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THE INCREASE OF WATER SUPPLY AND SANITATION SYSTEMS EFFICIENCY BY USING THE BENCHMARKING PROCESS

RESEARCH REPORT NO. 3

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CONTENTS

TABLES

FIGURES

1 Introduction

Dynamic economic environment of recent years constantly influencing organizations participating in global activity, but also those operating on regulated markets. One of the main effects of this dynamism is imperativitatea include these organizations in the strategy of enhancing the quality of products and services provided and profitability, a prerequisite for sustainable development.

One of the main techniques to improve product quality-oriented management / services and increasing profitability is benchmarking.

This management technique appeared constantly in the writings of management in the years ' 70, ' 80 and ' 90 (Stapenhurst, 2009, 7), but the basic idea dates back long before that period.

With the introduction of new regulations in the UK on the water and wastewater in 1989, benchmarking has been chosen by the regulatory authority water services as a regulatory tool as a competition artificial (yardstick competition) to compare performance various water companies and compensate for the lack of competition in the sector, thus causing companies to improve their performance.

Research Foundation of the American Association of the water companies issued a report on benchmarking - site in 1996 based on the concepts used by Xerox and " yardstick competition " . The report made first differentiate between bechmarking - the metric and the process. (Cabrera Jr., 2011 4)

After the beginning of benchmarking in the water and waste water, it began to be used as benchmarking program carried out by associations of water in Australia, USA, Austria, Netherlands, Scandinavia, Southeast Asia and Canada, the government of India in collaboration with universities, the World Bank (IBNET) as well as a regulatory tool in Germany and the UK.

Of - time and - have developed several definitions of the management techniques, but for purposes of this paper we consider eloquent definition presented by Cabrera, Dane, Haskins and Theuretzbacher - Fritz: " Benchmarking - is a management technique designed to help improved performance through systematic research and adapting best practices of the market. " (Cabrera Jr., 2011, 3)

Three main types of benchmarking have been identified in terms of work methodology: Metric benchmarking, process benchmarking and benchmarking based on assessing and improving performance. (Cabrera Jr., 2011 5)

- Metric benchmarking is to compare key indicators of the participating organizations. Thus, the relative position of the participants and identify areas that require improved performance. This practice is currently used by most water and wastewater companies in the world. (Cabrera Jr., 2011 4)
- The benchmarking process is based on the benchmarking introduced by Xerox model in which to identify the best organizations in the market success factors of these market leaders, and they adapt within their own organization. (Cabrera Jr., 2011 4)
- Benchmarking proposed by the IWA (International Water Association) is the model for assessing and improving performance benchmarking model represents a combination of metric and benchmarking the process. Thus, it is considered that the performance appraisal will use a metric approach to provide insight into areas where there are deficiencies and improvement. Subsequently, the phase of performance improvement is

passed to the benchmarking process, is actively searching for the formulation of an action plan to improve the adaptation performance in areas deficient of best practices in the industry leaders. (Cabrera Jr., 2011, 11)

The second categorization is according to participants in the exercise. In this Agus and Hassan (2009) developed a conclusive categorization:

- Internal Benchmarking: Is a comparison of similar operations in the same organization. Stable internal benchmarking et up performance standards internally (Agus, 2009: 66). This exercise aims at identifying the best internal procedures and is therefore a basis for external benchmarking.
- Benchmarking Competitive benchmarking represents a result - of the internal as information with national be collected et and analyzed before they can be made a comparison with the competition (Agus, 2009: 66). The process involves complicated comparison that organizations operating in S and markets that have competing products or services.
- Functional Benchmarking: Benchmarking conducted to compare the methods with those of companies with similar processes, even if they are active in industries other than the company performing the exercise. (Agus, 2009: 66)
- Generic Benchmarking: A comparison tert ie working processes with other organizations that have innovative work processes in various industries. This exercise is considered to be highly effective, but equally difficult to implement. For its implementation requires a broad conceptualization of the whole process and a thorough understanding of the procedures. (Agus, 2009: 66)

Global spread of this technique management in recent decades finds an explanation in the many benefits that this technique has demonstrated over time among companies that have implemented it. At a first level of analysis, we can define a set of advantages. Thus, organizations that use benchmarking benefits in addition to organizations that do not use this technique:

- Increase organizational performance by identifying ways to improve their product / service provided by comparing with competitions firms / sector and by identifying the time evolution of their results;
- Understanding the relative market position / in the sector about cost, profit margin and other key indicators of the organization that helps the company to identify areas where action is needed to improve and automatically opportunities to improve the current situation;
- Gaining a strategic advantage, which stems from the same benchmarking and identification of areas in which the company holds key capabilities critical or strategic reserves on which they can build a dominant position.
- Increasing the pace of learning organization as benchmarking exercises bring new ideas within the organization and thus help advance faster learning curve. Companies benefit from the sharing of experience and continuous exchange of ideas in the sector, being able to progress in a much faster rate.

Besides these advantages arising directly from nature benchmarking exercises, another series of benefits of this exercise are identified by Stapenhurst (2009):

- Encouraging a culture of performance within the organization, as acceptance and adoption of such an exercise creates a continuing concern for improved performance. (Stapenhurst, 2009: 11)

- Used in budgeting and performance targets for benchmarking exercises can be used to establish realistic targets instead of arbitrary values, these targets can be used later to build realistic budgets.
- Exercise benchmarking and comparative results is in itself an incentive to increase organizational performance by knowing the current situation.
- Creating a complex knowledge and professionals in the field that can push the entire industry forward / whole sector. (Stapenhurst, 2009: 13)
- Benchmarking can be used to justify domestic proposals by exposing the success of some initiatives in companies in the same sector. (Stapenhurst, 2009: 12-13)

All these are reasons enough to justify and encourage benchmarking project implementation in organizations. These benefits are applicable to companies in the water and wastewater sector in general and the Romanian sector.

2 Case Study

In order to identify indicators prevalent in exercise of benchmarking and - selected three operators of different sizes in terms of the area of operation, the numbers of personal and business but in general the complexity of systems of water supply and sewerage (small - A operator, environment - operator B and high - operator C) and 199 indicators were analyzed in the following table.

Table 2.1. Indicators analyzed in the benchmarking exercise.

Nr. crt.	Indicator	UM	operator	operator B	operator C
Indicators - General					
1	Period Receivable	days	52.5	93.5	56.8
2	The period of payment providers	days	88.6	62.8	43.8
3	Net profit rate	%	2.2%	12.0%	5.7%
4	The average cost of an employee (including tax)	RON / employee / month	2603.4	3544.2	3522.0
5	current rate	ration	1.12	1.13	2.39
6	total training	hours / employee	2.7	77.8	50.7
7	Total Training - ISO and projection without work	hours / employee	-	40.3	23.6
8	Work safety training / employee	hours / employee	2.7	18.0	24.6
9	Training procedures ISO / employee	hours / employee	-	19.5	2.6
10	Training training / employee	hours / employee	-	12.5	21.4
11	PIU personnel training / employee	hours / employee	-	48.7	-
12	Other training / employee	hours / employee	-	26.6	2.2
13	EMPLOYEE direct proportion total water	%	41.7%	53.8%	41.3%
14	The total percentage in the forward channel EMPLOYEE	%	15.2%	15.5%	24.3%
15	EMPLOYEE indirect percentage in total	%	0.0%	4.7%	12.4%
16	EMPLOYEE share in total general and administrative	%	40.0%	23.4%	24.3%
17	EMPLOYEE total percentage PIU	%	3.2%	2.5%	2.2%
18	Number of employees PIU	no.	15	15	2. 3
19	The percentage of staff costs in total operating costs without depreciation and royalty	%	52.1%	58.1%	41.4%
20	The average cost of an employee (including tax)	RON / employee / month	2603	3544	3522
21	Average revenue per employee	RON / employee / month	5590	7824	11.033
22	profitability staff	Anagjat income / cost per employee	2.15	2.21	3.13
Indicators - water					
2. 3	Total consumption per capita	l / day	151	111	179
24	Average consumption property	m3 / property	104	100	120
25	Household consumption per capita	l / day	104	81	109
26	Property population consumption per year	m3 / property / year	74.2	76.5	81.6
27	Property population consumption per month	m3 / property / month	6.2	6.4	6.8
28	Otherwise consumers consumption per property per year	m3 / property / year	834	695	441
29	Otherwise consumers consumption per customer per year	m3 / client / year	834	944	3410
30	Otherwise consumers on branching consumption per year	m3 / branching / year	101	60	203
31	household size	people / property	2.0	2.6	2.1

Nr. crt.	Indicator	UM	operator	operator B	operator C
32	Level of connection of population	%	51.4%	85.3%	50.6%
33	Level of connection of the ADI ATU water	%	43.9%	100.0%	58.4%
34	Number of ATU sites water connection	no.	29	18	52
35	Complaints on branching	No / 1000 connections	258.8	21.5	20.7
36	Customer complaints	No / 1000 clients	93.6	22.7	21.7
37	Complaints property	No / 1000 properties	93.6	10.4	5.3
38	Complaints to pressure	%	32.7%	8.5%	86.7%
39	Complaints about continuity	%	0.2%	9.8%	0.1%
40	Complaints about water quality	%	0.0%	39.6%	1.0%
41	Complaints related discontinuations	%	36.4%	33.1%	5.7%
42	Complaints and questions about billing	%	27.9%	6.8%	3.1%
43	Complaints related to the contract	%	0.0%	0.0%	0.3%
44	Complaints and questions about billing	No / 1000 clients	26.14	1.55	0.68
45	The average tariff per m3 (without VAT)	RON / m3	2.66	3.49	2.94
46	Average bill per property (excluding VAT)	RON / property / year	275	350	353
47	Average bill per property (excluding VAT)	RON / property / month	2. 3	29	29
48	The average price for exported water (without VAT)	RON / m3			1.88
49	Average tariff for the population (without VAT)	RON / m3	2.64	3.41	2.98
50	Average bill property for population (without VAT)	RON / property / year	196.2	260.9	242.8
51	Average bill property for population (without VAT)	RON / property / month	16.3	21.7	20.2
52	The average price for remaining consumers (without VAT)	RON / m3	2.68	3.70	2.88
53	Average bill per property for the rest of consumers (without VAT)	RON / property / year	2235.0	2573.5	1268.0
54	The rate of operating profit before amortization and royalty	%	15.0%	4.6%	18.3%
55	Operating profit rate	%	6.6%	-4.2%	8.2%
56	The percentage cost of raw water total operating costs without depreciation and royalty	%	10.3%	4.0%	7.3%
57	Percentage energy costs in total operating costs without depreciation and royalty	%	18.7%	11.7%	20.1%
58	The percentage cost of raw materials in total operating costs without depreciation and royalty	%	8.6%	13.2%	16.9%
59	The percentage of staff costs in total operating costs without depreciation and royalty	%	51.1%	55.3%	39.0%
60	The percentage cost of maintenance and repairs in total operating costs without depreciation and royalty	%	4.1%	3.2%	3.9%
61	The percentage cost of services provided by third parties in total operating costs without depreciation and royalty	%	3.2%	8.2%	6.9%
62	Percentage other expenses in total operating costs without depreciation and royalty	%	4.0%	4.5%	5.8%
63	Total unit operating cost (excluding VAT)	RON / m3	2.81	3.77	2.69
64	Total operating unit costs (excluding depreciation and royalty) (without VAT)	RON / m3	2.56	3.45	2.39
65	Unit cost of capital (depreciation and royalties) (without VAT)	RON / m3	0.25	0.32	0.30

Nr. crt.	Indicator	UM	operator	operator B	operator C
66	Coverage indicator of operating costs	ration	1.07	0.96	1.09
67	The share of the population in total amount invoiced amount sold	%	68.8%	73.3%	60.2%
68	The share of the amount billed to consumers in the rest of the total amount sold	%	31.2%	26.7%	39.8%
69	Employees water produced	no. / Million m3	48.2	49.2	22.1
70	The average cost of an employee (including tax)	RON / employee / month	2259	3226	3515
71	Average revenue per employee	RON / employee / month	5200	6121	11.040
72	profitability staff	Anagjat income / cost per employee	2.30	1.90	3.14
73	Energy consumption per m3 of water produced	kWh / m3	0.33	0.67	0.90
74	Energy consumption per m3 of water billed	kWh / m3	0.91	0.84	1.38
75	organoleptic tests	%	N/A	100.0%	100.0%
76	microbiological tests	%	97.1%	98.5%	96.4%
77	Physicochemical tests	%	90.3%	96.0%	100.0%
78	Amount of energy produced - water	kWh	-	-	-
79	Losses in the distribution network	m3 / km / day	49.8	9.3	17.6
80	total loss	m3 / km / day	40.3	8.8	48.1
81	Losses in the distribution network on branching	l / branching / day	1390.4	162.1	566.8
82	Total loss on branching	l / branching / day	1659.3	175.4	2182.8
83	Damage on headrace	No / 100 km	3.7	-	-
84	Damage to distribution network	No / 100 km	18.5	164.5	132.1
85	Total damage in networks	No / 100 km	13.8	143.8	93.6
86	NRW (non-revenue water)	%	67.9%	21.7%	60.6%
87	NRW property	m3 / property	219	28	203
88	Investment unit - local budget or own	RON / m3	0.23	0.17	0.54
89	Investment unit - SOP	RON / m3	0.01	0.07	1.02
90	Investment unit - Total	RON / m3	0.24	0.24	1.56
91	Percentage rehabilitation and replacement of pipelines - POS	%	0.0%	0.0%	0.5%
92	Percent extension tubes - POS	%	0.0%	0.0%	0.5%
93	Percentage rehabilitation and replacement pipe - or their local budget	%	0.0%	1.5%	1.2%
94	Percentage extension pipes - or their local budget	%	0.0%	0.7%	1.3%
95	Percentage rehabilitation, replacement and extension pipes - total	%	0.0%	2.2%	3.6%
96	Total value of investment unit - local budget and own resources	RON / year	1.63004 million	1494565	13,013,649
97	Number of direct employees on branching	No / 1000 connections	8.13	7.79	8.55
98	Intensity direct personal	No / 1000 properties	2.94	3.76	2.18
Indicators - Wastewater					
99	The total amount of wastewater per capita	l / day	180	213	215
100	The total amount of wastewater Property	m3 / property	132	205	232
101	The total amount of waste water to the population per capita	l / day	108	97	118
102	The total amount of wastewater from households on the property year	m3 / property / year	81	98	155
103	The total amount of wastewater from households property per month	m3 / property / month	7	8	13

Nr. crt.	Indicator	UM	operator	operator B	operator C
104	The total amount of wastewater from the rest of the year consumer property	m3 / property / year	1899	2648	589
105	The total amount of wastewater from the rest of the year the consumer client	m3 / client / year	1899	2824	# DIV / 0!
106	The total amount of wastewater from the rest of the year consumer connection	m3 / branching / year	1848	3853	3319
107	household size	people / property	2.1	2.8	3.6
108	Level of connection of population to sewerage	%	39.1%	64.9%	38.4%
109	Level of connection of the ADI ATU sewer services	%	10.6%	38.9%	22.5%
110	Number of ATU sites sewerage connection	no.	7	7	20
111	total complaints	No / 1000 locutitori / year	1	21	19
112	Complaints related bottlenecks	No / 1000 locutitori / year	0.1	18.9	18.8
113	Complaints related to floods	No / 1000 locutitori / year	0.0	0.9	0.0
114	Complaints about pollution	No / 1000 locutitori / year	0.3	-	-
115	Complaints about odors	No / 1000 locutitori / year	-	-	0.0
116	Complaints related to rodents	No / 1000 locutitori / year	-	-	-
117	other complaints	No / 1000 locutitori / year	0.1	1.0	0.0
118	The average tariff per m3 (without VAT)	RON / m3	1.26	1.93	2.07
119	Average bill per property (excluding VAT)	RON / property / year	166	396	482
120	Average bill per property (excluding VAT)	RON / property / month	14	33	40
121	Average tariff for the population (without VAT)	RON / m3	1.12	1.97	2.08
122	Average bill property for population (without VAT)	RON / property / year	91.2	191.8	322.2
123	Average bill property for population (without VAT)	RON / property / month	7.6	16.0	26.9
124	The average price for remaining consumers (without VAT)	RON / m3	1.46	1.90	2.07
125	Average bill per property for the rest of consumers (without VAT)	RON / property / year	2768.8	5024.0	1219.9
126	Profituluidin rate Operating profit before amortization and royalty	%	14.4%	43.5%	23.8%
127	Profituluidin operating rate	%	5.8%	38.0%	11.4%
128	Percentage energy costs in total operating costs without depreciation and royalty	%	35.7%	7.6%	16.4%
129	The percentage cost of raw materials in total operating costs without depreciation and royalty	%	3.4%	8.2%	18.3%
130	The percentage of staff costs in total operating costs without depreciation and royalty	%	44.4%	64.0%	43.2%
131	The percentage cost of maintenance and repairs in total operating costs without depreciation and royalty	%	0.1%	1.9%	1.3%
132	The percentage cost of services provided by third parties in total operating costs without depreciation and royalty	%	11.2%	14.9%	4.8%
133	Percentage other expenses in total operating costs without depreciation and royalty	%	5.3%	2.3%	16.0%
134	Total unit operating cost (excluding VAT)	RON / m3	1.42	1.24	1.84
135	Total operating unit costs (excluding depreciation and royalty) (without VAT)	RON / m3	1.29	1.13	1.58

