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This new journal series is the new face of two former journals:

- The *Scientific Bulletin of Politehnica University of Timisoara, Transaction on Economics and Social Sciences (ranked according to CNCSIS classification in Romania: D class);*
- *The Scientific Bulletin of Politehnica University of Timisoara, Transaction on Management. Economics Engineering. Transportation Engineering (ranked according to CNCSIS classification in Romania: C class).*

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CONTENT

Scientific Bulletin
of Politehnica University of Timisoara, Romania

Transactions on ENGINEERING AND MANAGEMENT

Vol. 4, Issue 1, 2018

Editorial

Anca DRĂGHICI[1]

In this issue we publish the articles that were presented at the international conference: Water management in the context of climate change. International Experiences, Aquademica 2018. The event has been organized by Aquademica Foundation from Timisoara (http://aquademica.ro/), Aquatim company (www.aquatim.ro) which is the local provider for water services in Timisoara, Romanian Water Association (http://www.ara.ro/) and Politehnica University Timisoara (www.upt.ro), Romania.

The event took place at the Polivalenta Hall of the Politehnica University Library and brought together water industry practitioners, researchers, students and academics, decision makers and funders from several European countries. The conference topics address the challenges of climate change management in the water sector, the latest technologies, directions and trends in the area of development strategies of the Romanian water companies, as well as the financial performance forecast.

International Scientific Conference
WATER MANAGEMENT IN THE CONTEXT OF CLIMATE CHANGE INTERNATIONAL EXPERIENCES

October 11-12, 2018, Timisoara, Romania

AQUADEMICA

AQUATIM

A special place in the program has been the debate on the standardization of sector-specific activities. From this point of view, a great step has already been taken by the Romanian Water Association, through the partnership with the German Waste Water Association (DWA), the top name in the development of standards and work procedures in the field. The German experience and, in particular, DWA's expertise in water standardization have benefited participants at the Aquademica 2018 Conference, thanks to the presence of Johannes Lohaus, DWA General Manager and Secretary General of the European Water Association, the Lecturer of the event.

In the context of the conference topics, the first issue of the 2018 years Scientific Bulletin volume presents a collection of papers dedicated to researches on engineering and management aspects related to public administration and governance of the water sector in Romania.

Furthermore, the aim of this issue is to encourage the academic research staff collaboration with specialists of public bodies and to support knowledge exchange and sharing. The Editorial Board has decided that articles that reflect the ideas and achievements of a large diversity of researchers, could better support the journal mission focus on interdisciplinary. In addition, by accepting for publication articles that have a more practical oriented content, we expect a better knowledge and wisdom transfer of the research results into organizations' practice. This will contributed to a strong knowledge partnership with practitioners from companies and public institutions.

The first issue of 2018 of the Scientific Bulletin includes eight selected papers, presented during the International Scientific Conference: ***Water Management in the context of climate change International experiences***. We would like to address worm thanks to reviewers, because their careful and professional (volunteer) review work has a positive impact on the quality content of this issue/number.

In order to show each paper focus there have been generated word clouds using the World Cloud generator software (https://www.wordclouds.com/). Thus each paper idea have been summarized and additional explanations about authors have been added to better understand the research genesis in each case.

The first paper has been developed by Prof. Claudiu ALBULESCU, Associate Prof. Dr. Matei TAMASILA and Lecturer Dr. Mihaela VARTOLOMEI, (all authors from the Faculty of

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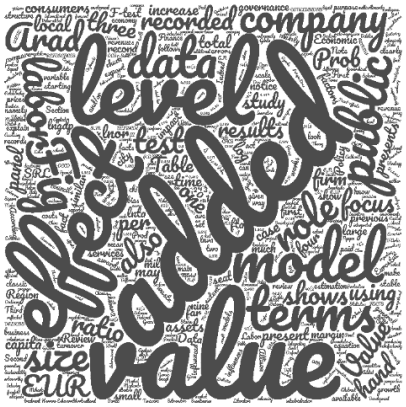
Management in Production and Transportation, Politehnica University of Timisoara, Romania) and it is a study on the "***Value Added and Productivity Determinants in the Water Industry: Panel Data Evidence from the West Region of Romania***". In addition, the research has been supported by an on-going grant/project of the Romanian National Authority for Scientific Research and Innovation, CNCS – UEFISCDI, project number PN-III-P1-1.1-TE-2016-0142.



Paper 1 word cloud – Albulescu C., Tamasila M., Vartolomei M., Value Added and Productivity Determinants in the Water Industry: Panel Data Evidence from the West Region of Romania

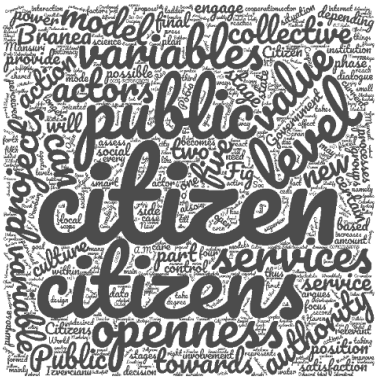
The second paper has been developed by Associate Prof. Dr. Matei TAMASILA, Lecturer Dr. Larisa IVASCU and Lecturer Dr. Alin ARTENE (all authors from the Faculty of Management in Production and Transportation, Politehnica University of Timisoara, Romania). Their research on "***Sustainable Development and Market Trends in Romania***" reflects a traditional preoccupation of this group of researchers. Their last findings demonstrate the capacity of the Romanian market to achieve the goals set of the 2030 Agenda for Sustainable Development.

Paper 2 word cloud – Tamasila M., Ivascu L., Artene A., Sustainable Development and Market Trends in Romania

The third paper has been developed by PhD. Student Corina DUFOUR together with Prof. Anca DRAGHICI (authors from the Faculty of Management in Production and Transportation, Politehnica University of Timisoara, Romania), her supervisor and it refers to "***A Quantitative study on Sustainability Reporting over the Past 20 Years in the Water Utilities Sector***".

Paper 3 word cloud – Dufour C., Draghici A., A Quantitative study on Sustainability Reporting over the Past 20 Years in the Water Utilities Sector

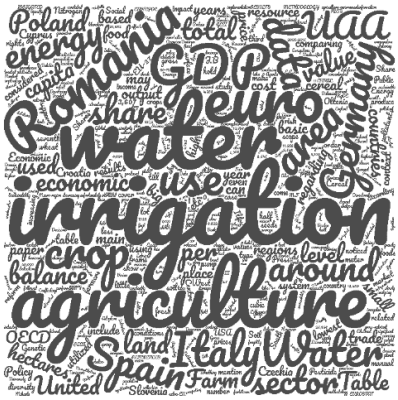
The fourth paper has been developed by Lecturer Dr. Sabina POTRA and Assistant Dr. Serban MICLEA (authors from the Faculty of Management in Production and Transportation, Politehnica University of Timisoara, Romania) and it is entitled: "***Engaging Citizens in Effective Collective Action: How and Why?***" Their paper explores the public participation typology with the final scope of developing a new citizen engagement model.



Paper 4 word cloud – Potra S., Miclea S., Engaging Citizens in Effective Collective Action: How and Why?

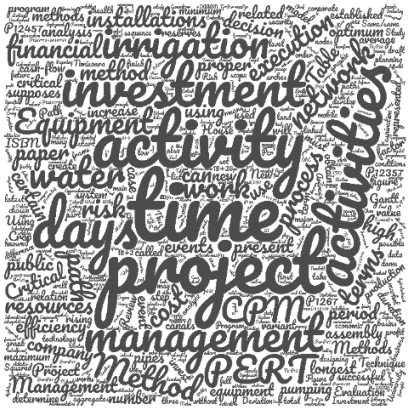
The next paper has been developed by Dr. Mihaela BORAN from the Prefect Institution of Timis County, Romania, who is also, researcher at Politehnica University of Timisoara and supporting the didactical process of the public administration specialization. Her research is dedicated to an actual subject of water sector: "***Water Governance and Its Effectiveness***". The article underline the aspect that water governance refers to the political, social, economic and administrative systems (holistic perspective is underlined) in place that influence water's use and management.

