0	29.6	25.64	139

Table 7. The ratio between the revenues and expenditures of the water supply services (2013).

No.	Localities	Volume of delivered water, thousand m^3	Revenues from water distribution		Expenditures, thousand MDL	Difference between revenue and expenditure, thousand MDL	General tariff, (MDL/m^3)	Average prime cost, (MDL/m^3)	Difference between tariff and prime cost, thousand MDL
			Thousand MDL	To population, (%)					
1	Ocniţa	33.8	1011	72	1294	-283	*19.19*	23	-3.81
2	Donduşeni	94.1	1640	63	1318	321	*17.7*	14	3.7
3	Drochia	291	3797	68	4274	-476	17.81	14.7	3.11
4	Soroca	619	11856	55	10825	1032	17.85	17.5	0.35
5	Acva Nord Soroca	7546	28127	0.5	31447	-3320	4.05	4.2	-0.15
6	Floreşti	369	7252	66	9125	-1874	17.76	24.7	-6.94
7	Râşcani	170	2179	78	2297	-119	13.85	13.5	0.35
8	Bălţi	3681	53984	54	58036	-4053	15.05	15.8	-0.75
9	Sângerei	239	2564	68	2486	78	10.71	10.4	0.31
10	Şoldăneşti	67.1	445	67	899	-455	6.0	13.4	-7.4
11	Rezina	207	4234	49	4277	-43	*21.5*	20.7	0.8
12	Teleneşti	79.9	1155	57	1192	-38	12.39	14.9	-2.51
13	Orhei	693	11475	76	10391	1084	15.7	15	0.7
14	Criuleni	134	1544	71	1723	-179	10.7	12.9	-2.2
15	Anenii Noi	259	3889	75	3457	433	*13.53*	13.4	0.13
16	Străşeni	192	3134	79	3644	-510	15.0	19	-4.0
17	Călăraşi	237	4418	71	4006	413	18.16	16.9	1.26
18	**Chişinău**	**45271**	**401475**	**71**	**381320**	**20155**	**8.86**	**8.4**	**0.46**
19	Cricova	230	2432	87	2589	-158	12.86	11.3	1.56
20	Ciorescu	178	1583	81	1593	-10	11.05	8.9	2.15
21	Floreni	118	850	78	1255	-405	8.88	10.4	-1.52
22	Căuşeni	207	3702	68	3760	-58	*17.38*	18.2	-0.82
23	Ştefan Vodă	123	2312	71	2695	-383	17.60	21.9	-4.3
	Dniester bazin	**61037**	**555055**	**66**	**543902**	**11153**	**14.07**	**14.9**	**-0.85**
	Total	**65939**	**612372**	**65**	**613647**	**-1275**	**14.89**	**15.53**	**-0.64**

Source: elaborated by author after data from [9, p. 74].

4. CONCLUSION

Dniester basin contributes with over 90% to the total volume of captured and used water, of which over 80% are used by the enterprises from Transnistria, which determines the overall situation in the Republic of Moldova. The absolute majority of localities on both banks of Dniester are supplied from groundwater sources. Dniester River and its tributaries have only the receiver function for the discharged wastewater. In most rural localities, the extension of water supply network was not accompanied by the necessary work of sewage and waste water purification, which increased significantly impact on water and human health in these areas. The very low coverage sewage network (15 of rural localities) stimulates the massive depopulation of rural space from the Republic of Moldova and significantly limits the local development.

Despite the unique methodology of calculation of tariffs, we find large differences (up to 6 times)

between the minimum and maximum rates approved by local councils, which proves the major influence of the political factor.

In most companies of Association „Moldova Apă-Canal" located in the Dniester basin the tariffs for water supplies are under those prime costs, and profitability is negative. It is necessary to adjust taxes and tariffs for water in accordance with the inflation rate, the real cost of water supply, discharge and purification of wastewater and with the ecological status of water resources and human health in the territory**.**

The enterprises of Association "Moldova Apă-Canal" bring a major contribution (80%) in water supply on the right side of Dniester River. Therefore, the information used by the author for the economic analysis of water use is sufficient to determine the overall effectiveness of water supply enterprises and of it services. Meanwhile, the water supply services provided by the Association "Moldova Apă-Canal" cover only the urban areas and some suburbs of Chişinău city. The information on financial and production indicators of Water Users Associations from the absolute majority of the rural localities is not centralized, and it is not subject to statistical processing and/or used in decision making. Therefore, the integrated water management of the rural secondary users, especially households and budgetary organizations, should be included into the informational circuit whereas the principle „beneficiary and polluter pays" should be entirely applied.

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