Nr. crt.	Indicator	UM	operator	operator B	operator C
136	Unit cost of capital (depreciation and royalties) (without VAT)	RON / m3	0.13	0.11	0.26
137	Coverage indicator of operating costs	ration	1.06	1.61	1.13
138	The share of the population in total amount invoiced amount sold	%	59.8%	45.5%	54.9%
139	The share of the amount billed to consumers in the rest of the total amount sold	%	40.2%	54.5%	45.1%
140	The average cost of an employee (including tax)	RON / employee / month	2583	4312	3509
141	Average revenue per employee	RON / employee / month	6802	11.935	10.653
142	profitability staff	Anagjat income / cost per employee	2.63	2.77	3.04
143	Total energy consumption per m3 of wastewater from sewage	kWh / m3	0.29	0.25	0.82
144	Total energy consumption per m3 of wastewater invoiced	kWh / m3	0.79	0.25	0.82
145	Energy consumption per m3 of wastewater on sewage	kWh / m3	0.07	0.00	0.06
146	Energy consumption per m3 of wastewater to treatment	kWh / m3	0.30	0.27	0.77
147	Unit cost of operating long Reata sewage	RON / km sewerage network	22.807	60.895	60.495
148	Unit operating cost and royalty free damping length of Reata sewage	RON / km sewerage network	20.713	55.467	52.045
149	Unit costs of operating the	RON / on	246	124	77
150	Unit operating costs without depreciation and royalties on the	RON / on	224	113	66
151	Operating income in the	RON / on	305	262	88
152	sewer inspections	%	30.2%	8.7%	6.3%
153	Sewer inspection - visual	%	25.9%	5.6%	3.8%
154	Sewer inspection - CCTV	%	4.3%	3.1%	2.6%
155	Blockages in the sewerage network	No / 100 km	22	122	918
156	Blockages in drains, except connections	No / 100 km	8	88	120
157	Bottlenecks related connections	No / 100 km	14	34	798
158	The amount of sludge used for agricultural	%	0%	32%	0%
159	The amount of sludge exploited in afforestation	%	0%	0%	0%
160	The amount of settled sludge to landfill ecological	%	0%	64%	0%
161	The amount of non-organic sludge deposited in landfill	%	0%	0%	0%
162	The amount of sludge deposited in the company's own warehouse	%	100%	0%	100%
163	The amount of energy harnessed sludge (incinerator)	%	0%	5%	0%
164	Another use of the sludge (say)	%	0%	0%	0%
165	Amount of energy produced - wastewater	kWh	-	309.083	2.10744 million
166	Amount of energy produced - wastewater	kWh / m3	-	0.02	0.10
167	Percentage wastewater discharged without treatment	%	25.0%	8.5%	0.0%
168	Production sludge from wastewater treatment plants	kg. su / on	51.37	13.03	2.01
169	Population equivalent (pe) at the largest operator station	on	31.325	97.856	513.069
170	Energy consumption per m3 of treated water to the greatest work station	kWh / m3	0.35	0.28	0.22

Nr. crt.	Indicator	UM	operator	operator B	operator C
171	Energy consumption by the largest operator station	kWh / on	114.6	29.1	32.0
172	Mugs energy produced in energy consumption amount to the largest operator station	%	0.0%	10.8%	12.8%
173	Quantity of sludge produced per m3 greatest work station	./ m3 1000 kg DM	157.5	166.3	10.7
174	Amount of sludge produced in the greatest work station	kg DM / in	51.66	17.09	1.53
175	Number of employees at the station the greatest work	no. / 1000 in	0.83	0.42	0.13
176	Wastewater treated in wastewater treatment plants on the	m3 / in	407	120	43
177	Investment unit - local budget or own	RON / m3	0.05	0.06	-
178	Investment unit - SOP	RON / m3	0.01	1.36	1.42
179	Investment unit - Total	RON / m3	0.06	1.42	1.42
180	Percentage rehabilitation and replacement of pipelines - POS	%	0.0%	0.0%	0.4%
181	Percent extension tubes - POS	%	0.0%	0.0%	2.6%
182	Percentage rehabilitation and replacement pipe - or their local budget	%	0.0%	0.0%	0.0%
183	Percentage extension pipes - or their local budget	%	0.0%	0.6%	0.0%
184	Percentage rehabilitation, replacement and extension pipes - total	%	0.0%	0.6%	3.0%
185	Total value of investment unit - local budget and own resources	RON / year	310.750	812.549	-
186	Number of direct employees in connection	No / 1000 fittings	9.29	4.93	15.39
187	Intensity direct personal	No / 1000 properties	1.50	1.52	2.73
188	Intensity direct personal	No / million m3	11.34	7.40	11.74
189	Number of employees on long sewage network	No / 100 km	18.2	36.4	38.6
Technical data context - water					
190	The number of water treatment stations (not including water treatment plants which consist solely of disinfection with chlorine)		5	3	7
191	The number of treatment plants which consist solely of disinfection with chlorine		1	26	12
192	The total number of pumping stations		11	25	35
193	length of headrace		322	106	673
194	The length of the entire distribution network		680	738	1636
Technical data context - wastewater					
195	The number of wastewater treatment plants		6	9	12
196	The total number of wastewater pumping stations		1	8	30
197	The length of the sewerage network server unit		395	261	663
198	Length domestic wastewater sewerage network		-	-	-
199	The length of the sewage network stormwater		-	-	-

2.1 General indicators (context)

The figure below illustrates the level of connection to water and canalization of the population or of the administrative - territorial cohesion within the three operators considered. If

a small operator level of connection to public water is higher than the level of connection of the ATU which leads to the conclusion that there are administrative units in the level of connection of the population is 0. For medium and large sized companies ATU level of connection of the water is higher than the level of connection of the population. Regarding the level of connection to the sewerage network is seen as it is lower than the degree of water access for all operators analyzed. In this case the degree of conactare ATU is lower than the level of connection of the population for all operatoroii and varies in the range 10% - 40%.

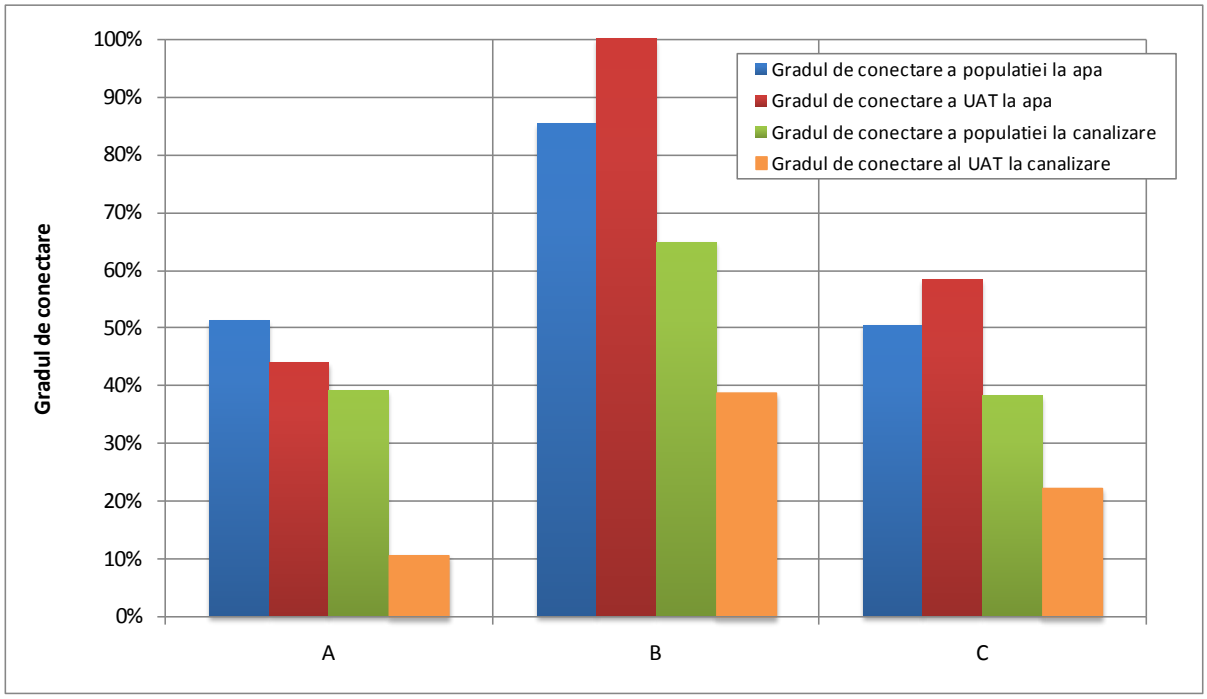


Figure 2.1. The level of connection of the population and ATU water and sanitation.

In the figure below illustrates the use of water or returned quantity of waste water. For all operators analyze total drinking water consumption is less than the amount of wastewater returned. It ranges from 110 l / person. Day for operators of medium size and 180 l / loc., Great day for the operator. In terms of water consumption in the population, it is lower by approx. 5 - 20 l / person day to the amount of wastewater returned.

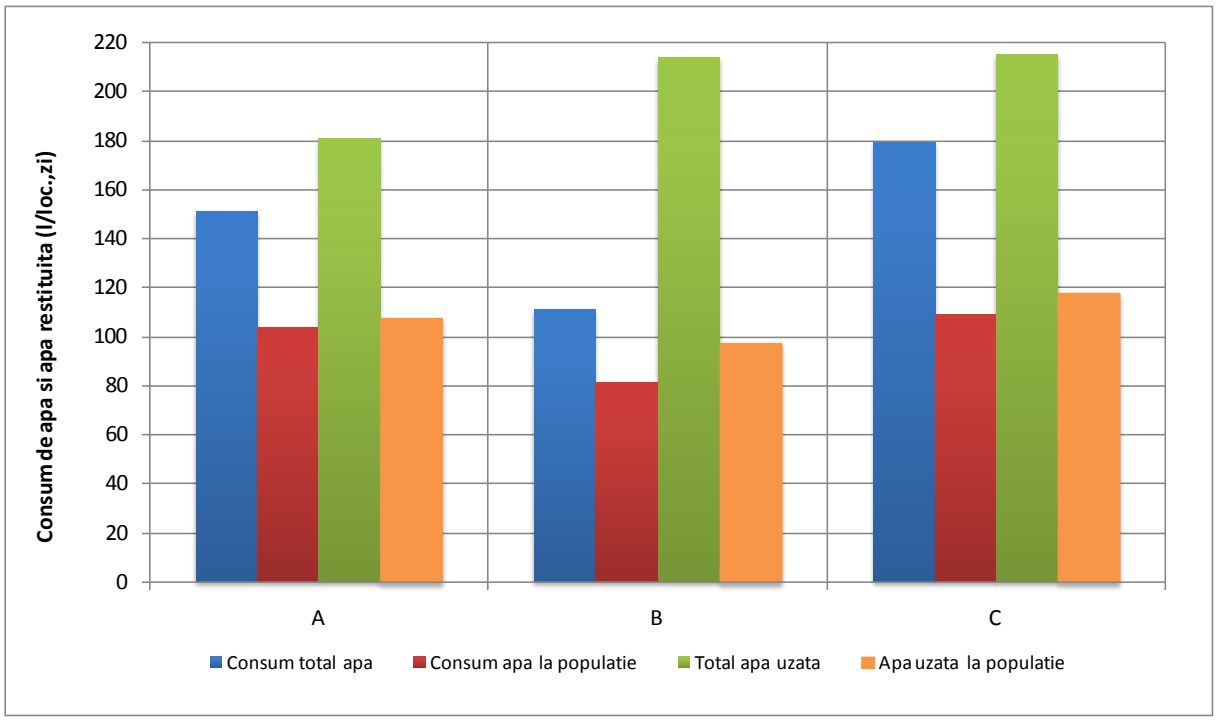


Figure 2.2. Water consumption and amount of water returned.

In the following figures are given the weights of the respective water and wastewater invoiced to the rest of the consumer population.

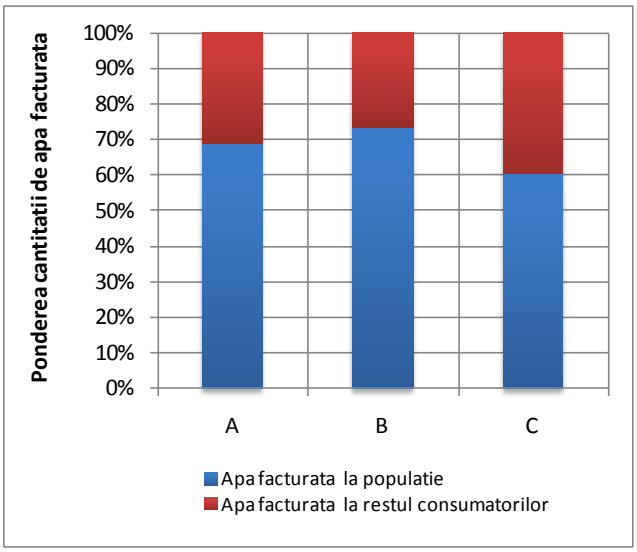


Figure 2.3. Share amount invoiced drinking water

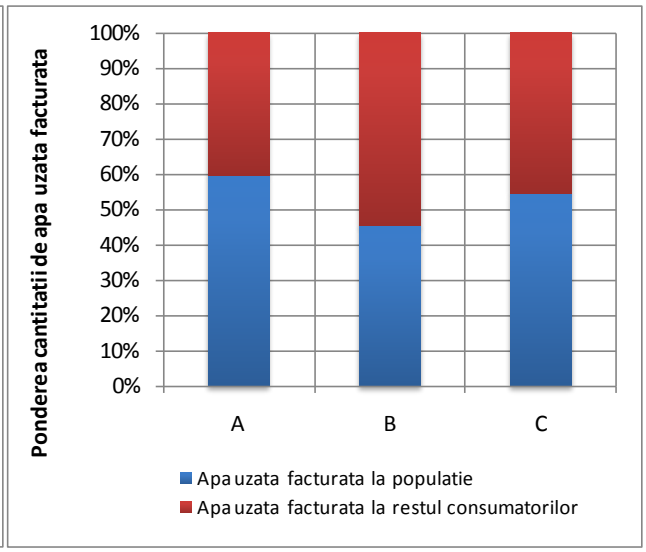


Figure 2.4. Share amount of wastewater invoiced

In the case of water, 60 - 70% of the amount billed is billed as if the population in waste water; only 45 - 60% of the population is billed to the rest of the other consumers. The biggest difference is recorded in the operator B, where 73% of drinking water is billed population and 45% of waste water is billed from the population.

2.2 Indicators on quality of service

Compliance with legislation regarding water quality is shown in the following figure.

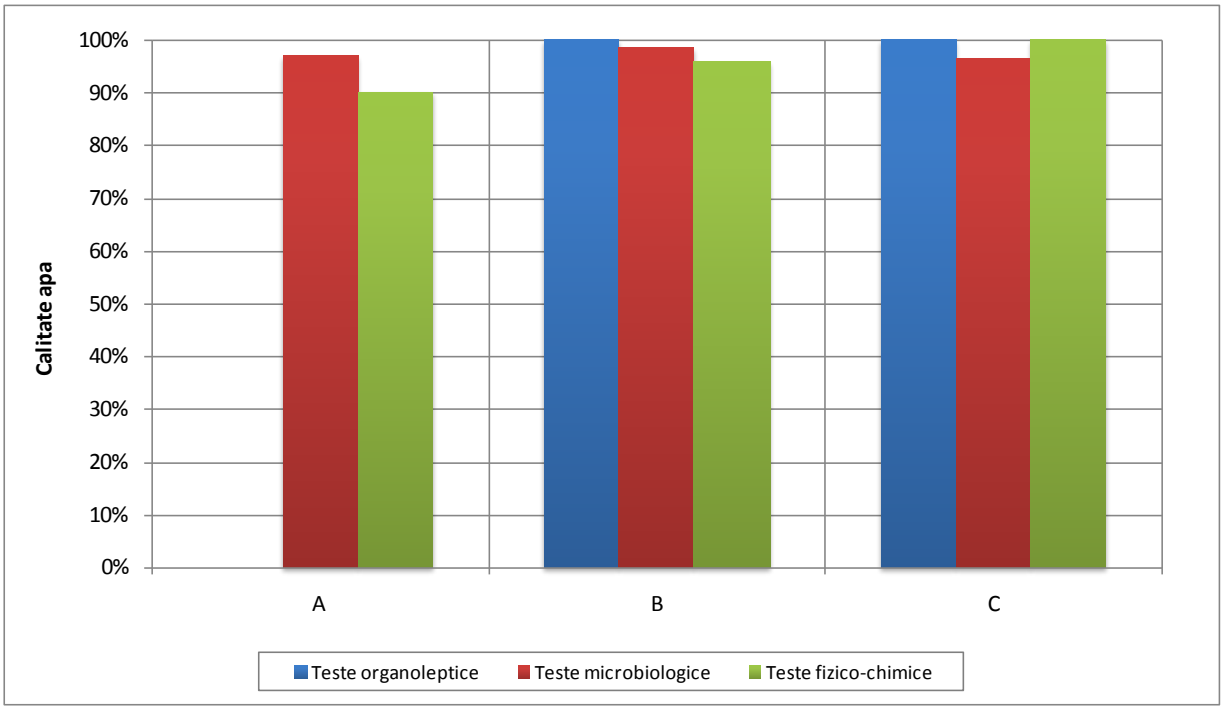


Figure 2.5. Drinking water quality

From the point of view of physico - chemical operator can be noticed that in the case of compliance C is 100%, while if the operator only 90%. From a microbiological for all operators, the percentage of samples in accordance with the law was 96 - 98%.

The quality of services in the water sector, as the number of complaints shows that if the operator small number of complaints is much higher than the other two operators. This is also related to investments in water supply system. The investments for the three operators will be subsequently coonsiderati.

Of the total number of complaints in the water sector have an important weight related pressure provided to the consumer and the related billing for all operators analysisyou. If the operator B has registered a number of complaints regarding water quality. Analyzing data context in the water sector is seen as it is in operation 26 treatment plants that require only chlorination of water which leads to the conclusion that these plants treating groundwater that may have non-compliant levels of iron and manganese, elements that give water color but does not directly affect human health.