Paper 5 word cloud – Boran M., Water Governance and Its Effectiveness

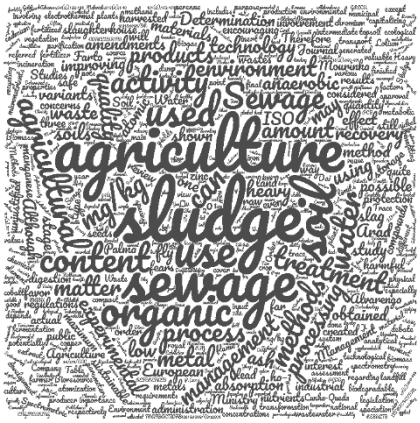


Paper 7 word cloud – Vartolomei M., Irrigation Investment and Agricultural Efficiency

The next two papers has been delivered by the same author, lecturer Dr. Mihaela VARTOLOMEI (from the Faculty of Management in Production and Transportation, Politehnica University of Timisoara, Romania). The first research is related to "***The Efficiency of the Irrigation Systems Management Investment***" and its scope is to analyze the efficiency of investment in irrigation project. The second research is related to the "***Irrigation Investment and Agricultural Efficiency***" and it describes an empirical analysis regarding the relationship between irrigation and efficiency in agriculture sector, the use of water in irrigation and the share of agriculture sector in GDP related to European and world environmental policies, in the frame of water resource management and climate change conditions.



Paper 6 word cloud - Vartolomei M., The Efficiency of the Irrigation Systems Management Investment



Paper 8 word cloud – Grecu E., Marsu S., Possibility of Using Sewage Sludge in Agriculture

The last paper presents the result of a collaboration between two researchers: Assoc. Prof. Dr. habil. Eugenia GRECU from the Faculty of Management in Production and Transportation, Politehnica University of Timisoara, Romania and Dr. Smaranda MASU from the National Research and Development Institute for Industrial Ecology - ECOIND, Timisoara, Romania. Their research debate the problem of the "***Possibility of Using Sewage Sludge in Agriculture***".

Only by visualizing the word clouds related to each paper, readers could have a brief overview of each paper selected and published in this first number of the Scientific Bulletin. We consider this as a useful and productive way of exploiting big data technologies in publishing and search activities.

Scientific Buletin
of the Politehnica University of Timisoara, Romania

TRANSACTIONS on ENGINEERING AND MANAGEMENT

Volume 4, Number 1, 2018

Value Added and Productivity Determinants in the Water Industry: Panel Data Evidence from the West Region of Romania

Claudiu Tiberiu ALBULESCU[1], Matei TĂMĂȘILĂ[2], Mihaela VARTOLOMEI[3]

Abstract – This study compares the level of value added and productivity generated by the companies activating in the water and wastewater sector and investigates their determinants. To this end, we perform a panel data analysis over the period 2007 to 2014 using firm-level data. We include in our analysis nine public companies located in four counties inside the West Region of Romania, namely Arad, Caraș-Severin, Hunedoara and Timiș. We compare a classic Pooled OLS, a fixed effect and a random effect estimator. Our static analysis shows that the value added is mainly explained by the operating revenue, profit margin and liquidity ratio. While the size of the companies positively influences the level of value added, the consumers wealthy, measured in terms of GDP per capita, has no clear influence. It appears that regional operating companies perform better compared with small firms acting at local level. A similar result is recorded when we estimate the drivers of the productivity level, measured in terms of value added per employee. We conclude that the economies of scale recorded by companies located in the main cities of the region, and an adequate financial management of these companies, both contribute to enhancing their economic performances.

Keywords: value added, firms' productivity, water industry, regional study, panel data analysis.

I. INTRODUCTION

The efficiency of public companies is not enough debated in the economic literature. However, these companies continue to expand their activities and to invest more and more in R&D activities compared to private firms [14]. A narrow strand of the literature tries to explain the role of environmental factors and corporate governance in influencing companies' performances in terms of value-added creation [3], [10] and productivity [8]. Nevertheless, as far as we know, none of the previous works addresses the impact of financial performances and regional economic context on the level of value added and labor productivity for state-owned firms.

To fill in this gap, we focus on nine public companies activating in the water and wastewater industry from the West Region of Romania. We apply a panel data investigation using firm-level statistics for the period 2007 to 2014, to see how the financial performances and the regional economic context influence the value-added creation and the productivity of these companies.

Consequently, our contribution to the existing literature in fourfold. First, we focus on the role of financial management and regional context in explaining the value-added creation, using firm-level data for public companies. More precisely, we investigate to what extent the turnover, profitability and investment influence the value added generated by the companies located in four counties (Arad, Caraș-Severin, Hunedoara and Timiș – NUTS 3) from the West region (NUTS 2) of Romania. Second, we focus on the water and wastewater industry, performing a regional analysis. Indeed, [6] make a comparative study between public and private companies activating in the water and waste services in Italy and investigate the efficiency of these companies in terms of distance from the stochastic frontier of the production costs. However, our focus is on efficiency in terms of value-added creation and labor productivity. Third, we investigate in a comparative manner the performances of public companies that are not in direct competition, neither between them, nor with private firms. These companies are held by local municipalities and/or county councils, and present noteworthy efficiency discrepancies. These discrepancies might be explained by the local political context, which is reflected in the financial performances of companies, but also by the local economic context, in terms of market size and purchasing power. Therefore, our study reveals which

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elements make some companies more efficient than others. Finally, we use different panel specification for robustness purpose, comparing a Pooled Ordinary Least Square (POLS) specification, with a fixed effect and a random effect model. This is the first study that investigate the performances of the water and wastewater companies from Romania.

The rest of the paper is as follows. Section 2 presents the literature review and a comparative investigation in terms of value-added creation and productivity at regional level. Section 3 describes the data and the methodology. Sections 4 and 5 presents the results of the empirical estimation regarding the determinants of value-added level and productivity, respectively. The last section concludes.

II. LITERATURE REVIEW AND STYLYZED FACTS

2.1. Literature review

On the one hand, the analysis of value-added determinants is scarce in the financial management literature. Most of empirical works focus on the implications of economic value added [15], or on the value added generated by the level of exports [2]. The value added in the public sector is mainly analyzed from the perspective of education role in fostering the economic performances [16]. Little effort is paid to assess the factors generating higher value added for public company. As far as we know, there is no attempt so far to investigate the determinants of value added in the water industry.

On the other hand, there is a broad literature investigating firms' efficiency, with a focus on productivity level. First, the capacity of the firm to innovate (estimated in terms of R&D expenditures) is put forward by [12]; [7], [17]. Second, the role of corporate governance in enhancing the productivity is intensively investigated by [5] and [9]. Third, the relationship between the business performances and environmental practices is considered as a potential determinant of productivity, with mixed empirical evidence. The results depend on the participation to certain environmental program [11], and on the voluntarism of these environmental regulations [13].

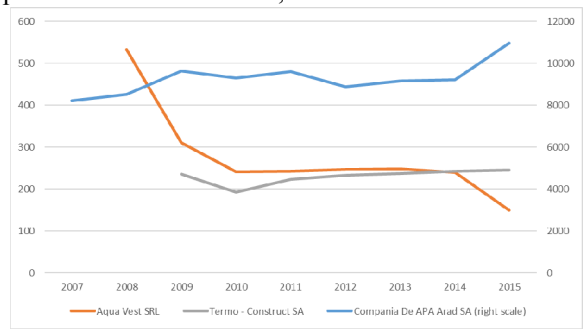
However, much attention is paid to firms' financial performances. In this line, the literature underlines the role of firms' size, profitability, and structure of investment [18], or the role of financial constraints [4]. Given the fact that the water companies are not necessarily financial constrained being public companies with important assets, we focus on the role of financial performances and structure of investment. In addition, we investigate the role of the regional economic context.

2.2. Stylized facts

In what follows we present some stylized facts about the water and wastewater sector from the West region of Romania. According to the Eurostat database, the gross value added recorded by the Romanian economy in 2014 is about 133,176.7 mil. EUR, out of which 17,309.6 mil. EUR are generated by the public sector (13%). If we look to the water and wastewater industry, we notice that according to the AMADEUS statistics, the value added in 2014 is about 407.5 mil EUR (0.3%). Indeed, data are not available for all 115 companies acting in this industry in Romania, but this sector has a marginal contribution to the total value added (or to the Romanian GDP).

In the four counties composing the region, we have three companies located in Arad county (Compania de APA Arad SA, Aqua Vest SRL, Termo - Construct SA), one company located in Caraș-Severin (Aquacaras SA), three located in Hunedoara (APA Prod SA, APA Serv Valea Jiului SA, Activitatea Goscom SA) and three in Timiș (Aquatim SA, Meridian 22 SA, Aqua Dumbrăvița SRL). However, for the small company Aqua Dumbrăvița SRL operating in the Timiș county, data are available starting with 2011 only. Therefore, we have excluded it from the analysis.

Fig. 1-4 present a comparison between the level of value added (a) and the level of productivity computed as ratio between the value added and the number of employees (b), for each county included in analysis. Fig. 1a shows that, for the water companies located in Arad county, the value added records different trends, while being considerably higher for the main company, which is also a regional operator – Compania de APA Arad SA. This company is located in the county seat, namely Arad city, and shows a higher level of productivity compared with other small firms acting in Arad county (Fig 2b).



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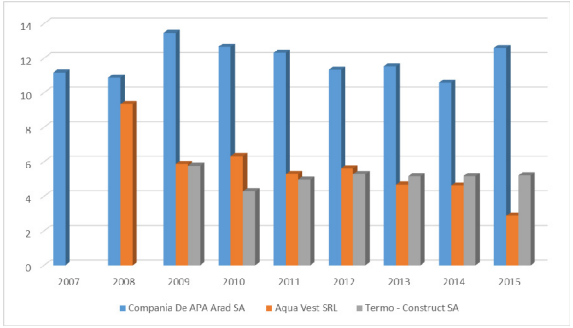
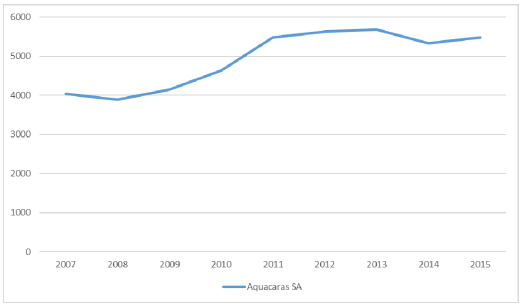


b.

Fig. 1. Value added in th. EUR (a) and labor productivity (b) in the water industry from Arad county



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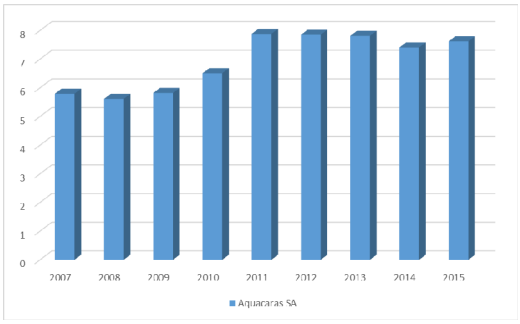
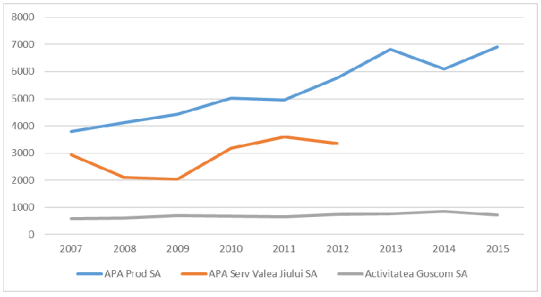


b.

Fig. 2. Value added in th. EUR (a) and labor productivity (b) in the water industry from Caraș-Severin county



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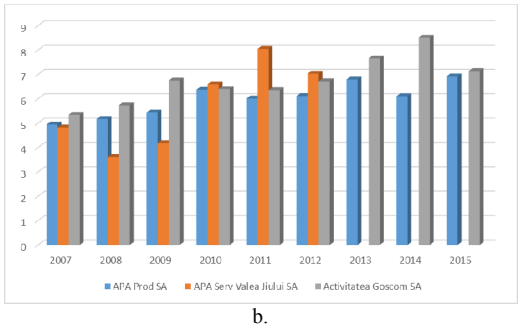
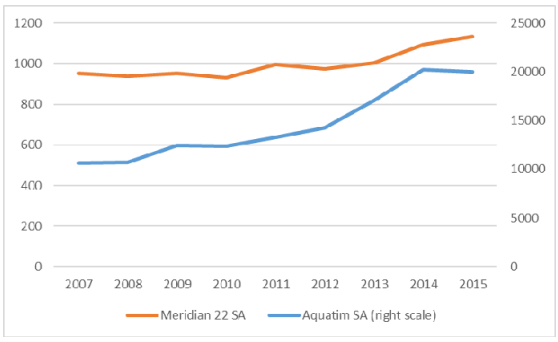


b.

Fig. 3. Value added in th. EUR (a) and labor productivity (b) in the water industry from Hunedoara county



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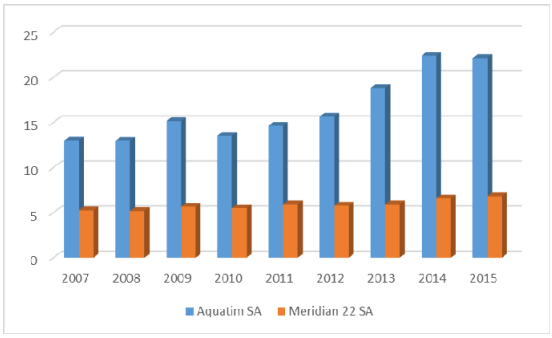

b.

Fig. 4. Value added in th. EUR and labor productivity in the water industry from Timiș county

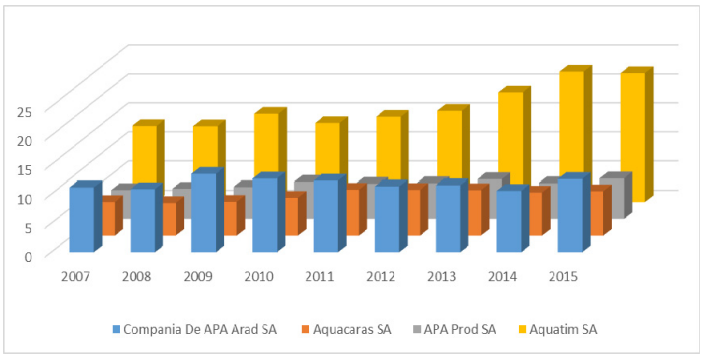

Fig. 5. Labor productivity for the regional operating companies from the West region of Romania

Fig. 2 shows that for the water company located in Caraș-Severin county (Aquacaras SA), both the level of value added, and labor productivity slightly increase during the analyzed period.

Fig. 3a presents the dynamics of the value added for the three companies located in Hunedoara county. For all these companies the value added is increasing, although for a higher extent for the regional operator APA Prod SA – the company established in the city of Deva, which is the Hunedoara county seat. A similar trend is recorded for the labor productivity, but no significant differences between the three companies can be noticed (Fig. 3b).

Finally, for the Timiș county there are important differences between the two companies settled here, both in terms of value-added dynamics (Fig. 4a) and in terms of productivity level (Fig. 4b). Although the level of value added recorded by the regional operator Aquatim SA is not surprising given its location in the city of Timișoara, the Timiș county seat, the

productivity level is clearly much higher, and the gap between the two companies continue to increases.
We also notice that the level of value added, as well as the productivity level, seem to be much higher for the regional operating companies. When we compare the regional operators' productivity level, we observe a higher productivity for Aquatim SA and Compania de APA Arad SA, the companies located in the most developed counties of the region. Nevertheless, only Aquatim SA records a continuous increase in the productivity level starting with 2012 (Fig. 5).