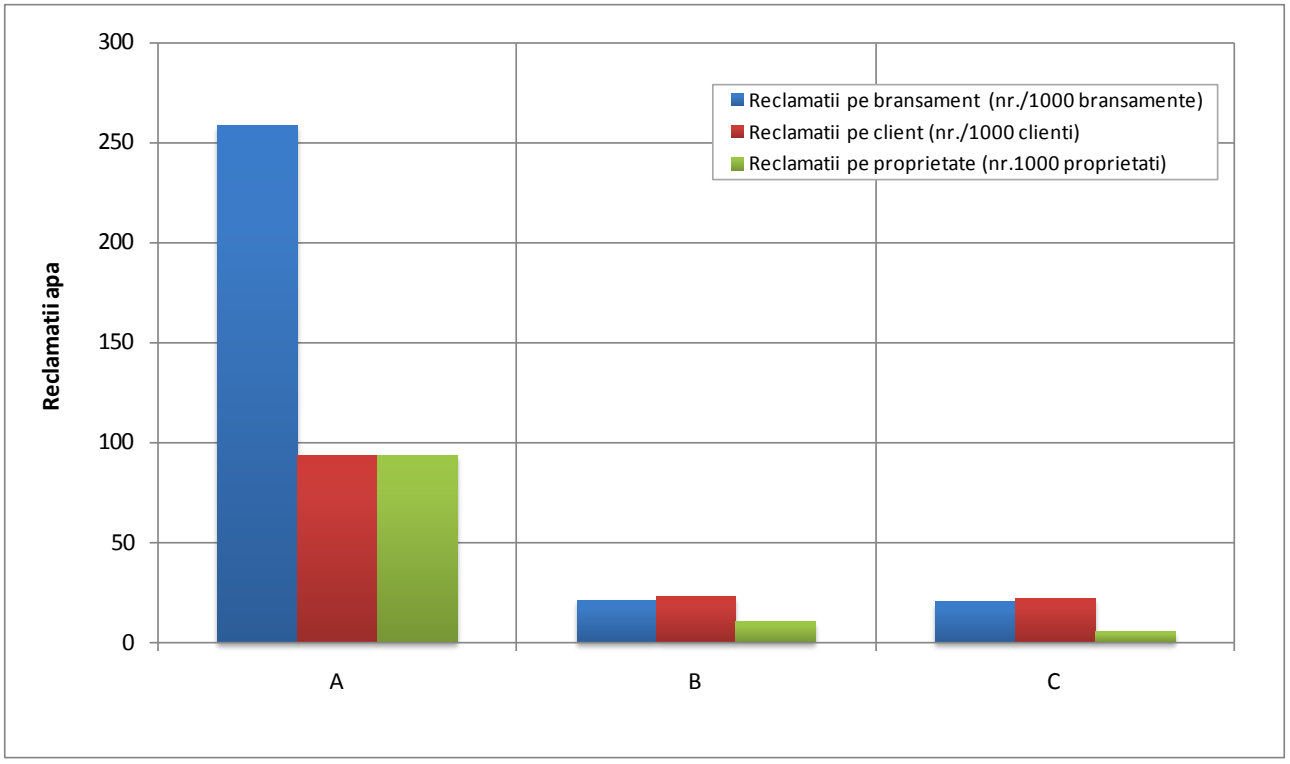


Figure 2.6. Complaints registered in the water sector.

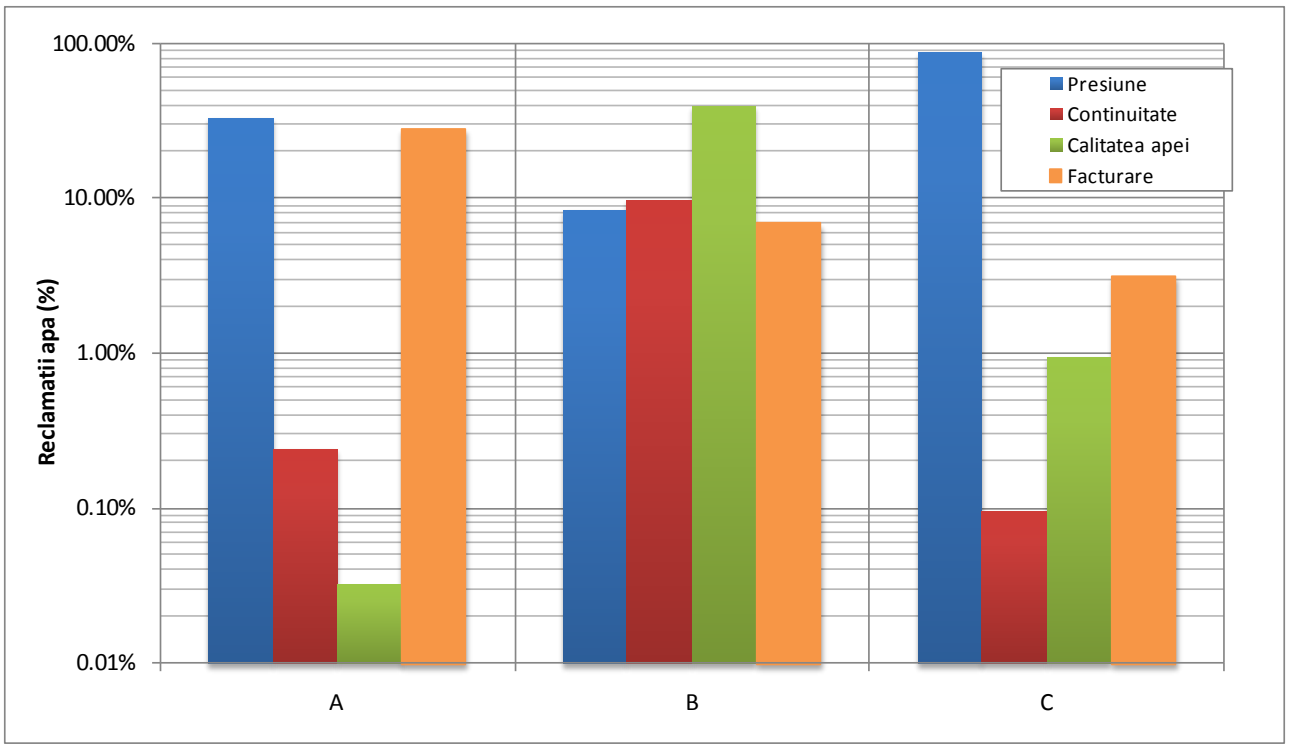


Figure 2.7. Type complaints recorded in the water.

Complaints registered in the waste water sewerage system aimed jams. Note that if the operator of the number of complaints is extremely low, although investments in wastewater system were extremely low.

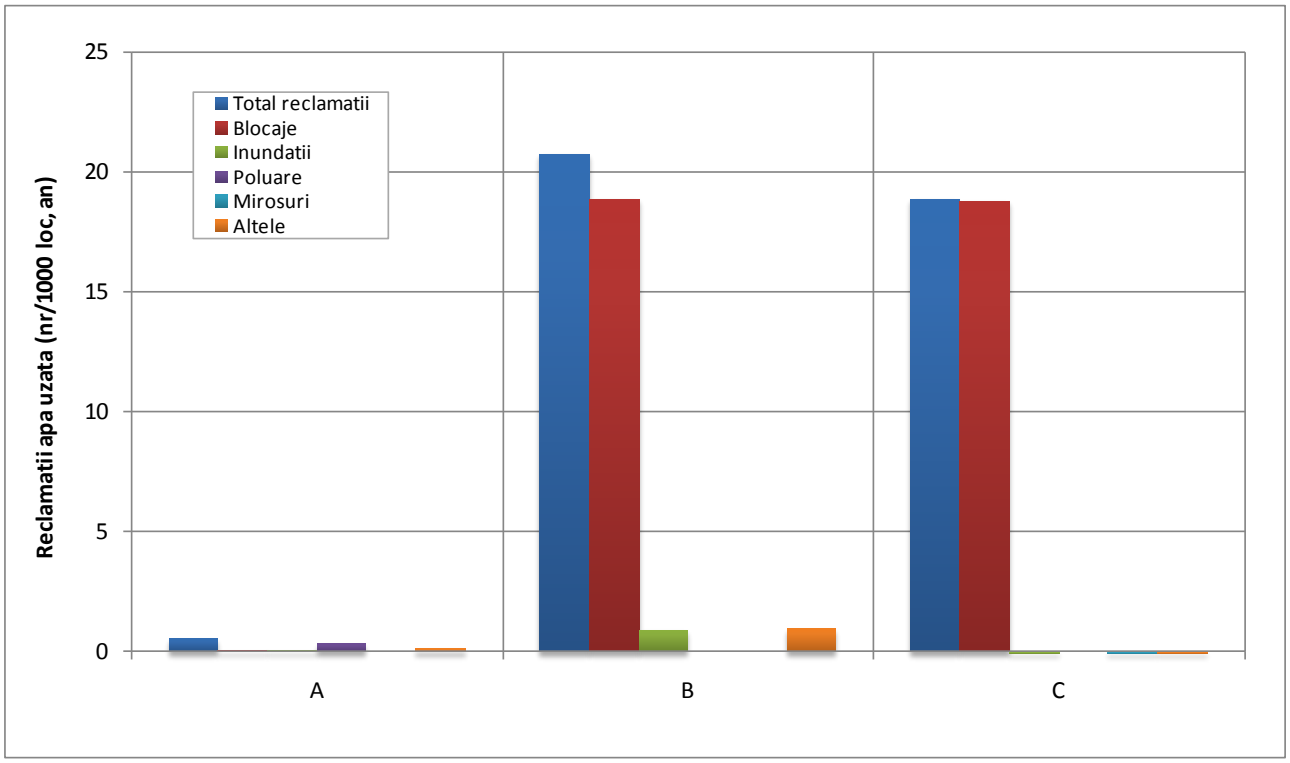


Figure 2.8. Complaints registered in the wastewater.

2.3 *Indicators of asset management*

In the following figures are presented losses of water in the water supply system.

The smallest amount of water loss was recorded for the operator B which has recorded the highest number of failures in the distribution network. According to data, loss of water when the operator B occurs only in case of failure and perhaps they are detected quickly. There are no permanent water loss leading to a high level of total amount of water lost from the system.

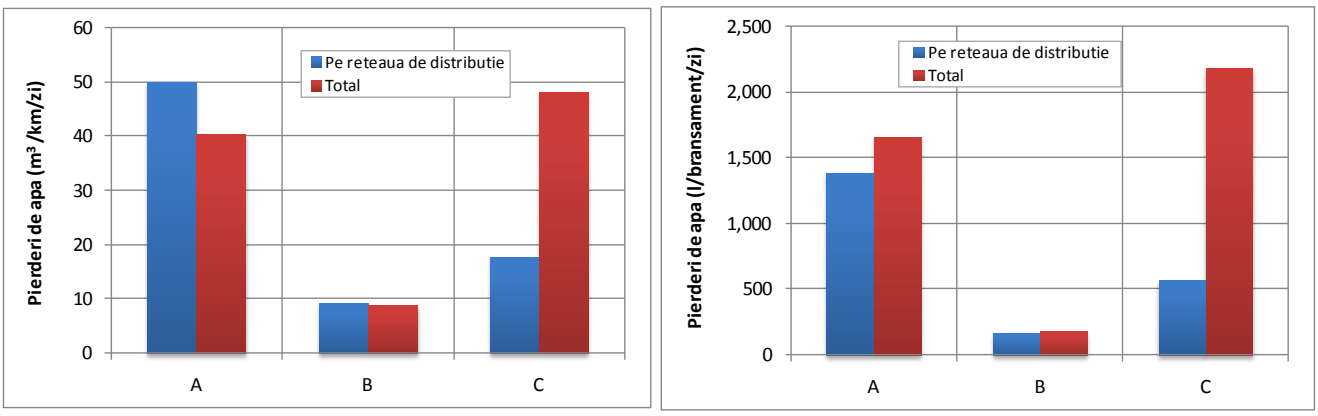


Figure 2.9. Water loss in water supply system.

In terms of the number of failures in supply and distribution network in the case that the operator finds thatof the number of failure is very low (20 completely destroyed / 100 km to 162 completely destroyed / 100 km in the case of operator B, respectively 130 completely destroyed / 100 km in the case of operatorrului C) even if it were rehabilitated / extended pipe water and the investment was minimal.

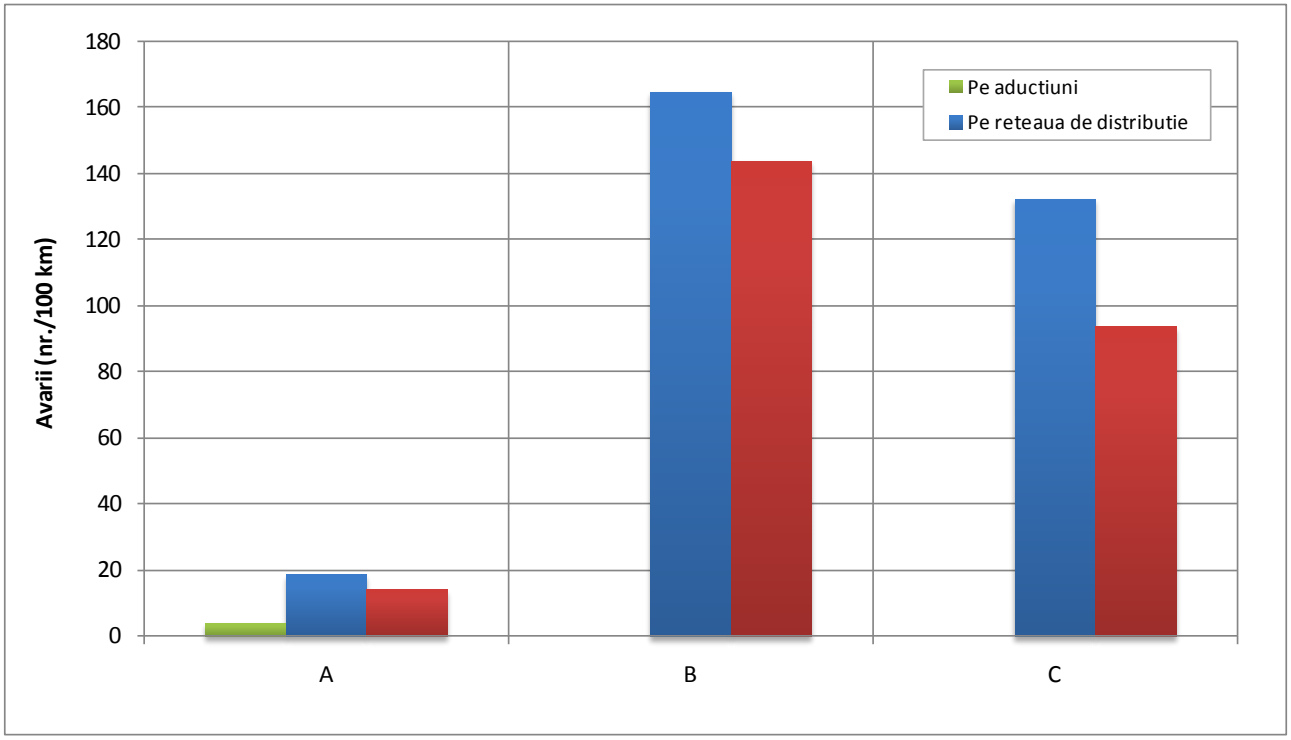


Figure 2.10. Damage to the water supply system.

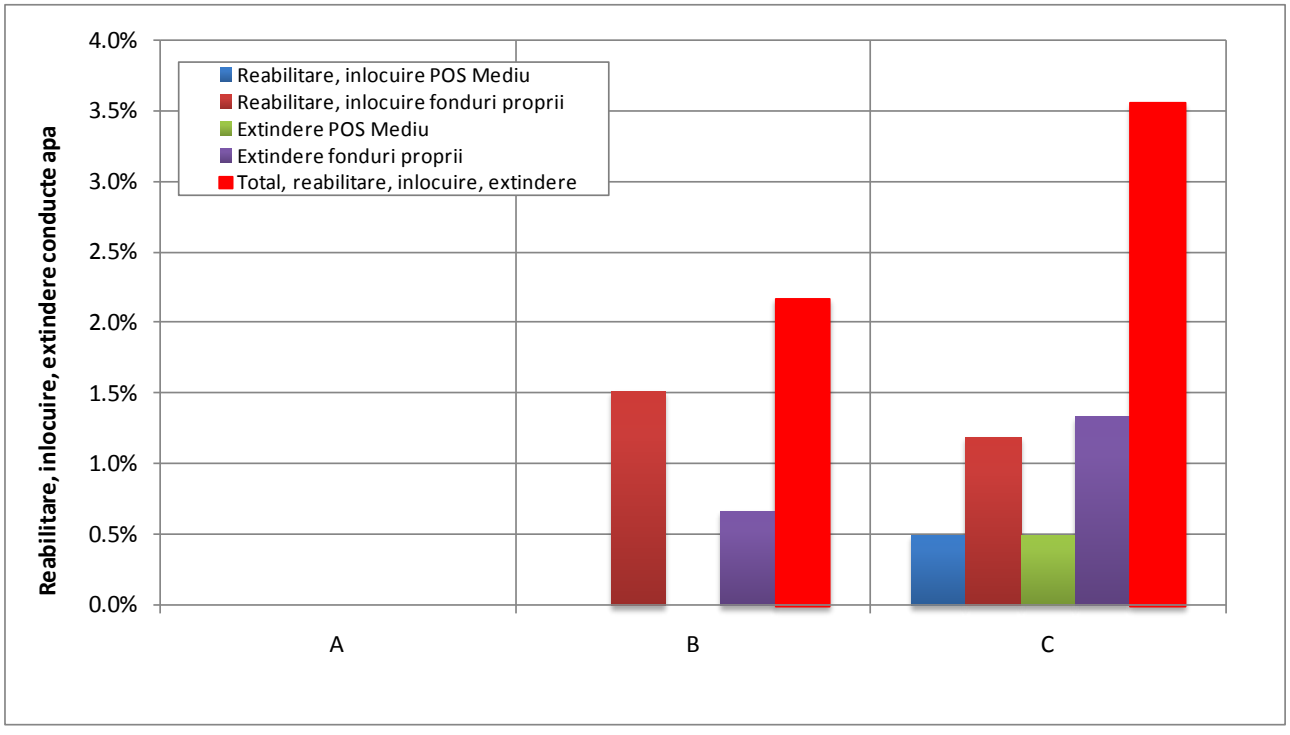


Figure 2.11. Rehabilitation and extension water pipe.