III. DATA AND METHODOLOGY

3.1. Data

Value-added data come from AMADEUS database (Bureau van Dijk) and were extracted in December 2016. Data cover the period 2006 to 2015. However, because the data were unavailable for a large set of explanatory variables in 2006 and 2015, the final time-span is from 2007 to 2014 (67 observations). The factors considered to have an influence on both the value added expressed in natural log (*lnva*) and labor productivity computed in terms of value added per employee (*ave*), are the operating revenues expressed in natural log (*lnor*), the profit margins (*pm*), the liquidity ratio (*lr*) and the level of investment, proxied by the fixed to total assets ratio (*fta*). We also check for the size effect, considering the role of total assets, also expressed in natural log (*lnta*). In addition, the economic context is included in the analysis, by assessing the role of consumers' welfare measured in terms of GDP per capita (*lngdp*), data extracted from Eurostat database. Finally, using dummy variables we test the regional operator effect and we award a value of 1 if the company acts in one of the county seats of the region and represents thus a regional operator, and 0 otherwise (*dummy1*). At the same time, we check for the role of Timiș country as leader in the region and we award the value 1 for the companies located in Timiș (which is the economic capital of the West region), and 0 otherwise (*dummy2*).

3.2. Methodology

The general POLS equation we test is:

$$y_{it} = \alpha + \beta x_{it} + \varepsilon_{it}, \quad (1)$$

where y_{it} are the dependent variables (the value added expressed in natural log and the labor productivity), α is the intercept, β represents the coefficients of explanatory variables, x_{it} is the set of explanatory variables and ε_{it} are the error terms.
The fixed effect model allows to avoid the omitted variable bias and addresses the disparities between companies. In this case the general equation becomes:

$$y_{it} = \alpha + \beta x_{it} + \gamma_i + \varepsilon_{it}, \quad (2)$$

where γ_i represents all the stable characteristics of companies.
Finally, because the fixed effect model does not, in fact, control for all stable covariates [1], we also test a random effect model:

$$y_{it} = \alpha + \beta x_{it} + \gamma_i + \mu_{it} + \varepsilon_{it}, \quad (3)$$

where μ_{it} are the between-entity errors and ε_{it} are the within-entity errors.
A Hausman test is afterwards performed to select the most appropriate model between the fixed and random effect model, while a Breusch–Pagan test helps us to choose between the random effect model and the classic POLS estimator. The F-test shows if the fixed effect model is recommended to the POLS model.

IV. VALUE ADDED DETERMINANTS

We first present the results of estimations that investigate the determinants of value added. Table 1 clearly shows that for all three specifications, the operating revenues (*lnor*) and the liquidity ratio (*lr*) have a positive influence on the level of value added, while the positive influence of the profit margin (*pm*) is observed only for the fixed-effect model.
Therefore, companies that record higher sales and practice higher prices unregister an increase in their value added, which is not surprising. At the same time, more liquid companies can negotiate better prices with their suppliers, and may reduce this way their production costs, with a positive effect on the value added. The size matters and large companies realize economies of scale increasing their value added.
The Breusch–Pagan test shows that there are no random effects in our estimation, while the Hausman and F-tests show that the fixed effect model is preferred. Overall, we conclude that the financial management of the companies activating in the water industry is important for their economic performances.
However, when we look to the regional economic context, our findings become less evident. On the one hand, the GDP per capita, a *proxy* for the consumers' wealth has either a negative, or a positive impact on the value added, depending on the estimated model. Thus, it is hard to affirm that the consumers from the wealthy counties are willing to pay a higher tariff for the water and wastewater services.
On the other hand, the fact that the companies are regional operators has no significant influence on the value added, contrary to our expectations. However, under the random effect model, we notice that the companies from the Timiș county have better performances.

These results may be influenced not only by the firm size measured in terms of total assets, but also by the number of employees of each company. These companies are owned by local municipalities and/or county councils and may be prone to political pressure to increase their number of employees, especially after financial turbulence episodes, as those recorded in 2008 and 2009 in Romania.

At the same time, more employees can generate more value added. Therefore, in order to see how important the financial management and the local economic context are for the companies' performances, we calculate the ratio between value added and the number of employees, a *proxy* for the productivity level.

V. LABOUR PRODUCTIVITY DRIVERS

The potential drivers of the productivity level we consider in this subset of estimations are the same as in the previous analysis. Table 2 presents the results of the estimations. Different from the previous case, there is no clear dominance of one model compared to the other.

The results are similar with those reported in Table 1. Both the financial management and the firms' size have a positive influence on the firms' performances, measured in terms of productivity. In this case, the GDP per capita has a positive influence. In addition, both POLS and random effect models show that the regional operators (*dummy1*) record a higher level of productivity. According to the random effect model, the companies located in Timiş (*dummy2*) perform better.

Table 1. Value added determinants

lnva	**POLS**	**Random effect**	**Fixed effect**
c	3.974	7.897***	1.153
lnor	0.878***	0.672***	0.171***
fta	0.001	-0.000	-0.005***
lnta	0.073	0.176**	0.189***
lr	0.063**	0.060**	0.006
pm	0.010	0.008	0.017***
lngdp	-0.515*	-0.888***	0.410**
dummy1	0.101	0.272	-
dummy2	-0.172	0.298***	-
R^2	0.948	0.950	0.813
Breusch–Pagan (recommended)	Prob>chibar2 = 1.000 (POLS)		
Hausman test (recommended)	Prob>chi = 0.000 (Fixed)		
F-test (fixed effects)	Prob > F = 0.000 (Fixed)		
*Note: *, **, ***, mean significance at 10%, 5%, 1%.*			

Table 2. Labor productivity determinants

ave	**POLS**	**Random effect**	**Fixed effect**
c	-54.89***	-46.37***	-12.79
lnor	1.882***	0.778	1.186**
fta	0.007	-0.011	-0.039**
lnta	0.082	0.525*	1.240***
lr	0.414***	0.353***	0.081
pm	0.158***	0.156***	0.143***
lngdp	5.144***	4.822***	0.115
dummy1	2.460***	1.345*	-
dummy2	0.519	1.913***	-
R^2	0.876	0.897	0.621
Breusch–Pagan (recommended)	Prob>chibar2 = 1.000 (POLS)		
Hausman test (recommended)	Prob>chi = 0.351 (Random)		
F-test (fixed effects)	Prob > F = 0.000 (Fixed)		
*Note: *, **, ***, mean significance at 10%, 5%, 1%.*			

VI. CONCLUSIONS

We have analyzed the economic performances of public companies from the West region of Romania, activating in the water and wastewater industry. For this purpose, we have performed a panel data analysis comparing a POLS, a fixed effect and a random effect model, and we have used firm-level data for the period 2007 to 2014 (nine companies located in the four counties of the region were included in our analysis).

Our findings first show that the level of value added is positively influenced by the operating revenue, profit margin and liquidity ratio. In addition, the size of the companies is positively correlated with the size of the value added, as expected. However, the status of regional operator has no significant influence on the level of value added.

The productivity drivers are considered to be the same as the value-added determinants. On the one hand, the performances of the companies' financial management (e.g. profitability, liquidity), have a positive impact on the productivity level. On the other hand, the regional economic context matters. Firms perform better in wealthy counties, and if they act as regional operators.

Our findings should, however, be interpreted with caution, given the limitation of our empirical exercise. Our sample is very small and does not allow for additional robustness analyses. In addition, the endogeneity of our variables is not considered (i.e. the firms' productivity also influences their profitability level). Finally, a multicollinearity bias may exist when we consider both the firm size and turnover size for example. A possible way to deal with these drawbacks is to extend the analysis at national level.

AKNOWLEDGEMENTS

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Sustainable Development and Market Trends in Romania

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Abstract – The paper addresses sustainable development and shows the capacity of the Romanian market to achieve the goals set in the 2030 Agenda for Sustainable Development. The new Agenda focuses on a holistic approach to sustainable development in order to achieve global development. Sustainable development is addressed nationally and internationally because businesses do not exist in isolation. Business is a complex network that interacts and completes itself. The use of material, human, financial and informational resources by companies contributes to the assessment of the organisational capacity for sustainable development. Based on the 17 Sustainable Development Goals (SDGs) and 169 associated targets, the paper presents a general assessment of Romania's situation on the three dimensions: economic, social and environmental. Following this evaluation, we can conclude that the Romanian market needs to be aligned with the requirements of the European Union, and the difficulties encountered in various directions must be improved by defining strategic directions in line with international objectives.

Keywords: Technological Capabilities; Education for Sustainable Development; Sustainability Actions; Water; Waste Management; Environmental Pollution.