In terms of the level of investment in the water sector operator C (large operator) made 5 times more investments than other two operators, both in equity and budget and location by accessing European funds. Investments led both the rehabilitation and extension of water and increase water quality distributed population.

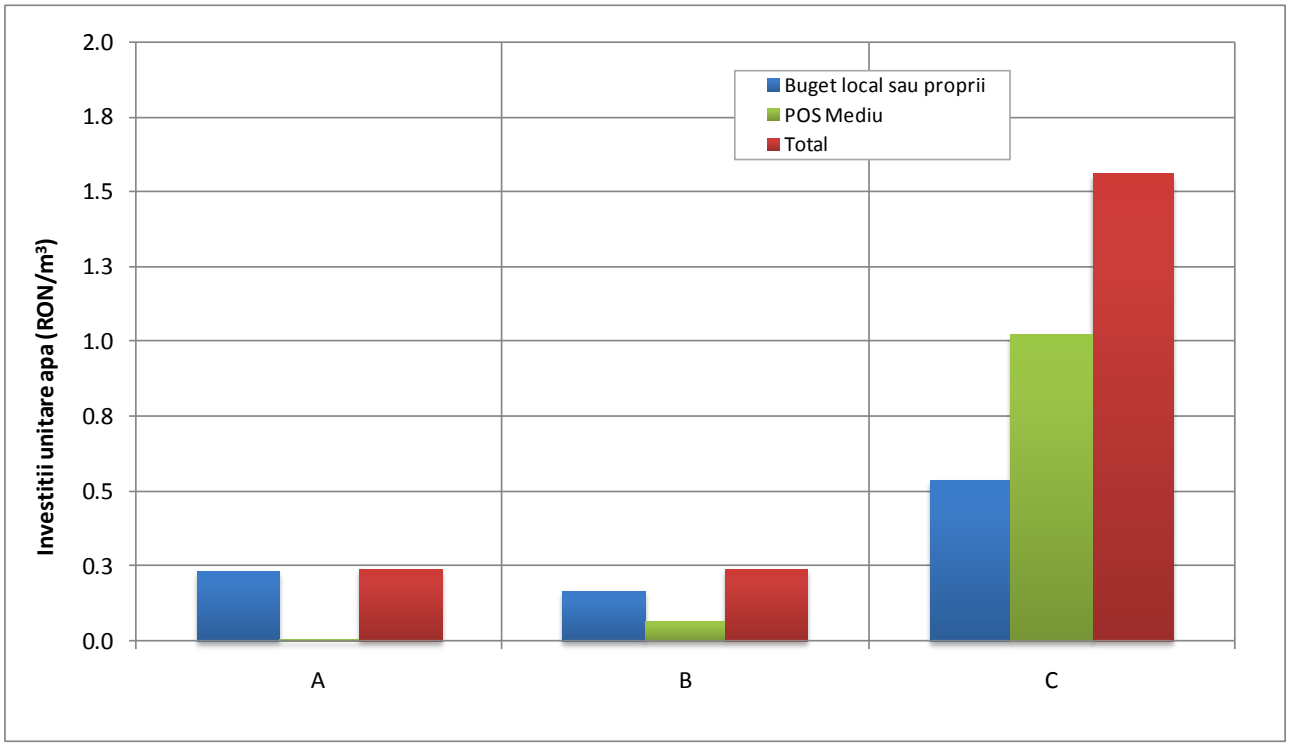


Figure 2.12. Investment in the water supply system.

The figure below illustrates the level of investments in the wastewater.

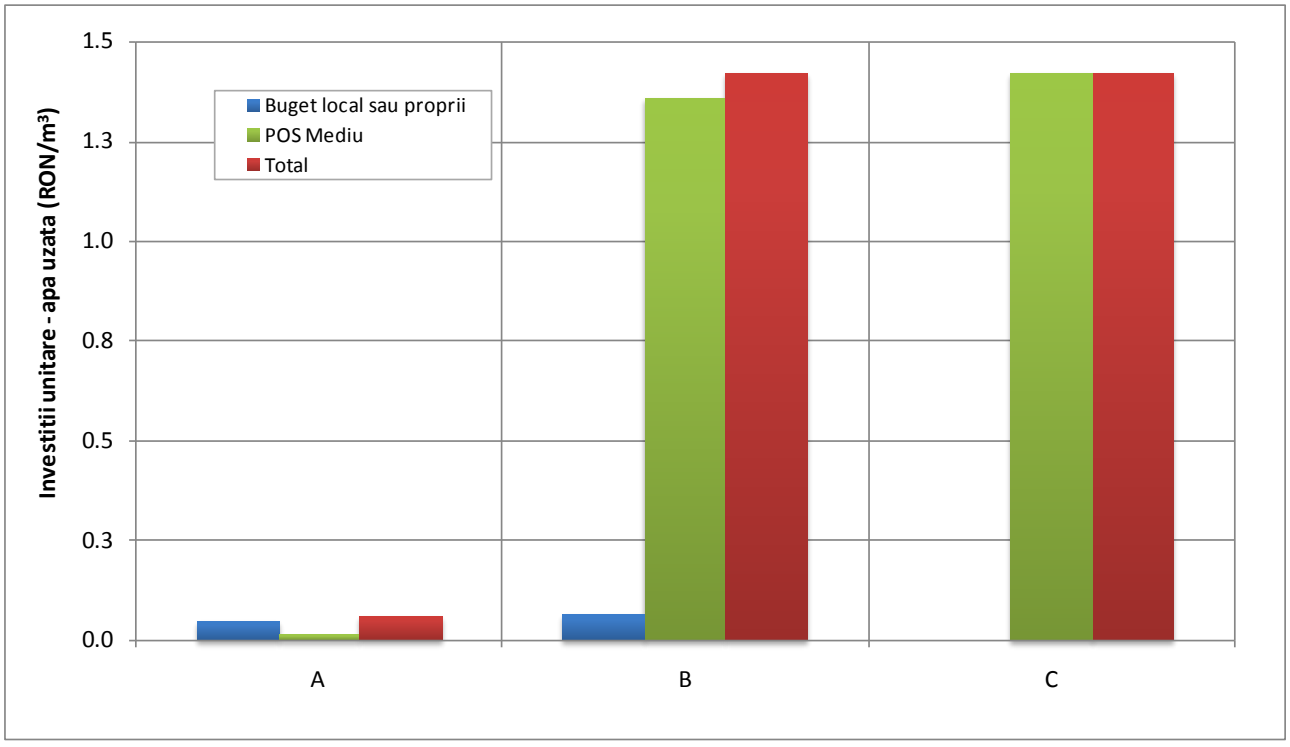


Figure 2.13. Investing in wastewater.

And in this case the operator C has the highest investment resulted in a 3% expansion of the sewerage system. The operator has achieved a minimum level of investment in both the water and wastewater sector.

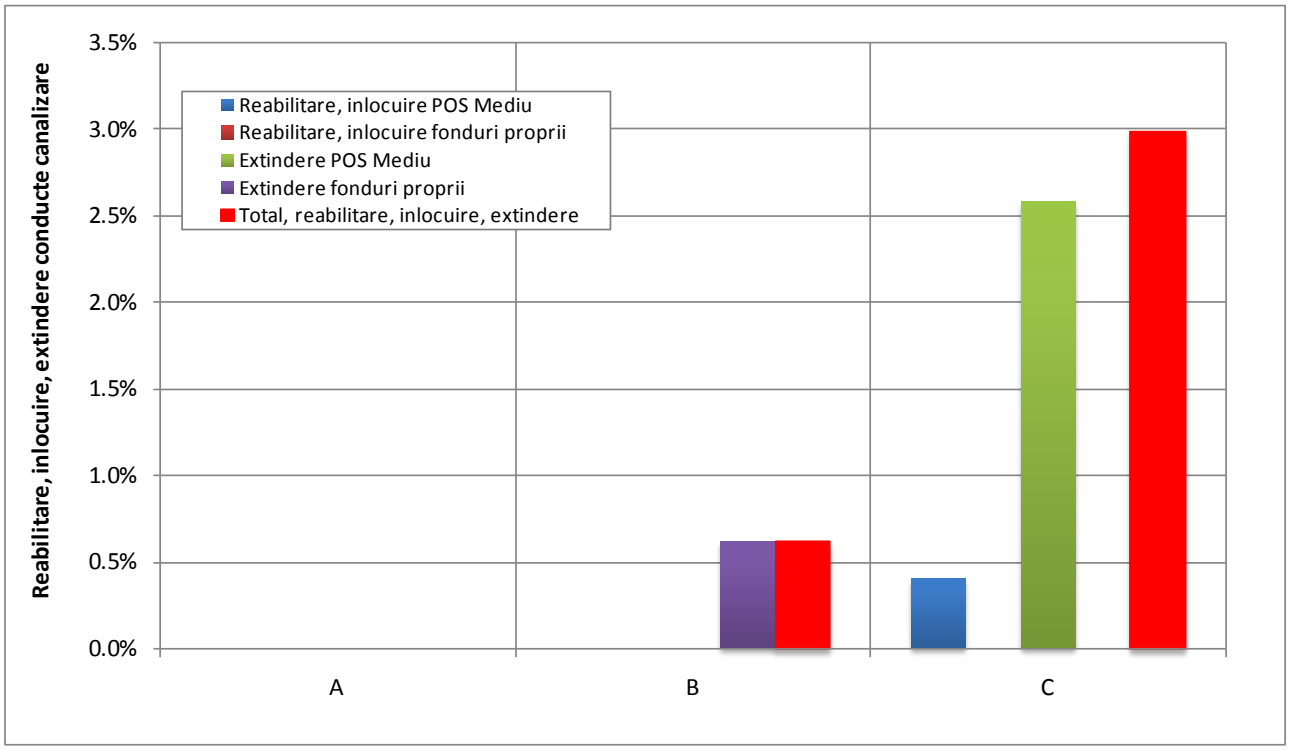


Figure 2.14. Rehabilitation / expansion of sewerage network.

2.4 operational indicators

Following figures presents the variation operators analyze operational indicators.

In the drinking water, energy cost accounts for 12 - 20% of total costs and the costs for maintenance and repairs below 5% of total costs. If energy consumption is expressed in kWh / m^3produced water is observed a variation of 0.3 kWh / m3 in the case of small-scale operator to 0.9 kWh / m3 in the case of large operator. This energy difference may be due to consumption of water treatment (large operator made investments in the water sector leading to energy consumption). Also in the case of high-operator it was found that the number of complaints was lower overall and therefore the number of complaints of the network water pressure (water pressure lead to higher energy consumption).

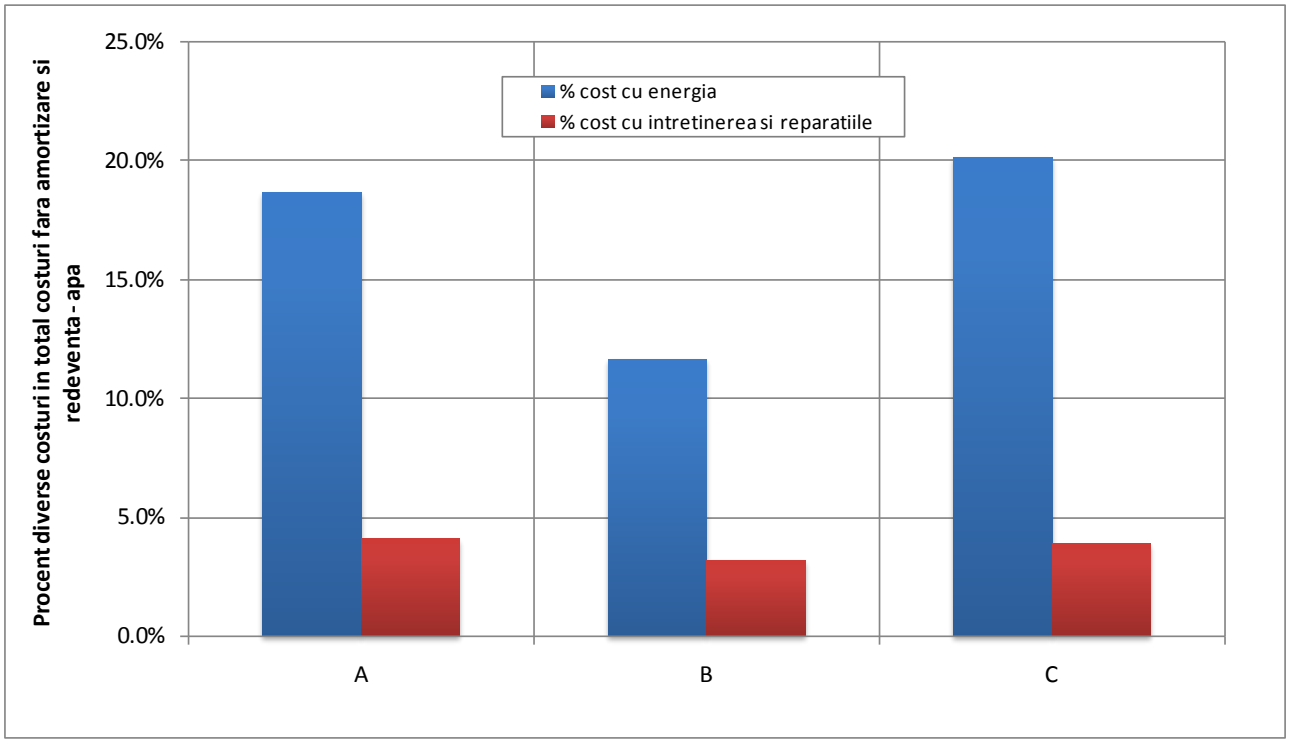


Figure 2.15. Energy costs or maintenance and repairs in the water.

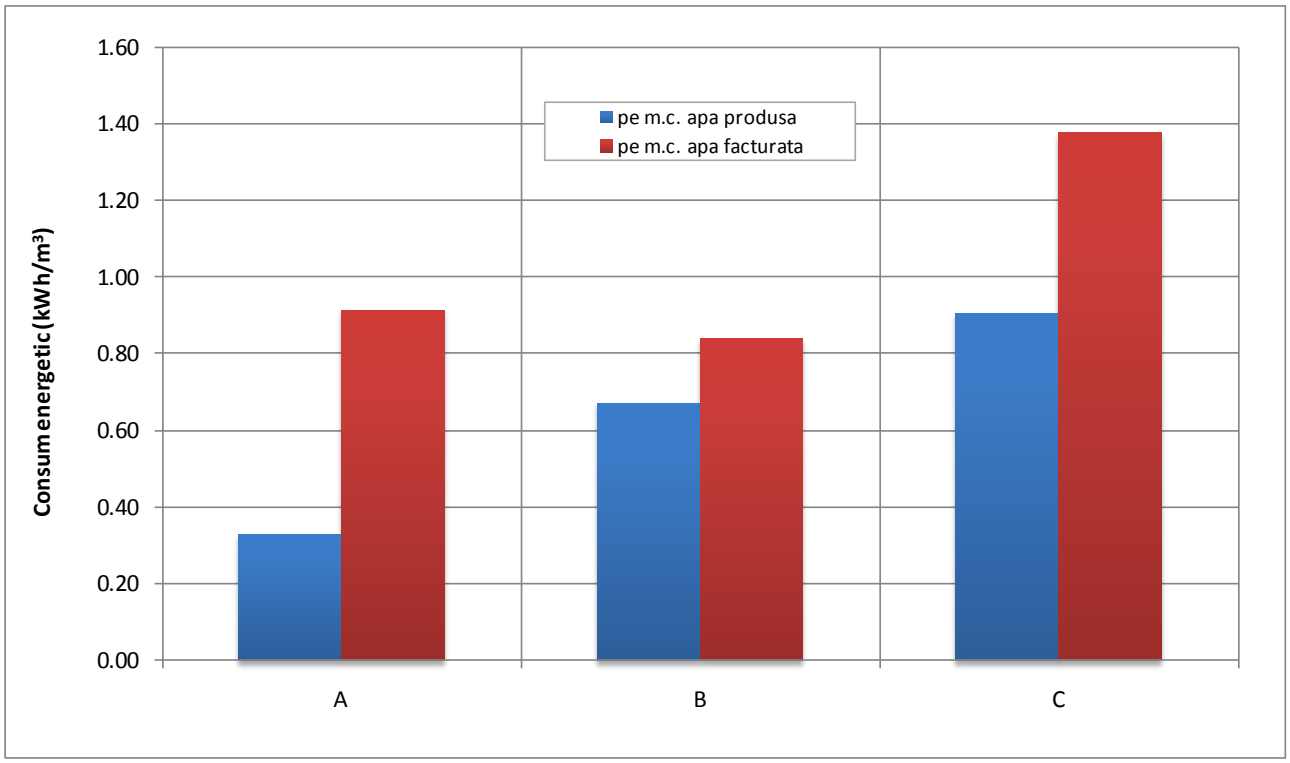


Figure 2.16. Power consumption in the water.

If wastewater is found that the percentage of energy costs is between 7 and 35% of total costs, and maintenance costs and repairs are 2 - 3% for 2 or 3 operators.The differences in energy costs can arise from the fact that operators in February and March have made investments in the wastewater, leading to equipment with lower energy consumption. Mostly, power consumption is achieved in wastewater treatment.

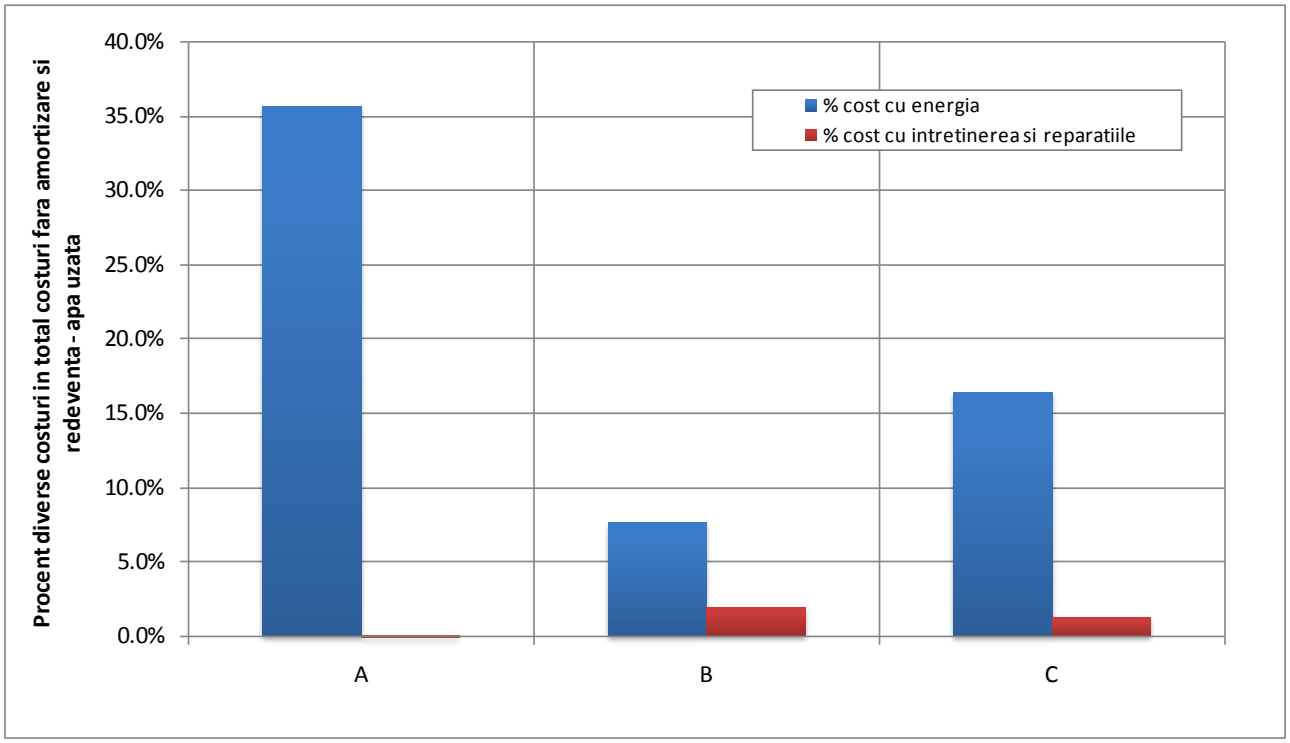


Figure 2.17. The cost of energy, namely maintenance and repair in the wastewater.

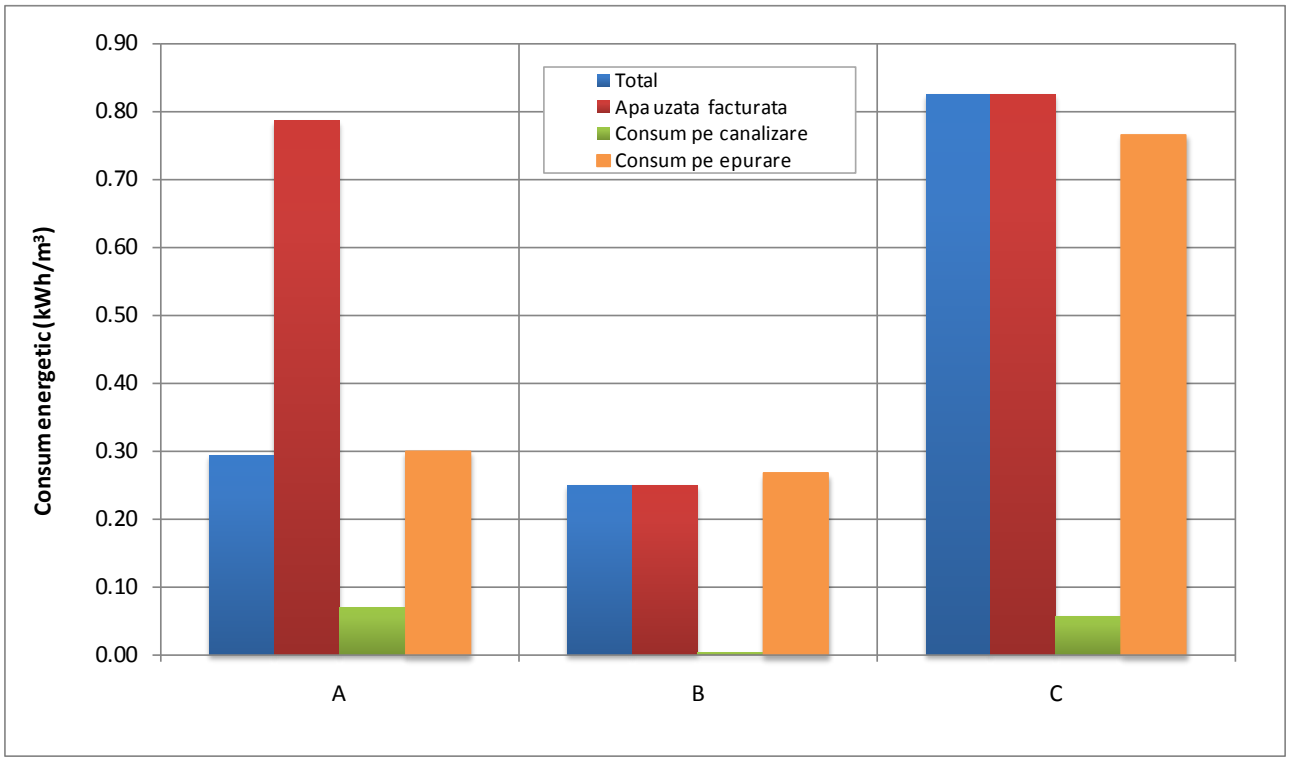


Figure 2.18. Power consumption in the wastewater.

The following figures show data for the largest wastewater treatment plants operated by each operator.It shows a slight reduction in energy consumption by increasing the capacity of treatment plant. It is 100 kWh / them to a cleaning station 30,000 you and 30 kWh / them to stations 100,000 comply 500,000 them if energy consumption is expressed in kWh / m3 treated water is found that it varies between 0.35 kWh / m3 water SE 30,000 purged if they and 0.2 kWh / m3 treated water for 500,000 SE them

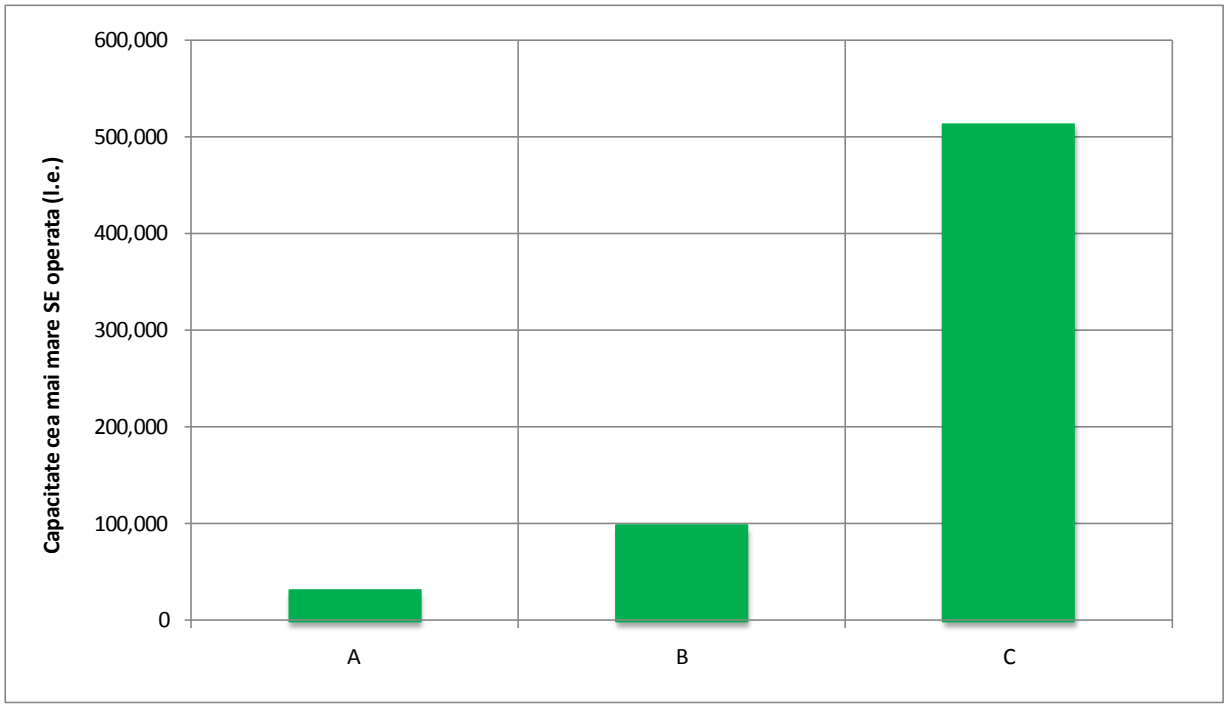


Figure 2.19. Capacity largest wastewater treatment plant operators.

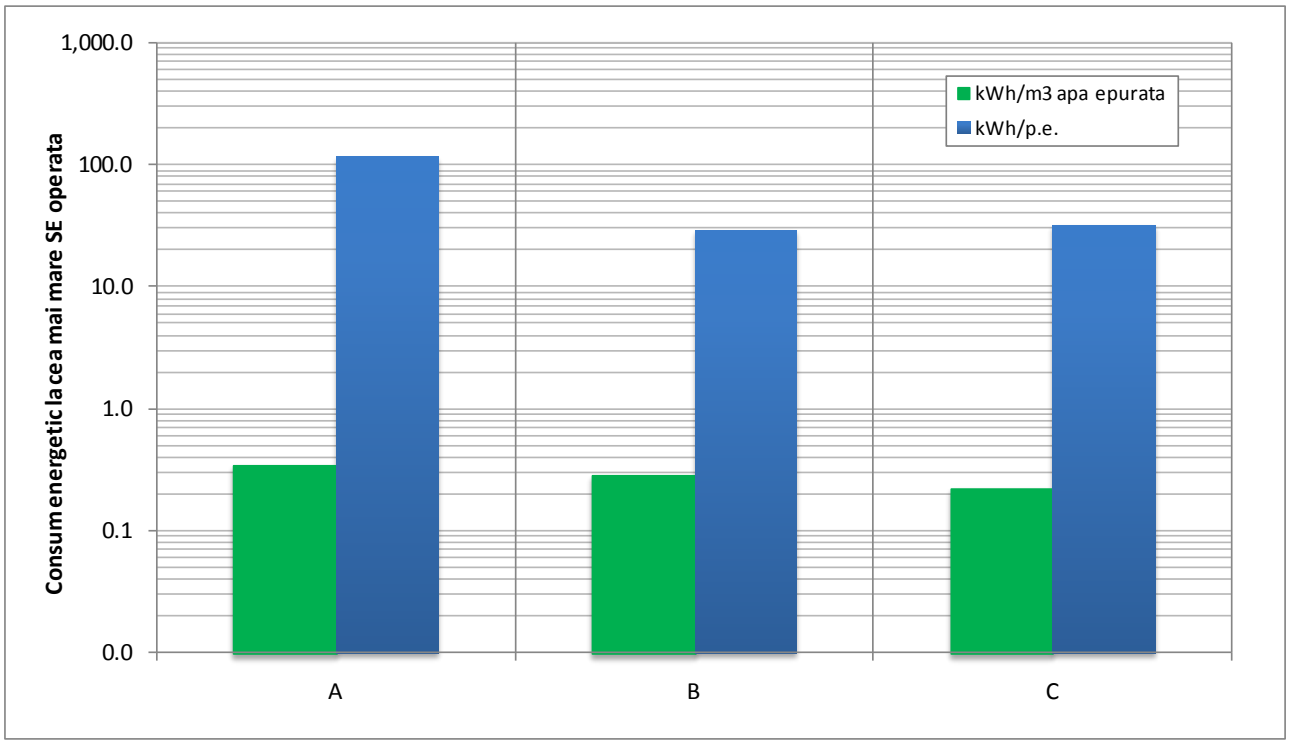


Figure 2.20. Energy consumption in the largest wastewater treatment plant operators.

The figure below illustrates the production of sludge in the wastewater treatment plant higher exloatata analyzed by each operator. It shows a variation in the range 10 - 170 kg DM / 1000 m^3purified water or 1.5 - 50 kg DM / the smallest amount of sludge and - registered in the SE with a capacity of 500,000 too much sludge produced is dependent on the quality of waste water.

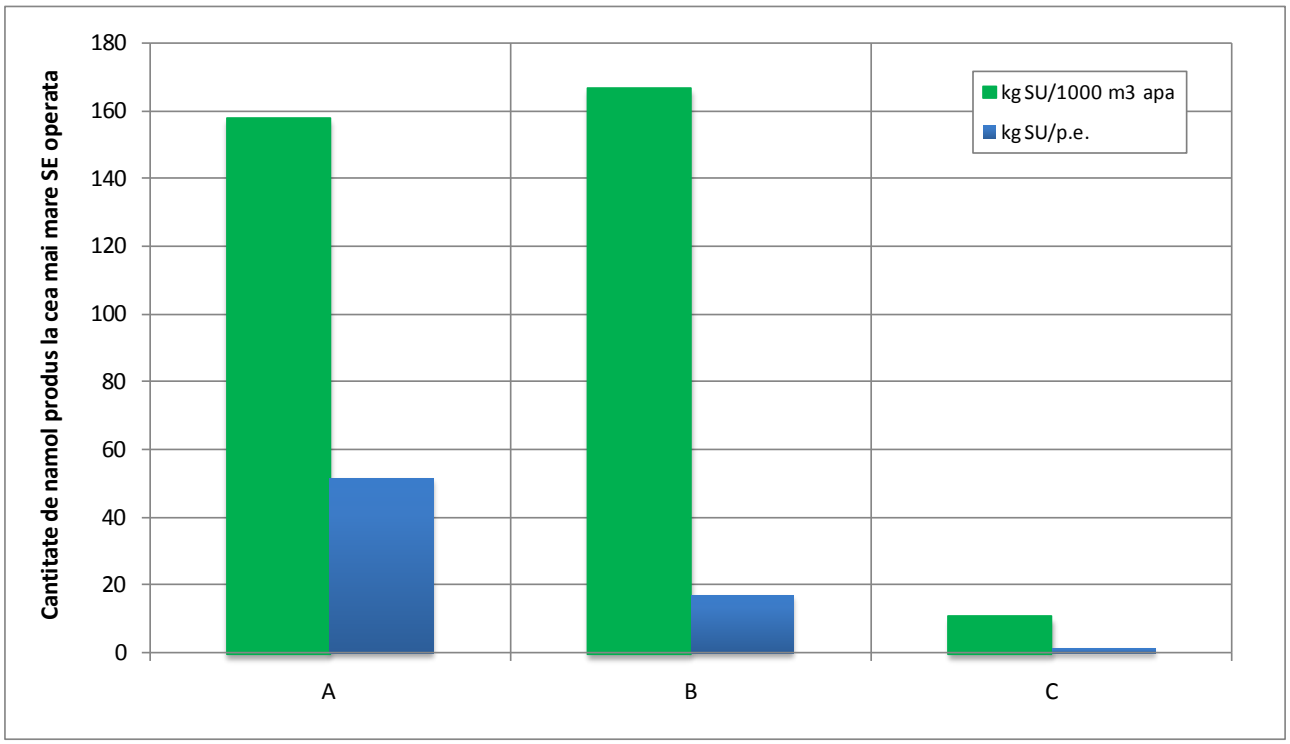


Figure 2.21. Quantity of sludge produced at the largest wastewater treatment plant operators.

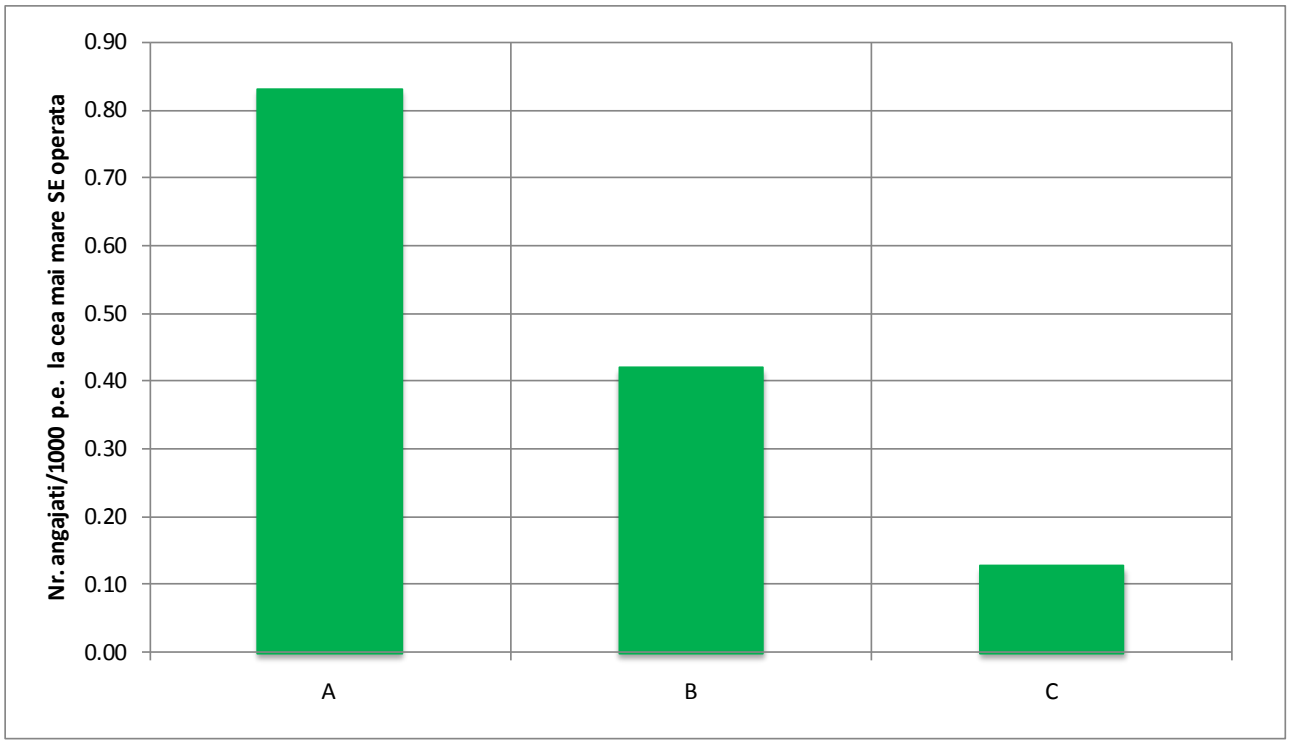


Figure 2.22. Number of employees at the largest wastewater treatment plant operators.