I. INTRODUCTION

Sustainability is a concern of companies nationwide and internationally. Sustainable development involves balancing the use of company resources to achieve its goals without jeopardizing the ability of future generations to access the same resources as at present [1-2]. Moving to sustainable production within an organization is a complex process involving rethinking and efficiency. Shareholders should adjust their profitability expectations because a company that engages in sustainable development can have modest short-term financial results. Sustainable development involves assessing the three dimensions: economic, social and environmental [3-5].

II. THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT

The 17 Sustainable Development Goals (17 SDGs) are accompanied by 169 specific targets and are part of the strategic document called "2030 Agenda for Sustainable Development" adopted in New York on 25.09.2015 by the governments of 193 countries within the UN Summit on Sustainable Development [5-7]. The development of this strategic document was based on a series of steps that have taken place since 1971 (see Figure 1) [2].

Fig. 1. The evolution of Agenda 2030

This document provides a new global strategic framework to eliminate all forms of poverty, to combat inequalities and to combat climate change. Agenda 2030 integrates in a balanced way the three dimensions of sustainable development: economic, social and environmental. Agenda 2030 cannot be shared, it needs to be implemented as a whole, in an integrated and not fragmented manner, based on the fact that goals and targets are closely linked [8].

The 2030 Agenda presents 4 sections:

(a) A political declaration;

(b) the 17 Sustainable Development Goals and 169 targets;

(c) Means of Implementation;

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(d) a framework for follow up and review of the Agenda (European Commission, 2018).

Agenda 2030 includes a powerful control and review mechanism that allows all organizations to assess the impact of their actions. This approach is supervised globally by the High-Level Political Forum on Sustainable Development [8-9].

For organizations, these goals provide directions for developing their own strategies and provide a reference framework for organizational capacity. The objectives of this agenda will guide the activities of existing institutions and organizations at local, national and global level. Local authorities, Shareholders, multilateral organizations, financial institutions, non-governmental organizations will develop programs and directions, will allocate resources and will control the proposed activities in order to achieve the proposed objectives. All this will influence markets, logistics chains, improve people's access to information, technology and innovation, generating opportunities for economic and social progress [8-10].

On global markets, meeting agenda goals will generate the following [5-11]:

- Strengthening new markets for sustainable products and services;
- Globalization of service and product markets;
- Reengineering the organizational processes;
- Reducing the amount of waste generated;
- Pressures on the business environment to make more efficient use of resources;
- Passing economic agents to use energy from renewable energy sources;
- Increasing the living standards of companies
- New opportunities for communities, consumers and employees offered by sustainable products and services;
- New projects for the development of infrastructure for energy production, water distribution, transportation and rehabilitation of the quality of life of all.

Environmental sustainability for the Sustainable Development Goals in the 2030 Agenda is presented in a structure as shown in Table 1, including the 17 SDGs. The 17 SDGs and 169 targets are global directions, with each authority, company or institution being able to implement actions in these directions.

The Agenda 2030 is not a mandatory for companies or institutions, but there are a number of rules and procedures which implies achieving these goals (e.g. the EU Action Plan for Circular Economy adopted on 2 December 2015, the 2014 Directive / 95 / EU on the obligation of large companies to report annually a number of non-financial and diversity-related aspects of the workplace, COP 21 - Global Climate Change Agreement, et. al.) [2].

Table 1. Environmental sustainability for the Sustainable Development Goals in the 2030 Agenda

Dimension	**Goal**	**Short description**
Healthy Ecosystems	SDG 15	Restoration of terrestrial ecosystems
	SDG 2	Food safety and sustainable agriculture
Improve soil & water	SDG 6	Sustainable water management and sanitation for all
Safeguard the oceans	SDG 14	Sustainable use of marine resources
Environmental governance	SDG 10	Reducing inequalities between countries
	SDG 16	Responsibility of society and equity of institutional levels
	SDG 4	Lifelong learning
	SDG 5	Equality between women and men
Reduce pollution & waste	SDG 3	Healthy life at all ages
Boost renewable energy	SDG 7	Affordable prices and sustainable resources
Increase resource efficiency	SDG 9	Promoting industrialization and stimulating innovation
	SDG 12	Sustainable consumption and efficient production
Live & prosper sustainably	SDG 8	Promoting economic growth, productive and decent work
	SDG 1	Eradicate poverty in all its forms
	SDG 11	Developing secure living environments
Combat climate change	SDG 13	Urgent action to combat climate change

III. SUSTAINABLE DEVELOPMENT IN ROMANIA

3.1. Analysis of the Romanian achievements related to the 2030 Agenda

The UE has taken steps to reach the 17 SDGs. Some progress has been made in some areas and other actions have not yet been taken. The greatest progress has been made with: SDG 7 “affordable and clean energy”, SDG 12 “responsible consumption and production”, SDG 15 “life on land”, SDG 11 “sustainable cities and communities” and SDG 3 “good health and well-being”. Moderate progress is recorded on 8 goals, as follows: SDG 4 “quality education”, SDG 17 “partnership for the goals”, SDG 9 “industry, innovation and infrastructure”, SDG 5 “gender equality”, SDG 8 “decent work and economic growth”, SDG 1 “no poverty”, SDG 2 “zero hunger” and SDG 10 “reduced inequalities”. Evaluating Goal Achievement is accomplished by specifying a decrease or an increase of an indicator for two selected periods [5-7].

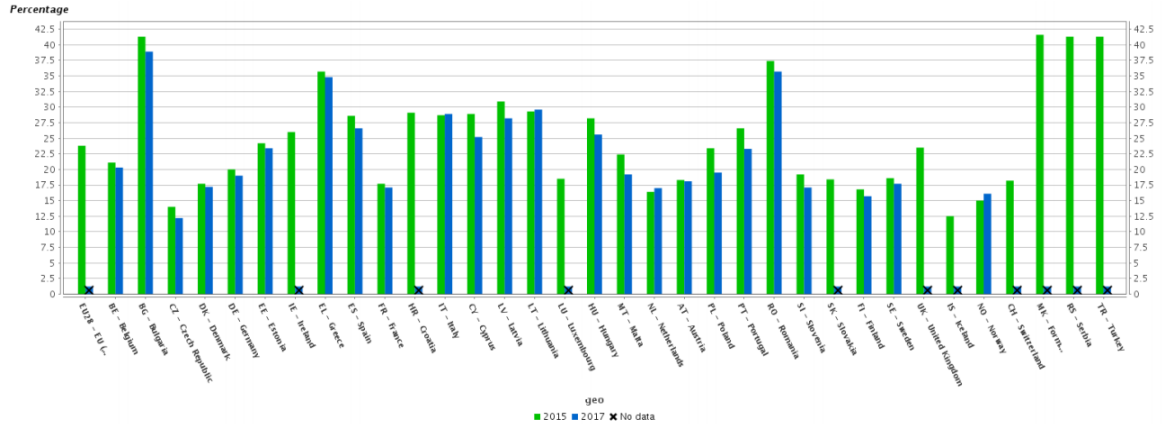

Fig. 2. People at risk of poverty or social exclusion, by country, 2015 and 2018 (% of population) (European Commission, 2018)

Assessing "People at risk of poverty and social exclusion", Figure 2, it can be noticed that Romania started to work in this direction, the percentage registered in 2015 was 37.4%, and in 2017 it was recorded a level of 35.7% [2].

From this point of view, country-specific approaches aim at encouraging fiscal and structural reforms (including social policies) that contribute to reducing poverty and poverty inequality. All other objectives are evaluated annually by the European Union in order to achieve them. Quantitative assessments are being carried out, with all objectives being pursued. From the perspective of Romania, the achievement of the 17 objectives is an approach to which he joined, a series of activities have been undertaken and several roles have been assumed [2]. Through an evaluation of the 17 SDGs, the following market trends in Romania can be systematized, Table 2.

It can be noticed that Romania is taking steps to reach the 17 SDGs and targets proposed. Strategies and approaches developed at national level contribute to achieving global goals [2].