The number of employees at the largest wastewater treatment plant operator within each analysis is presented in the previous figure. It shows a reduction in the number of employees by increasing the capacity of treatment plant from 0.83 employees / 1000 them to the treatment plant 0.12 30,000 employees it / them to the treatment plant with a capacity of 500,000 it

The figure below illustrates the amount of wastewater discharged untreated to the 3 operers analyzed. The operator C (high operator) is not flown into the discharge water while the operator A discharging 25% of untreated waste water collected. This can be explained by the investments made by the operator C both own funds and from SOP.

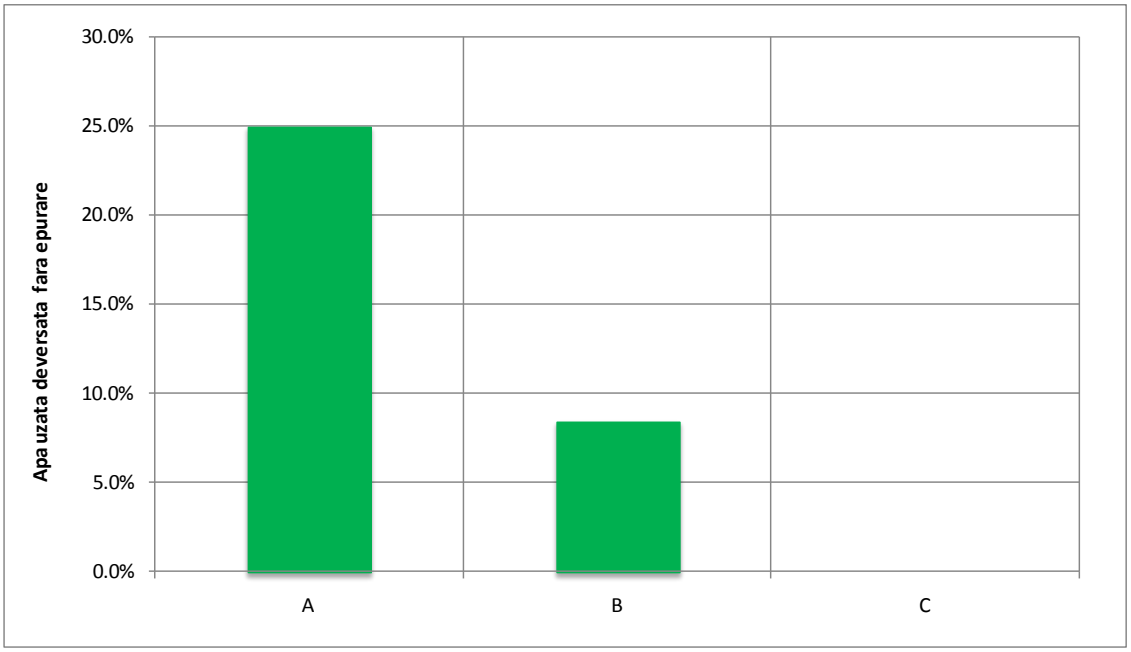


Figure 2.23. Amount of wastewater discharged without treatment.

The figure below illustrates the amount of sewage sludge produced by the three operators. Store trend recorded for the largest wastewater treatment plant within each operator, the smallest amount of mud registering ifOperator C (2 kg DM / them, while produce 52 kg DM operator A / B and the operator they produce 17 kg DM / em

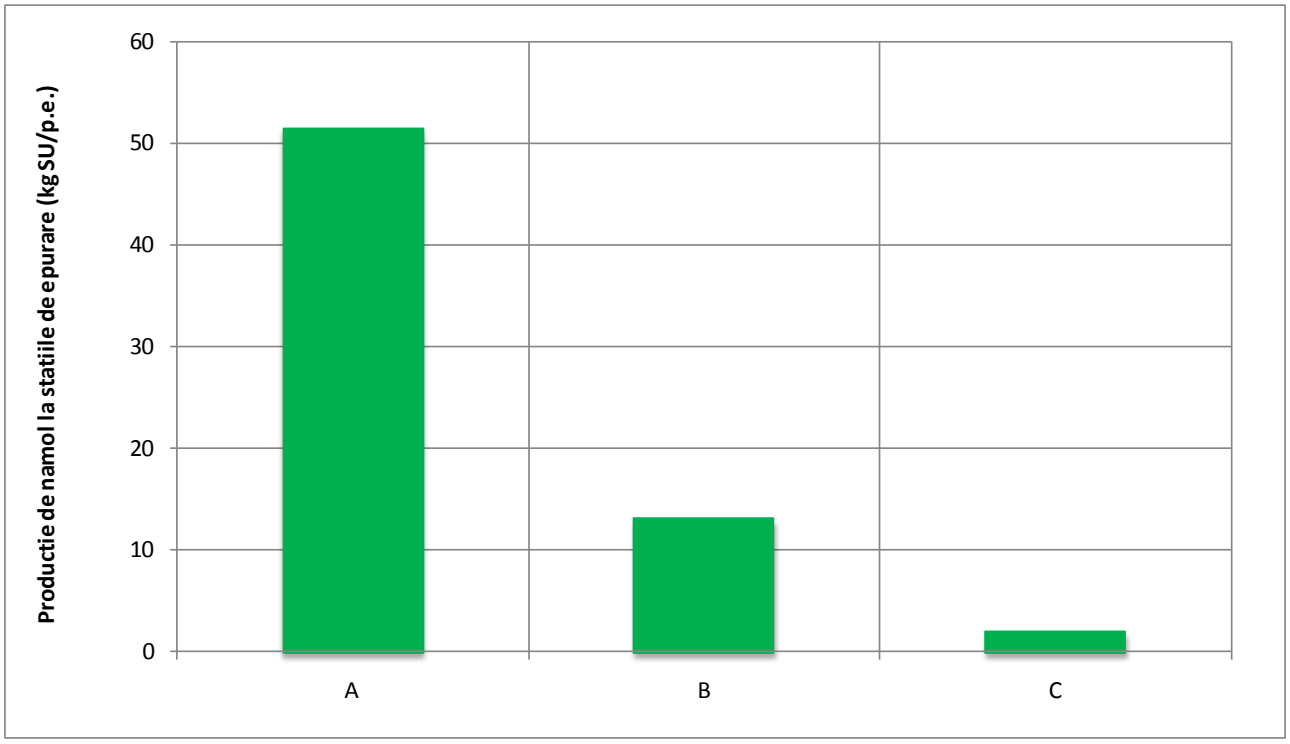


Figure 2.24. Production of sewage sludge.

2.5 Company staff

Efficiency of water supply and sanitation indicators can be assessed by staff: staff structure, the percentage of staff costs in total costs, average cost of an employee, average revenue per employee, profitability staff.

The following figures are presented for the three operators considered indicators analyzed.

Personnel costs in operating water supply systems ranges between 39% and 55% and for wastewater systems between 43 and 64% of total operating costs. The smallest share of personnel expenses reported for the operator C.

The following figures are costs or average revenue per employee for the water wastewater respectively. For operators A and B both costs and revenues are higher for employees of the wastewater while the operator C if they are uniform. The ratio of average income / employee and the average cost of an employee varies in the water from 1.9 to operator B 3.14 operator C and in the waste water from 2.6 to operator A 3 operator C (Figure 2.27 - Return staff). The best return of staff - has been recorded in the operator C.

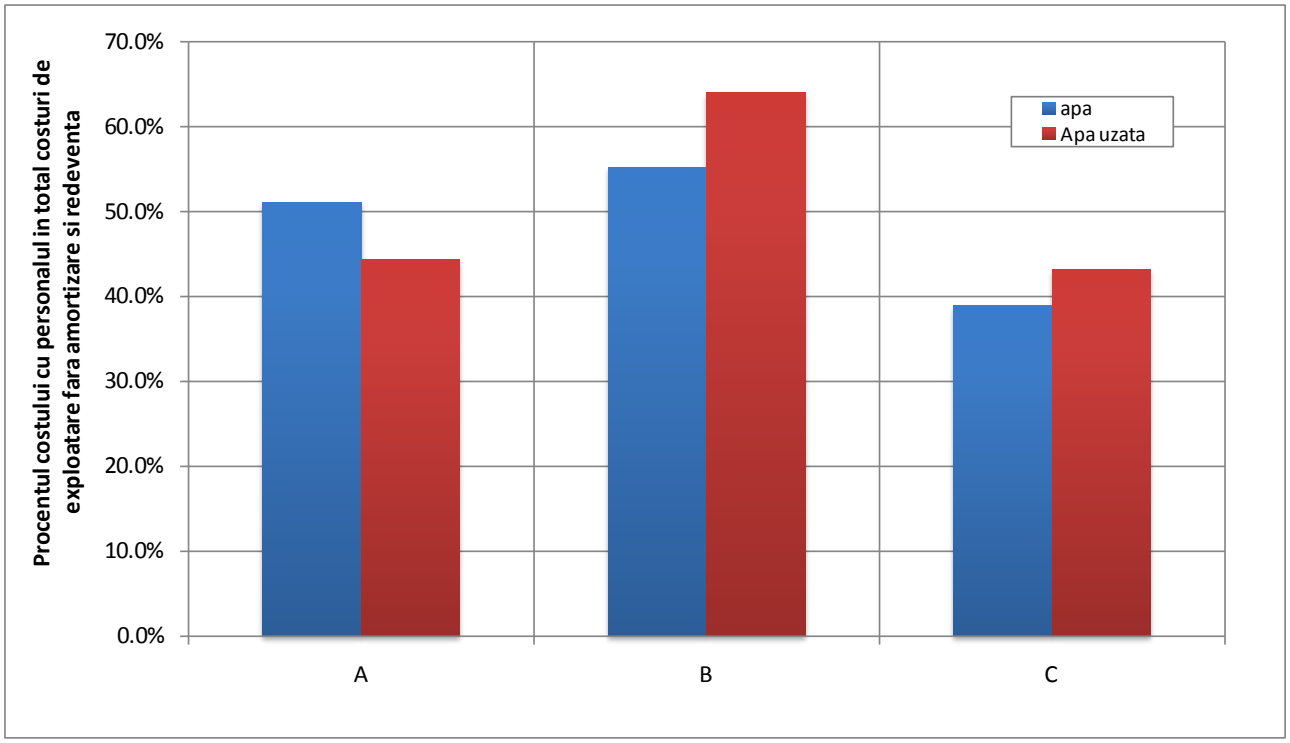


Figure 2.25. Personnel costs in total operating costs.

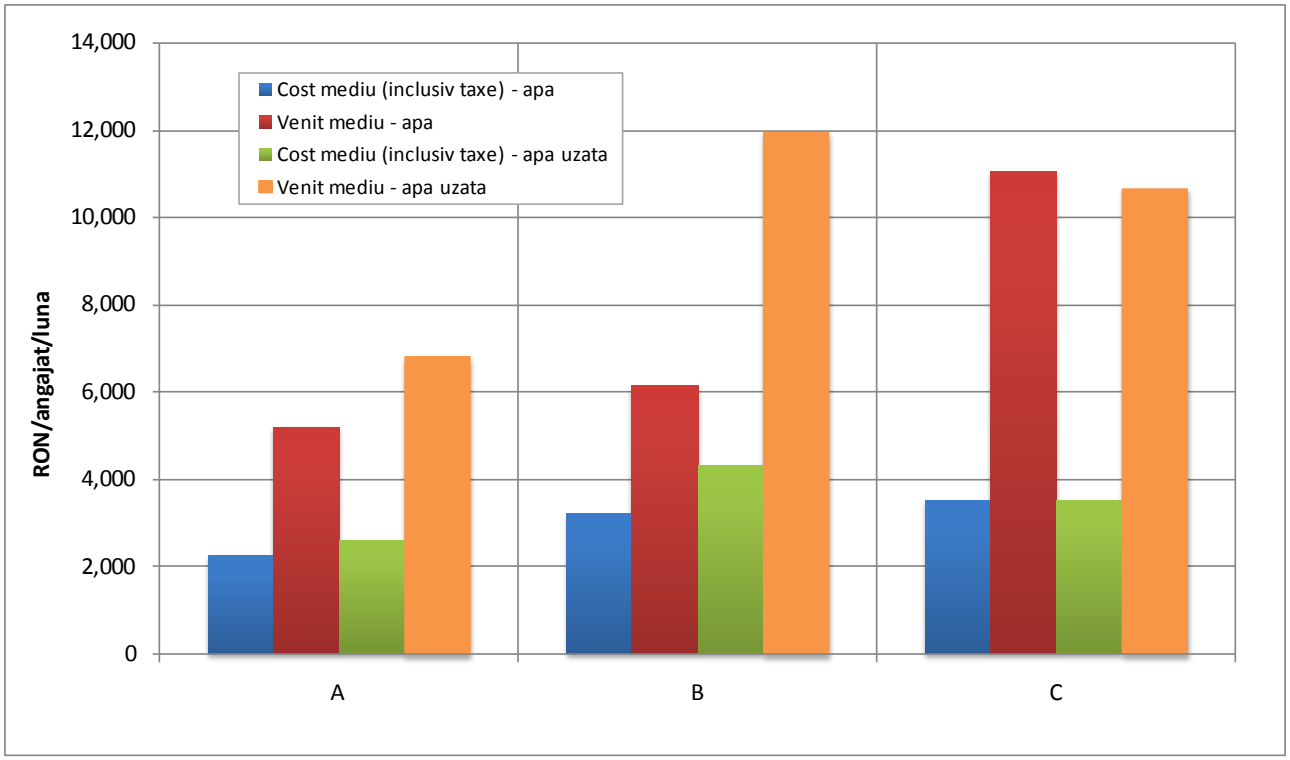


Figure 2.26. Average cost and average income employees.

Analyzing the average costs and average revenue per total society (figure 2.28) that varying the average cost of an employee is in the 2600 RON / employee, month - 3544 RON / employee,

month and average earnings are 5589 RON / employee, month up to 11032 RON / employee month. Return personnel carrier in the range 2.14 to 3.13 small to large operator.

In Figure 2.29 is shown the structure of staff operators analyzed. For all three operators largest share of employees are direct employees in the water sector. Small operator has the largest share of general and administrative employees is reflected in return on total company staff.

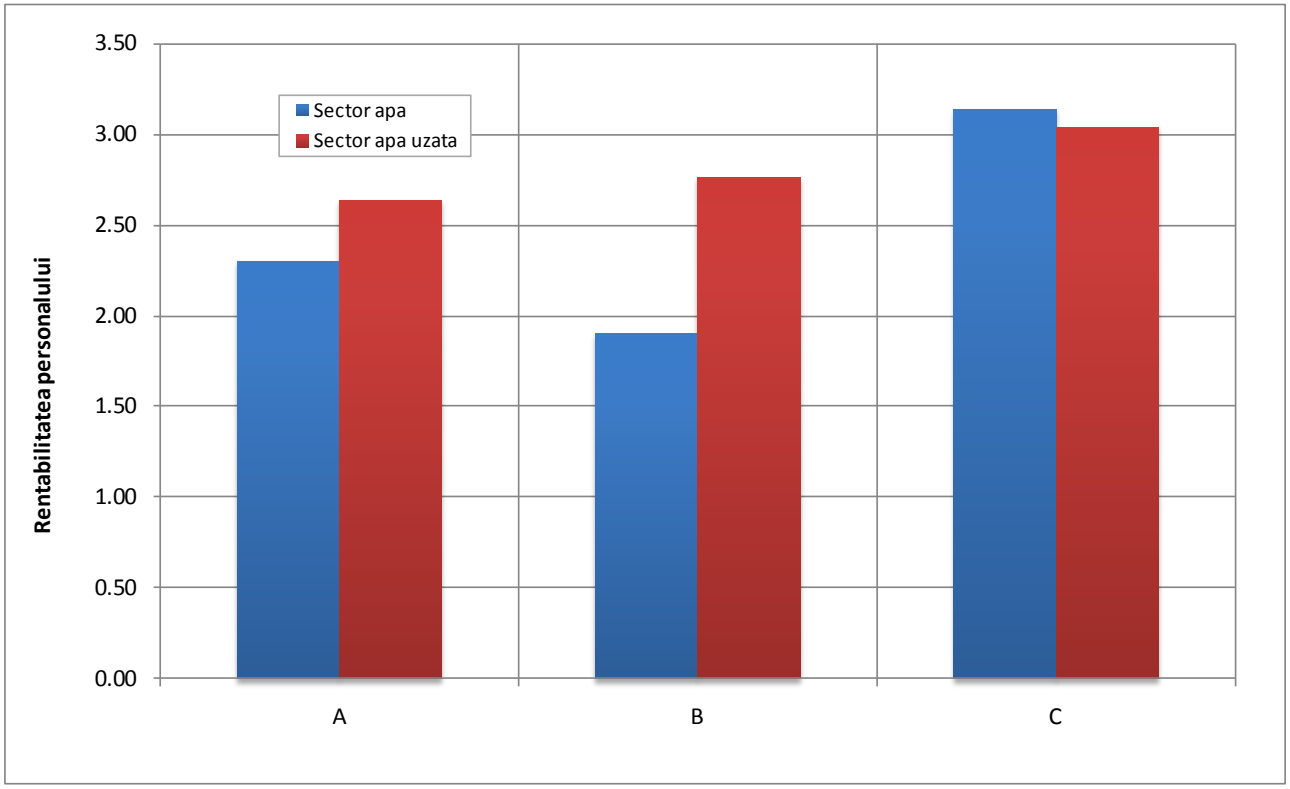


Figure 2.27. Profitability of staff.