Table 2. The market trends in Romania regarding SDGs [2-7]

Global Goal	Implication for Romania
SDG 1: No poverty	Romania needs to implement this goal at national level, as is done by each country. At national level, more than 40% of citizens live to the limit of survival, in poverty. Over 45% of children have major resource needs. In order to eradicate poverty, Romania needs to implement a series of rules and procedures. The country has some institutional challenges and the national strategy to eradicate poverty needs to be improved. Romania's main objective is to reduce the number of people living in poverty by 2020 by 400,000.
SDG 2: No hunger	Romania has started a series of collaborations with associations which are active in the field of agriculture, to strengthen this sector. Under the national rural development program of the country, farmers will have access to new funds that will help them to modernize their tools and equipment. At the same time, they will gain access to new product placement markets. They will have several alternatives for rural incomes, such as agro-tourism.
SDG 3: Good Health and Well-being	"The National Health Strategy of Romania for 2014-2020: Health for Prosperity" is proof of the commitment of the main actors and the Romanian government in assuring and promoting health as the main player of a prosperous country. Strategic principles include: equal access to essential services of life, cost efficiency, optimization of health services offered, focusing on services and preventive interventions, decentralization, international partnerships.
SDG 4: Quality Education	From the perspective of the quality of education at European Union level, Romania's position can be improved. At a global level, several steps are being taken, focusing on stimulating more complex responses and actively involving children in activities designed to develop different skills. Romania foresees several steps in the national strategy.
SDG 5: Gender Equality	Equality between men and women is one of the major objectives of the European Union. The Romanian legislation covers the fundamental principles of European Community legislation, these principles being already transposed into national legislation on human rights. Romania has a national strategy for equal opportunities between women and men. It responds through practical measures and activities to identified problematic situations.
SDG 6: Clean water and sanitation	Over 90% of Romania's water resources are collected by the Danube River. Human activities have affected the quality of groundwater and soil. Approximately 55% of all monitored rivers can be used as sources of drinking water. Approximately 46% of all potential resources are technically usable, mainly due to contamination. Satisfaction of water needs in all fields will be possible in the future only by carrying out major hydrotechnical works.

SDG 7: Affordable and clean energy	Depending on geographic regions, Romania can develop production systems for all types of renewable energy. Romania's potential for green energy production is composed of: 65% biomass, 18% wind energy, 13% solar, 5% hydropower, 2% solar energy and geothermal.
SDG 8: Decent work and economic growth	Economic growth is associated with the level of industrialization and innovation that exists at national level. Romania needs to implement new technologies in industrial processes based on greenhouse gas emissions.
SDG 9: Industry, innovation and infrastructure	Innovation and industrialization are directions that contribute to improve the quality of life at national level. At the level of Romania, the innovation process will find new directions, and the national strategy provides attracting funds to support companies.
SDG 10: Reduced inequalities	Reducing inequalities at national level is an approach that tracks existing actions at global level.
SDG 11: Sustainable cities and communities	The development of sustainable cities contributes to reducing greenhouse gas emissions and increasing the quality of life. Romania provides in the "Environment Strategy" a series of actions to be followed.
SDG 12: Responsible consumption and production	Romania is involved in reducing the amount of waste by 2030. Methods used in waste management must aim at prevention, reduction, recycling and re-use. The logistics chain must implement a series of resource efficiency measures.
SDG 13: Climate Action	National policies, strategies and plans aim at measures to reduce gas emissions.
SDG 14: Life Below Water	Prevention of water pollution is the action targeted in the national strategy. At the same time, a series of actions to improve water quality are foreseen.
SDG 15: Life on Land	Conservation and forest management are activities tackled at national level. Romania needs to increase the extent of forests and plantations.
SDG 16: Peace, Justice and Strong Institutions	The reduction of violence and other forms of violence are planned at national level.
SDG 17: Partnerships for The Goals	Strengthening internal organizational resources, including international support granted to Romania to improve its internal tax collection and other revenue, are important actions to strengthen partnerships.

3.2. Incorporating the SDGs in National Frameworks and Means of Implementation

The process of localizing the 2030 Agenda to the particularities of Romania is made through the upcoming review of the National Sustainable Development Strategy. The revised strategy aims to be innovative and intuitive in the sense that, instead of just proposing policies that contribute to a more sustainable future, it also seeks to add a sustainable component to other strategies that are either directly or indirectly involved in meeting the Sustainable Development Goals. In addition, the target audience is not only public servants, experts, and politicians, but also the civil society. As such, Romania's National Sustainable Development Strategy is the way of guiding public policy and justifying the principles of the 2030 Agenda for the national audience.

There are three issues encountered while revising Romania's National Sustainable Development Strategy which, presents a learning experience for other countries which are currently considering ways of incorporating the SDGs in their respective national frameworks. These are:

- Involving all segments of society;
- Having experts;
- A robust monitoring system.

Firstly, involving all segments of society is critical. Sustainable Development, being a vast topic, requires a plurality of opinions if its spirit is to be preserved in its integrity. Specialists tend to see their niche as the most crucial aspect of any given subject, and it is only through building bridges that one can find the balance. That requires bringing politicians, public servants, NGOs, the private 9 sector, academics, and civil society together and, at the same time, being aware of the specificities of the national context which it seeks to address.

Secondly, Sustainable Development requires experts that deal specifically with its complexities and nuances, and that requires training in the spirit of SDG 4: Quality Education. Romania's Ministry of Labor and Social Justice has recently recognized the title of "*Expert in Sustainable Development*", a new profession which, medium to long-term, will help enhance the act of incorporating the SDGs into Romanian public policy. There is envisioned a team of experts in every public institution, and these experts will act as a liaison between the public institution and the related department for the Ministry of Environment. Such experts will help boost inter-ministerial collaboration as well as help inform the public institution, they are working for about the importance of sustainability.

Third, monitoring Romania's progress by quantifying the SDGs into measurable indicators is essential in making sure things are on the right track. Considering the shift ushered in by the 2030 Agenda, experts and researchers have considered that Romania is currently in the process of updating its Sustainable Development indicator set – and this is an essential part of both the upcoming National Sustainable Development Strategy and the upcoming Action Plan which seeks to build upon the former by having a more specific, in-depth, character. To achieve this, the Ministry of Environment is closely collaborating with the National Institute of Statistics by bridging both the United Nations', and the European Union's indicator sets to choose the right indicators to address Romania's specificities.

IV. CONCLUSIONS

Romania is a supporter of the "Leave no one behind!" promise of the 2030 Agenda for Sustainable Development, according to which the UN Member States recognized that the dignity of the individual is fundamental and that the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals and 169 targets should be met for all countries and especially for all segments of society.

Agenda 2030 for Sustainable Development adopted by the United Nations in 2015 sets the foundations that contribute to achieving the 17 Sustainable Development Goals (SDGs).

Romania has the capacity to align itself with sustainable development goals, but a series of organizational actions must be imposed. The evaluation of the 17 objectives was done in a qualitative way to emphasize the national capacity for sustainable development. Existing organizations must join this approach and contribute to achieving the goals. Each objective must be pursued at national level and evaluated qualitatively to highlight its status. This assessment is carried out at national level by each country. There is also a qualitative assessment at EU level. The global assessment is carried out over a longer period following national reporting. Among the strategic steps to be taken at the level of Romania are:

- Improvement of the national strategy for environmental protection;
- Supporting purchases of electric vehicles;
- Improvement of public transport;
- Implementation of participatory management;
- Supporting forms of lifelong learning;
- Implementation of integrated management systems for municipal waste;
- Increase recycling rate through education.

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A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector

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Abstract – The purpose of reporting as communication or assessment tool has rendered it more attractive for organizations. The emergence of standardized frameworks which can be used for benchmarking was a step forward for sustainability reporting. In this context, water utilities are understudied with regards to sustainable development reporting. As such, the current work explores, from a quantitative perspective, reporting initiatives in the water utilities sector over the past 20 years, by using the GRI Sustainability Disclosure Database.

Keywords: Sustainable development reporting, water utilities, GRI

I. INTRODUCTION

Water, the backbone of life, is a finite critical survival resource with a direct impact on the quality of life and general health of the population, as well as industry itself. Sustainable water management is a transgenerational and across borders issue (developing and developed countries alike) [1]. Although the 1987 Brundtland report rang the bell regarding the challenges that post-war human development poses to society and environment, several decades have passed and initiatives aiming at a sustainable tomorrow are still varied, disjoint and difficultly measurable.