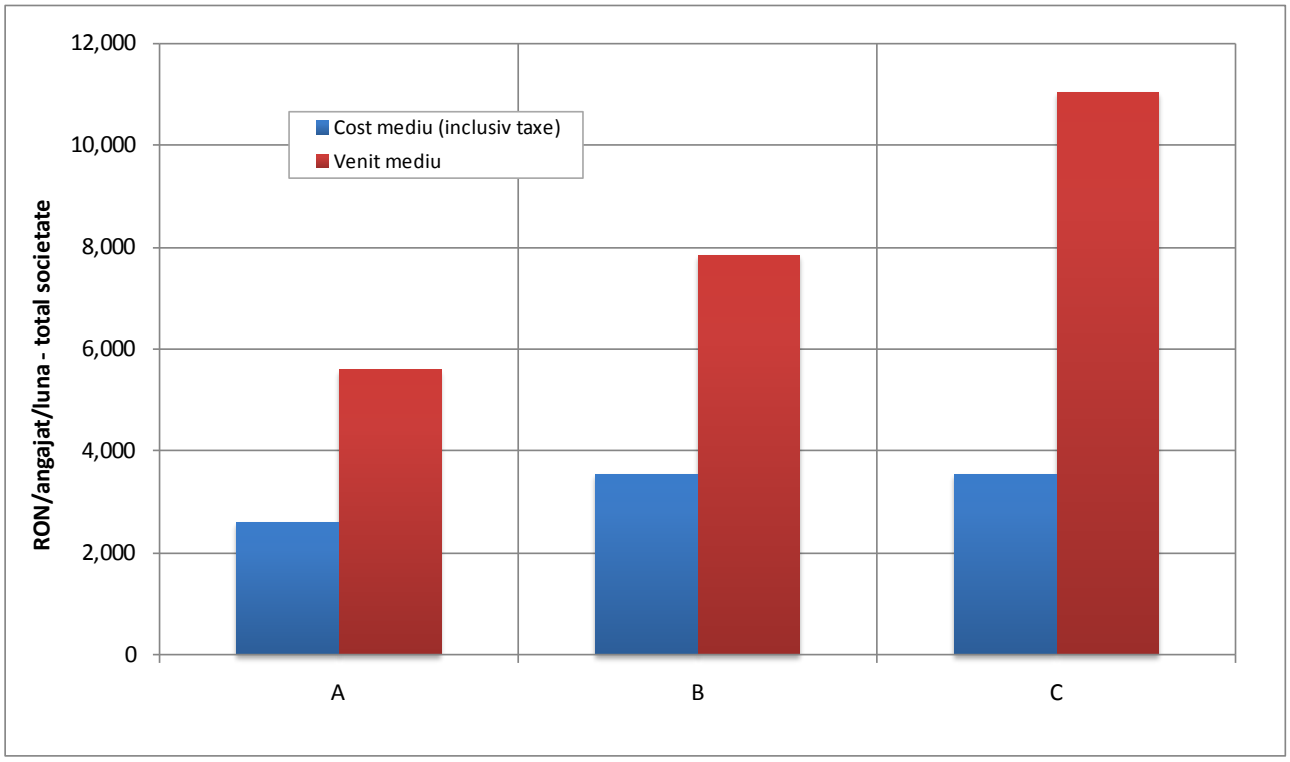


Figure 2.28. Average cost and average income employees - company total

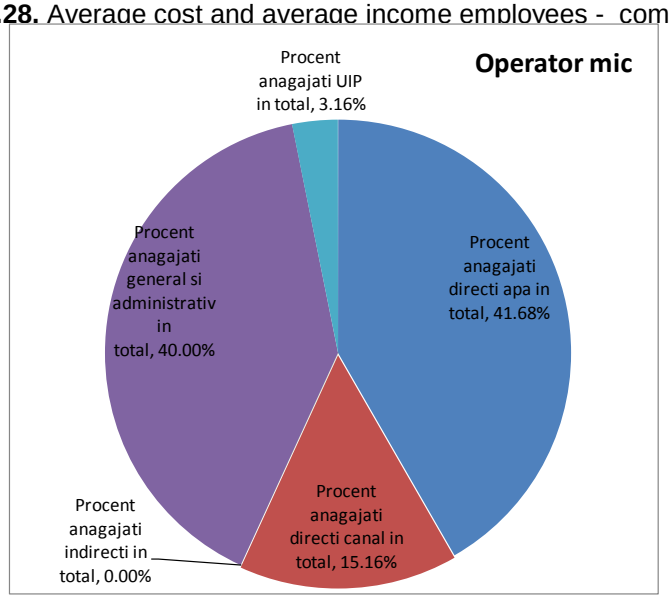


Figure 2.29. Structure of staff - operator A.

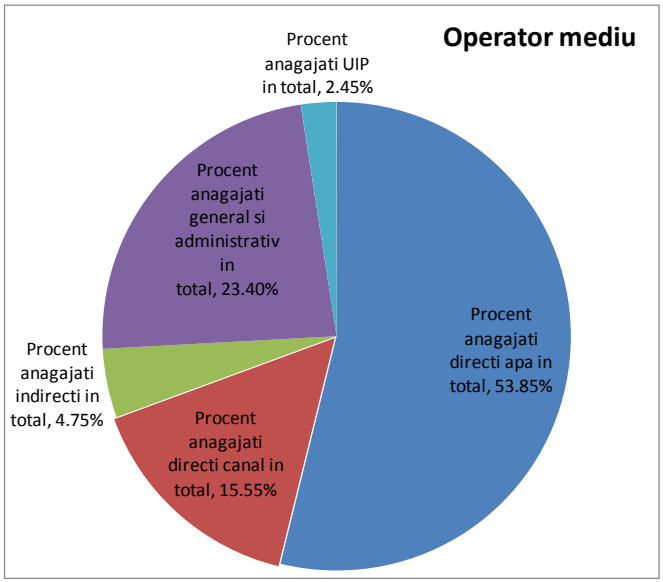


Figure 2.30. Structure staff - operator B.

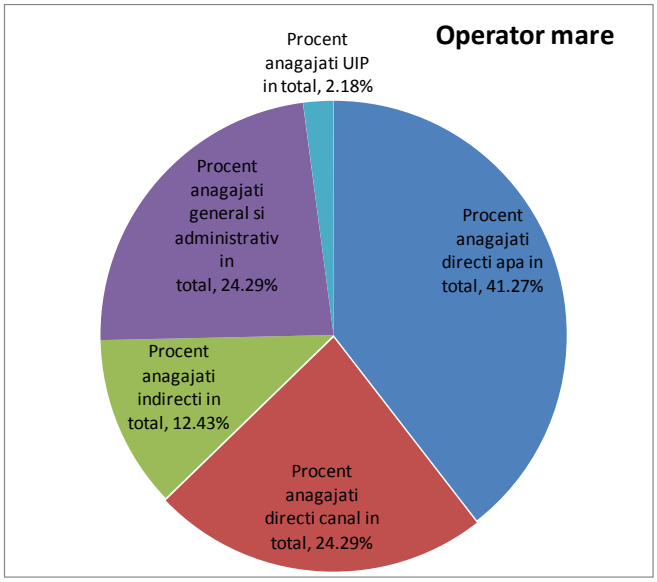


Figure 2.31. Structure staff - operator C.

2.6 Financial indicators

The figures below illustrates the profit rate in secotul water and wastewater for the three operators analyzed. If A and C operators profit rate in the wastewater that water is of the same order of magnitude for the rate of profit for the operator B is 5% water before amortization and royalties and -5% - Operating profit rate and water Waste 43% before amortization and royalties and 37% respectively - operating profit rate.

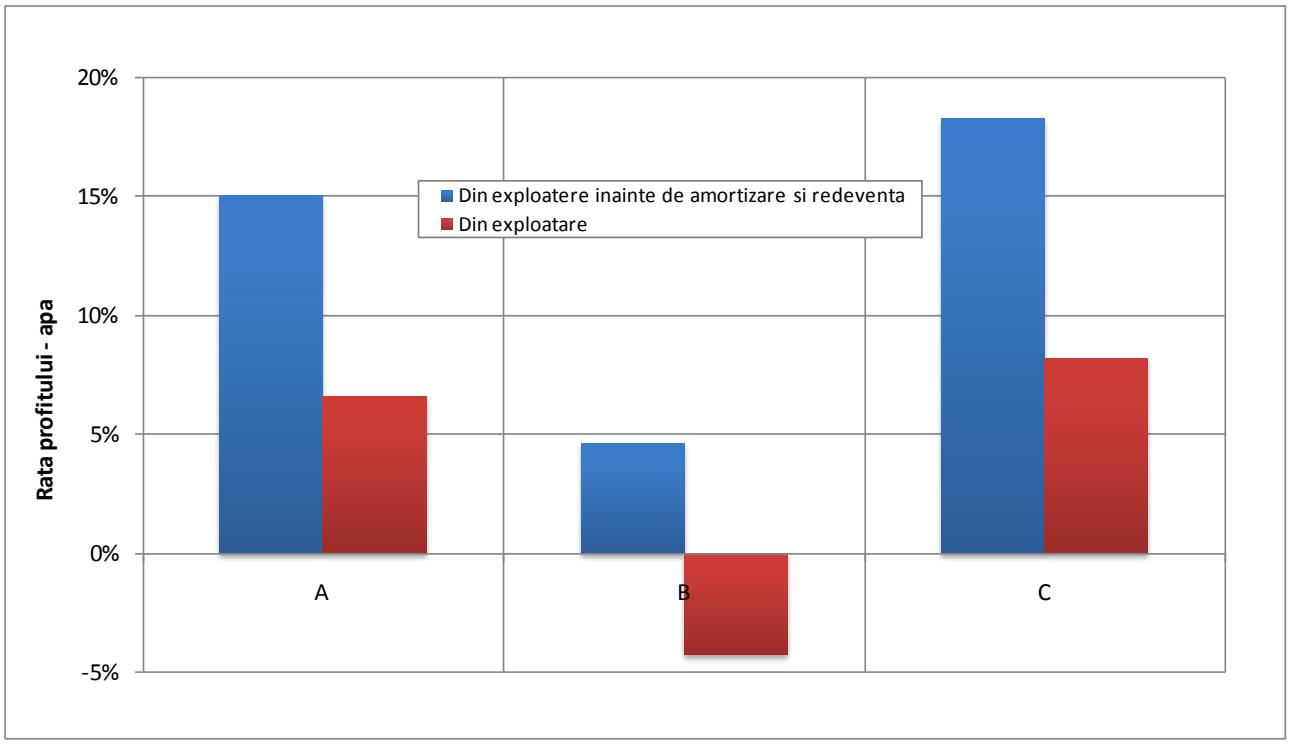


Figure 2.32. The profit rate in the water.

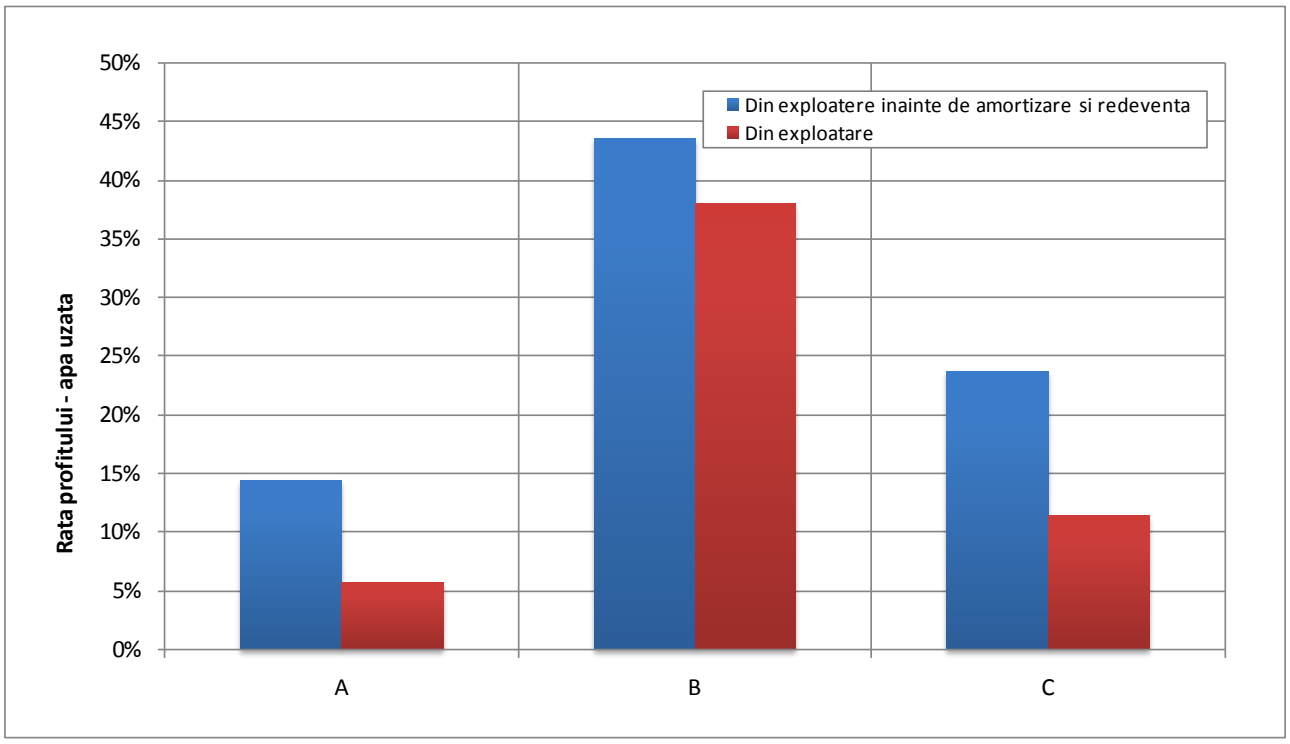


Figure 2.33. The profit rate in the wastewater.

Comparing the total unit cost of exploitation is found that the average tariffB and C operators have costs higher than the average tariff for water and wastewater operator B and. The operator C has higher average rate than the total unit cost of operation with 0.25 RON / m3 for both water and wastewater.

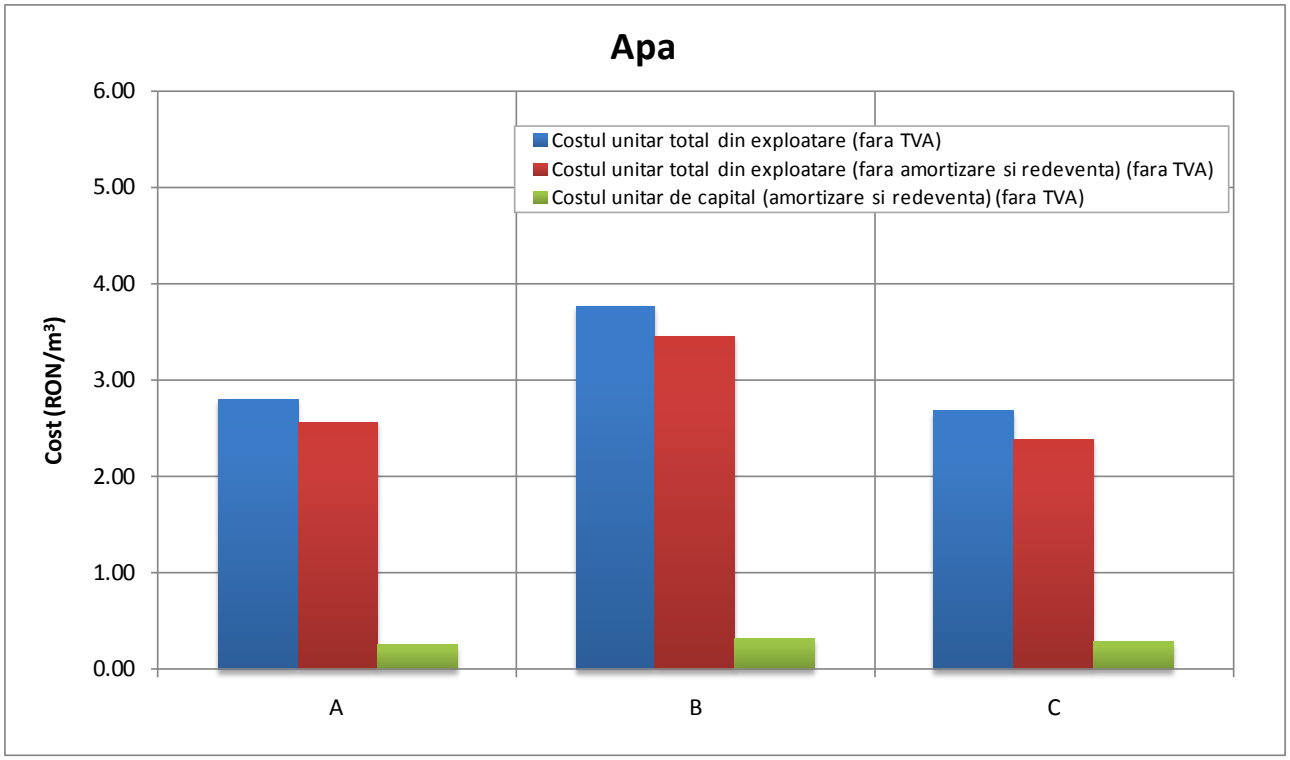


Figure 2.34. Comparison terrific environment - unit costs - water.

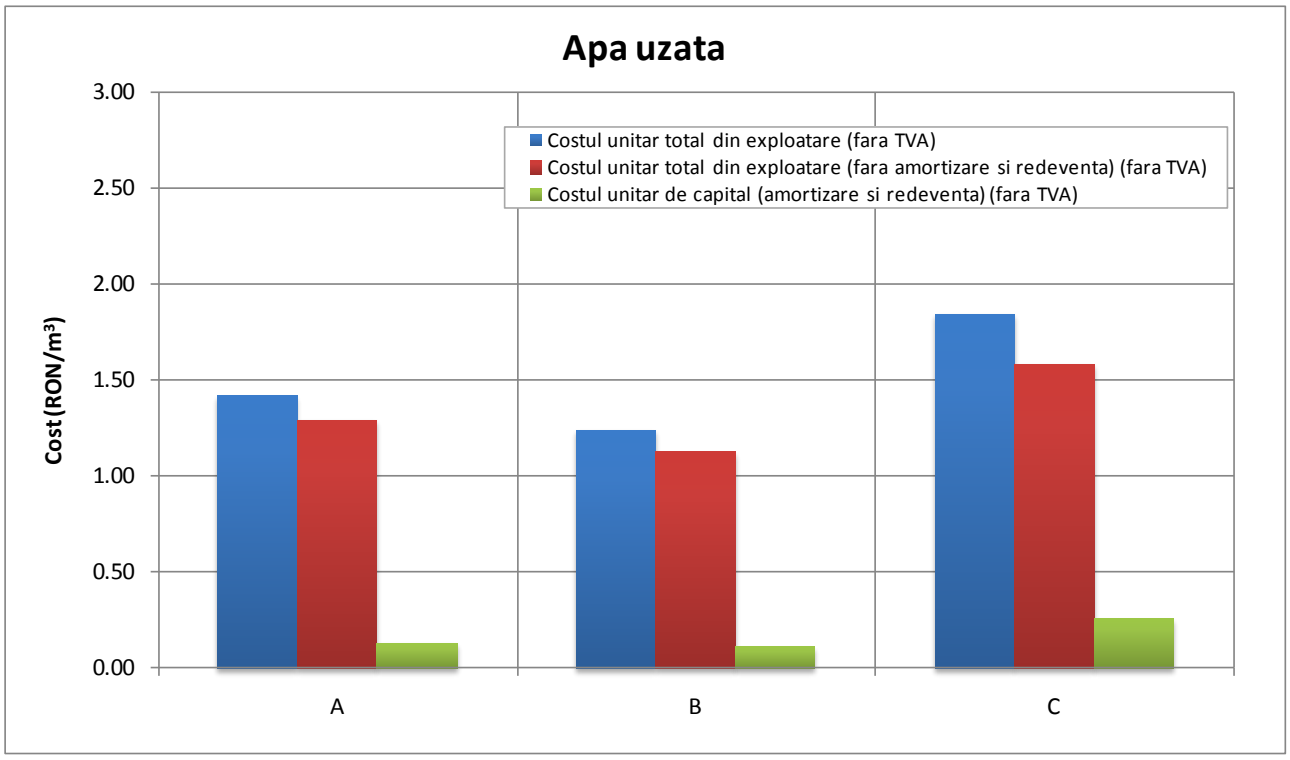


Figure 2.35. Comparison terrific environment - unit costs - wastewater.

The figure below illustrates the indicator cover operating costs for water and wastewater for the three operators analyzed. It is slightly morethan one operators A and C. It highlights the operator B has an index of cost for operating subunit equal to 1.6 for water and waste water.

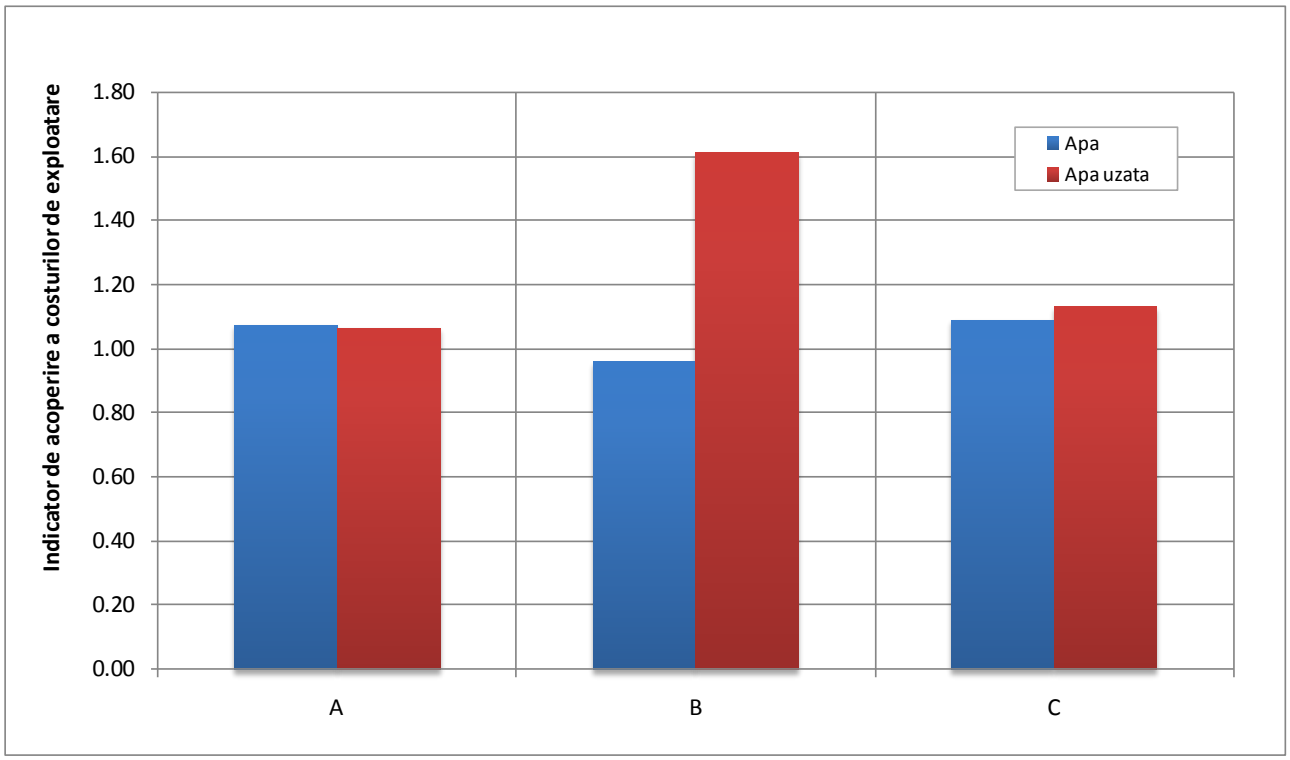
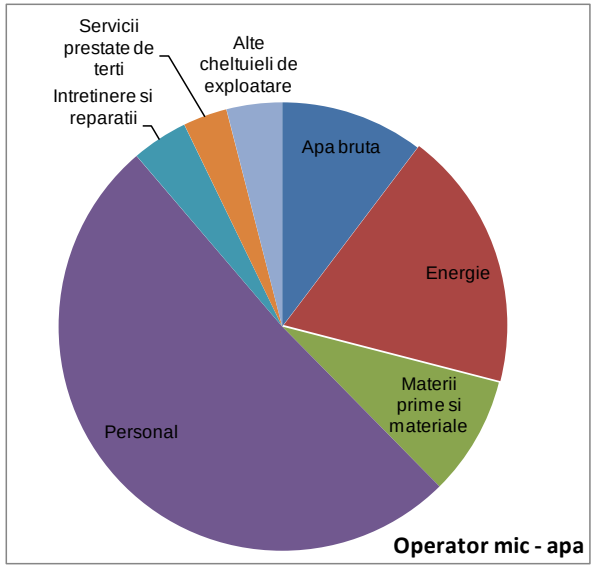
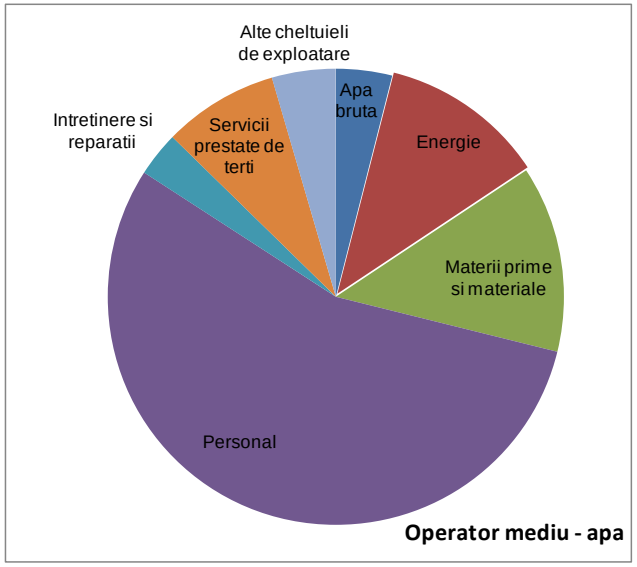


Figure 2.36. Variation indicator cover operating costs.

The following figure shows the distribution of costs for water and wastewater in those three operators.

For all operators most of the expenses is the cost of staff both in the water and in the wastewater (40 - 65% of total operating costs).





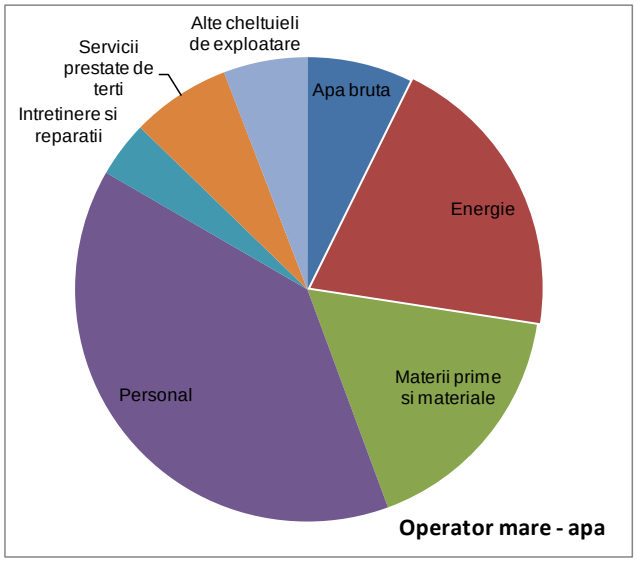
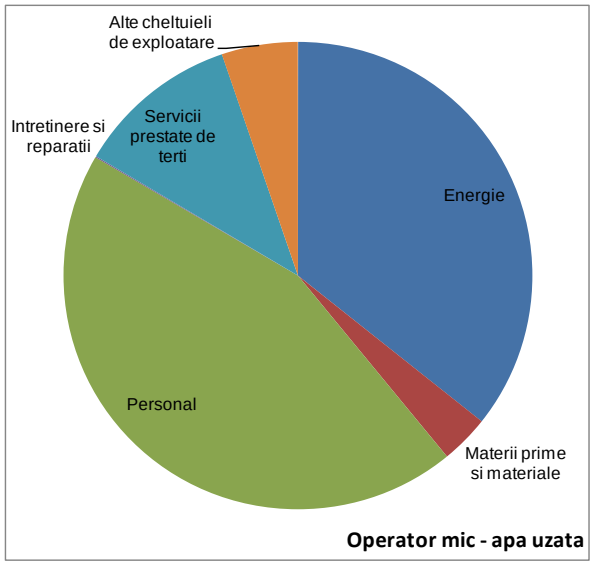
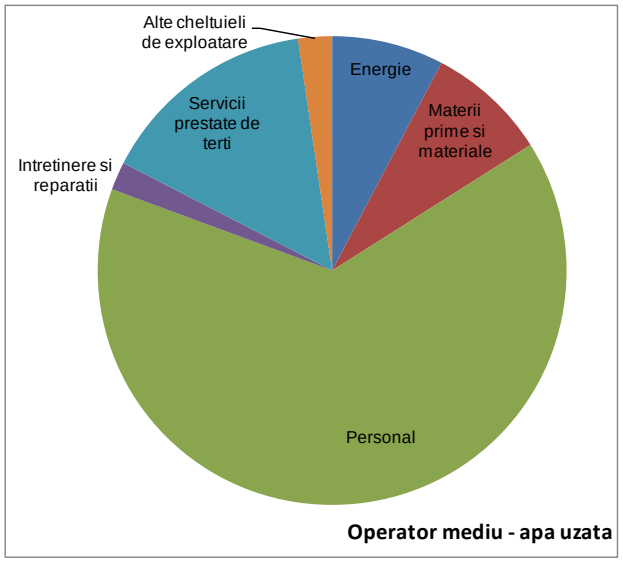


Figure 2.37. The structure of expenditure in the water.





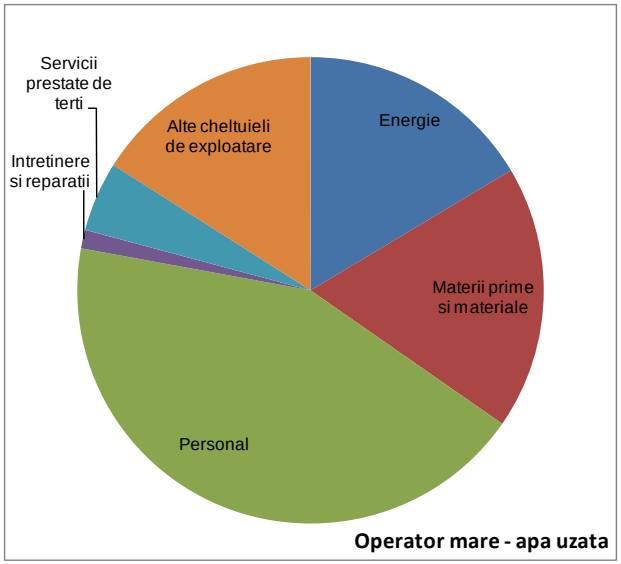


Figure 2.38. Structure of expenditures in the wastewater.

3 conclusions

Detailed analysis of the practices of the systems of water supply and sanitation has increased in recent years. The need for standardized and transparent information, based on which to compare the performances of operators has become more stringent, leading to increased efficiency importance of reporting operating results, the base charge, the parameters defining common representative and centralized operation. Therefore, the use of benchmarking and increased its value has wide recognition.

The first objective of benchmarking are:

- to make available a set of key performance indicators for management activities, financial, operational and regulatory requirements that could be used for internal performance measurement and give guidance on water management operator;
- to empower the operator to compare in terms of operational performance, in terms of indicators, with other operators representative, to identify areas where improvements are needed, while following and identify effective methods for formulating the target company and prepare investment plan for development.

Reporting are fundamental in determining the minimum rate for calculating the indicators and conditions reporting rules.

The aim must be to report performance in a manner separate component, if possible, as high-frequency and lowest geographical level possible. Be prepared reporting forms that will underpin reporting and performance monitoring. These forms will be necessarily contain information about:

- while for the reporting performance;
- public service and utility for the reporting performance;
- current situation and the performance achieved as time;
- performance levels set for next time. For indicators that are analyzed monthly or quarterly levels set will be highlighted for the next four to six months / quarters;
- based on which the safety system has been measured indicator;
- a summary action plan for achieving the level of performance for future periods of time.

Comparing performance indicators must be done by applying the same conditions reporting. The use of uncorrelated indicators may lead to wrong conclusions regarding the effectiveness of operating systems.

One such example, applied in the drinking water has been shown above in Section 2.2. Energy consumption in kWh / m3 produced water produced and distributed between 0.3 kWh / m3 if small operator and 0.9 kWh / m3 if large operator. A cursory review of this indicator can conclude that small is more efficient operator.

But this is not real, since the difference in energy consumption is due to consumption of water treatment and water distribution mode. Operator High has a treatment process complex and made investments in the whole system (treatment and distribution) generates a power consumption higher, while the operator's system small treatment process is minimalist length distribution network is more small and not made the investment in the system.

In this situation in order to draw a conclusion pertinent be analyzed simultaneously with other indicators. For example if the operator greater was found that the number of complaints overall about water pressure and water quality at the consumer's tap was lower, leading to increasing consumer satisfaction, that has implications in terms of increasing bill collection. A satisfied customer of a service quality without intarzaieri pay bill.

Complexity analysis indicators is great, therefore, utilities around the world looking for ways to improve the performance and service levels at lower costs. Conclusions can be drawn from the analysis of indicators should be analyzed in the particular context of each system to identify representative indicators, comparable with other systems.

Although demand for better service in terms of quality, but also to address a larger number of consumers is increasing, the financing of such services is increasingly limited.

Following the analysis presented above indicators can draw the following conclusions:

- areas served by small operators can not provide simultaneously both a long-term sustainable growth and meeting compliance conditions imposed by EU Directives. This reinforces the need to operate water systems at regional level and to implement the principle of solidarity. We can say that only this will ensure long
- large operators should receive a higher level of investment, but long term they will have to cover through revenues generated by the operation of drinking water and sanitation in their area, low efficiency systems water supply areas rural and smaller communities.

Equally, once created and became operational performance management systems need to be supported by measures to:

- improving data systems:
    - with the performance analysis should focus continuously on data systems that are collected and is reported performance;
    - through a process of continuous improvement, data systems should be brought to the desired level of the highest level of certainty regarding measurement;
    - agents may be employed independent verification of performance reports on a selective basis;
    - data collection and reporting should be the responsibility of the operator, or performance may be compromised;
- maintaining performance reporting and reassessment cycle times: To maintain the inviolability of system performance must be reported and analyzed carefully appointed time. If tests are timely, regular, data collection, analysis and reporting can degenerate over time;
- dissemination and availability: These are essential elements of a system of performance management. Performance data must be included in annual reports, which are available to the media and other key factors in the industry in the interests of transparency and stronger accountability;
- planning and resource allocation: Reports on performance should be a basis for planning investments and improvements to operating activity and therefore budgeting process;

- requiring some reward: Is an important component of performance management system; rewards will be for staff directly responsible for the impact on service provision.

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