The water industry manages water in its dual forms – drinking water and wastewater; consequently, the industry is subject to tight norms and controls which are usually defined at a national level. On the other hand, ownership of the water infrastructure spans from local / national government (most common types) to private ownership (rare). The operations of the infrastructure can be done directly through state owned companies or delegated to private operators. As part of the industrial basin, the water utilities companies have a dual role to play with regards to sustainable development as managers of a critical resource for human life and part of the more global economic actor tissue.

For sustainability, reporting is tightly related to transparency in practices and impacts [4] as both communication tool for internal and external stakeholders and a managerial assessment tool.

The purpose is to study the evolution of reporting initiatives and the usage of standardized reporting tools in the water utilities industry as an indication of increasing importance of sustainable development in the water utilities sector. This completes the research field of sustainability reporting in the water utilities industry by answering the question "*How much do companies report?*".

II. LITERATURE REVIEW

Sustainability reporting has emerged from the need for an adequate tool for reporting the social and environmental impacts of organizations that cannot be accurately rendered by the traditional reporting tools [3]. As often in the domain of sustainable development there is no consensus on one path, and as such several frameworks have been developed, the best known being the Global Reporting Initiative, ISO 14031 or the Sustainability Accounting Standard Board [2,3].

If the private sector has been at the outpost of the reporting initiative, the public sector has been lagging. Water utilities companies manage a public good vital for present and future generations and their sheer existence. As such, they have a paramount role in proposing a sustainable product in a sustainable way.

Sustainability reporting for the water sector has recently become an object of academic study as the importance of reporting on sustainable development initiatives is no longer just a means of communication towards stakeholders but also a method to answer to the increasing pressure for transparency on the social,

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environmental and economical dimensions [2]. It can also be perceived as prevention for legitimacy within the sector. Nonetheless, the literature on the subject is minimal and oriented towards assessing the quality and quantity of the content of the sustainability reports (indicator disclosure and coherence with the main reporting guidelines, such as GRI) [1, 2] or the reasons behind voluntary reporting [3].

Authors tend to agree that sustainability reporting is a communication tool rather than a sustainability assessment exercise [2] with debate around the need of more industry-specific frameworks [2].

Nonetheless the debate around the pressure to which stakeholders are submitted is still open. Previous research of [4] states that employees and investors are the main pressure groups that can influence in the direction of sustainability reporting, as opposed to the general idea that it is driven by customers and the external environment.

As regards water services, the research described in [5] outlines that sustainability assessment is an underexploited research field. Some of the difficulties stem from the general definition of sustainability and the understanding of what is sustainable. The driving notions within the water utilities industry are: implementing sustainable development-oriented practices and informing society in terms of method and results [2].

It can be concluded that literature discusses the existence of an increasing trend in sustainability reporting [2, 3]. In order to complete the broader picture of sustainability reporting, the extent to which sustainability reporting has been developing in the past years will be explored. As such, the current study aims at analysing, from a quantitative perspective, sustainability reporting in the water utilities industry. The study outlines the trends in reporting initiatives over the past 20 years through a data analysis of the GRI database. The choice of the usage of the GRI database is based firstly on the recognition of this standard by industrial, academic or governmental bodies, as well as NGOs and secondly on the inclusion in the database of reports that are not necessarily in a GRI standard format. Furthermore, GRI Guidelines are general enough so that a wide spectrum of stakeholders (companies, NGOs, public agencies etc.) can voluntarily disclose information on social, environmental and economic aspects [3].

III. METHODS AND RESULTS

The GRI database was used for data analysis. Although several standards can be used for sustainability reporting, the GRI is one of the most acclaimed with an important growth (plus 400 organisations between March 2005 and November 2006 [3]). Furthermore, the GRI Guidelines can be used as an initial reporting framework and can then be garnished as sustainability reporting matures. Finally, in a study of public sector organisations' motivations for sustainability reporting, Ref.[3] pointed that although, initially companies used other frameworks for reporting, they eventually chose to pass to the GRI format as it is considered a mark of legitimacy of the report and a matter of best practice.

Having this in mind, the data available in the GRI Sustainability Disclosure Database covers reporting from 1999 to 2018. It shall be noted that due to the implementation of a new registration system, in October 2018, some of the reports submitted under the GRI -Standards Guidelines had been temporarily removed for confirmation of report details.

The first step was to establish the core of data. To this end, the sector was restricted to "Water Utilities". This rendered a total number of 130 organizations worldwide and a total number of 597 sustainability reports for the period 1999-2018.

The first remark that can be made is that although the database goes back to 1999, within the water utilities sector, the first registered reporting attempt is dated in 2001 and it belongs to a state-owned company in Australia, effort that was only reiterated in the company's 2005 publication, then in 2010 and yearly thereafter. For the year 2002, the water utilities sector registered a very feeble growth as only two companies (one in New Zealand and one in the UK) published sustainability reports.

The peak in terms of sustainability reporting was attained in 2013 and 2014 with a maximum of 73 organizations that published 73 sustainability reports.

Figure 1 retraces the quantitative evolution of reporting between 2001 and 2018 in the water utilities sector.

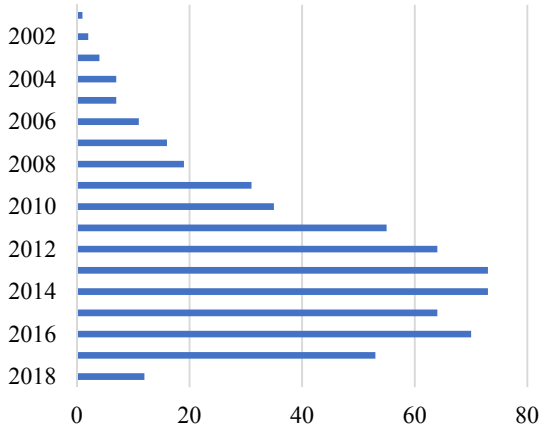

Fig. 1. Quantitative evolution of worldwide reporting initiatives – period: 2001-2018

Firstly, we have been interested in establishing if the more traditionally industrialised regions have a more increased sensitivity to reporting. To this extent, Figure 2 retraces, the average number of reports per organization between 2001 – 2018 throughout the world and according to geographic region (as per GRI definition). If the average number of reports per organization throughout the world is 4,6 reports/organization, sustainability initiatives in the water utilities sector are above average in Oceania. The countries within these regions being insular, they may

be more sensible to sustainability within the water sector as the impacts are more visible and within reach. At the other end of the scale was Northern America with a mere average of 2 reports/organization within the past 20 years.

The GRI database, includes also reports on sustainability that do not follow GRI standards. As the framework encourages an incremental reporting approach, it was considered that all attempts at reporting should be included in this analysis. As such Figure 3 retraces the usage of GRI Guidelines versions (Report Types). It can be concluded that an important number of reports are Non-GRI (158 reports), which points to initiatives within the water utilities sector to embark on the journey of sustainability reporting, but in non-standardised forms. As previously stated, reporting on sustainability was scarce in the first years of the GRI Guidelines; this can be due to it being considered a novel initiative, but also to the poor acquaintance of GRI. Versions 3 and 3.1 have been used for a total of 7 years and their issuing corresponds also to a period of increased interest in reporting initiatives.

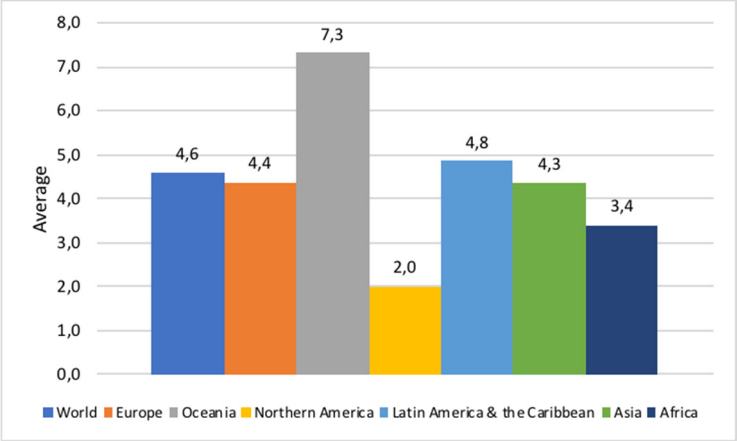

Fig. 2. Average reporting initiatives between – period: 2001-2018

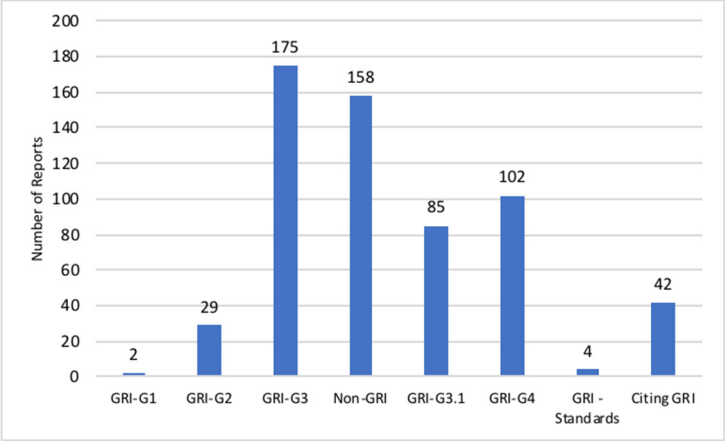

Fig. 3. Reporting initiatives according to Report Type – period: 2001-2018

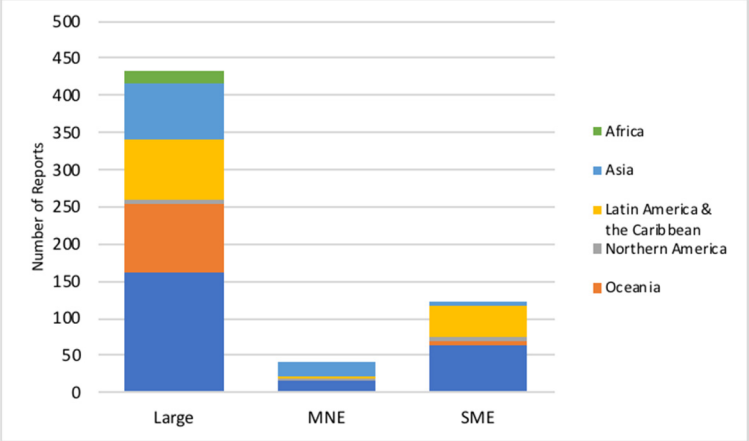

Fig. 4. Quantitative evolution of reporting according to organization size – period: 2001-2018

The last analysis considered the quantitative evolution of reporting according to size of the organization: Large, Multinational or Small and Medium Size (the comprehensive definitions being presented extensively in the GRI Sustainability Disclosure Database – Data Legend, 2018). It is visible that there is an overwhelming preponderance for reporting among Large organizations. This can be explained by a better understanding of reporting as a communication tool, but also through the ability to attribute specific resources for reporting. On the other hand, SMEs report less as they do not have dedicated resources for sustainability reporting initiatives which can are often considered as time and resource consuming, with little tangible benefit. Finally, the few reports attributed to Multinationals can be explained firstly through the fact that it is not a current type of organization within the water utility sector, but also to a preference for reporting at a national level (large or SMEs) rather than aggregated at the multinational level (often seen as more complex).

All in all, the results of the quantitative analysis through the GRI Standards supports the general hypothesis that reporting on sustainability in the water utilities sector has intensified in the past two decades. This quantitative analysis has been based on the GRI Sustainability Reporting Database as it includes also nonstandard approaches to sustainability; these also point to an increase in interest for reporting. The data analysis also concerned the demography of the water utilities companies reporting on sustainability, the quantitative evolution of reporting according to size of organization and the quantitative evolution of reporting as per evolution of the GRI framework. Reporting in the water utilities sector is historically linked to the geography of the region (insular) in which the water utility company operates. Although the usage of GRI Guidelines is well implemented, reporting initiatives that are less constrained are also spurring.

IV. CONCLUSIONS

The current study has proposed a quantitative analysis of reporting initiatives in the water utilities sector within the past 20 years. The findings set the background for sustainability reporting in the water utilities industry. It has been concluded that organizations belonging to the water utilities sector are reporting more on their sustainability practices and impacts. Further research can explore the methodology for aggregated reporting for multinational companies in the water utilities sector. Another aspect that needs further consideration is the reason why the Northern America region is lagging in sustainability reporting, far beyond the global average. An interesting field can be an empirical study of incentives for reporting in the developing regions of Africa or Asia, for which the economical aspect is often presented as preponderant.

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Engaging Citizens in Effective Collective Action: How and Why?

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Abstract – Empowering civic groups may lead to better outcomes than a centralized decision-making in a society where the social power is concentrated in the hands of a few. But effective collective action is almost always conditioned by the collaboration with functional state institutions which are forced to cede a certain amount of authority, power and finance in favour of communities they no longer totally control. The question emerges: how can we understand and nurture citizen engagement projects for successful public services in a current political society? The present paper explores the public participation typology with the final scope of developing a new citizen engagement model.

Keywords: authority delegation, citizen engagement, government communication mode, proactive citizens

I. INTRODUCTION

Citizen engagement in public services is considered a way to improve the responsiveness of these services [1], to innovate them for greater community satisfaction [2] and a principle directing towards welfare-state reform [3]. Participatory literature argues that groups of people, from village communities, urban neighborhood associations to water user groups or schools' councils, will always operate towards a common interest. Therefore, the state is often seen as a barrier to social development and many neoliberal development strategists argue that community participation in local projects is the key for effective public services.

Mohan and Stokke [4] advocate caution in focusing so heavenly and exclusively on 'the local' and Mansuri and Rao [5] describe the possible problems that may occur when organizing groups of people for effective collective action. Almost every citizen engagement effort is conditioned by an infrastructure consisting of functional state institutions. These government agents are forced to act against their self-interest by devolving power to communities they do no longer control, which is not a process we can easily manage. Mansuri and Rao [5] also state the fact that citizen participation in its early stages is not very useful, and changing this dynamic requires openness, a sustained commitment from the government sphere.

There are several hurdles for effective collective action, some coming from the part of the citizen and others from the government side. First, scholars discuss co-production, public participation and participatory governance as interchangeable concepts not being aware of their ambiguous interpretations [1]. Secondly, participatory processes are complex due to various rationales for engagement, different organizational cultures or varied strategy requirements for each participation project [3]. The reluctance of public sector actors to cede power to citizens together with certain mistrust in citizen data [6] or citizen decision making effectiveness represents a major drawback as well.

Current participation models like Arnstein [7] (1999)'s ladder of citizens' participation, Gramberger [8]'s citizen and authority cooperation level, Izvercian, Seran and Branea [9]'s policy development participation levels, and Nabatchi [10]'s participation spectrum have mainly discussed separately the citizen and the government point of view or have joined the two perspectives but focused only on one when delineating their strategic output. Potra, Branea and Izvercian [11] approached participation taking into consideration four specific citizen engagement variables and a general government openness level, resulting into an interesting open government model but insufficiently developed on the government side.
The present article aims to study the variables of each of the two actors involved and reunite the two perspectives into one new citizen engagement model. In this way, we can better understand the participation dimensions and the possible barriers when trying to cross into a superior engagement sphere. The how and why of the final engagement spheres will be furthermore explored.

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II. CITIZEN ENGAGEMENT LEVELS

Potra, Branea and Izvercian [11] propose four variables that affect citizen engagement level in public participation projects, based on Haven [12]'s engagement metric components (involvement, interaction, intimacy and influence) and Izvercianu and Branea [13]'s citizen participation levels in government initiatives. The new perspective thus formed included four citizen engagement states: a passivity, low feedback engagement, active engagement and fully creative engagement.

El-Haddadeh et al. [14] examine citizens' perceived value of internet of things technologies and propose a new engagement model which takes into consideration an interesting variable, namely, the citizen value envisaged by engagement: a perceived individual value and a collective societal value. Based on those two citizen engagement models, we delineate the citizen engagement level structured on five variables: involvement, intimacy, interaction, influence and desired value (Fig. 1).

The citizen can be engaged to a certain level if we provide enough incentives for the five variables detailed. The novelty of this engagement spheres resides in the fifth variable, the desired value. Citizens taking part in participation projects can be individually oriented and react or provide feedback for their personal gain or socially oriented, wishing to create community value. This single variable can make a considerable difference depending on the envisioned collective action plan.

III. GOVERNMENT ENGAGEMENT LEVELS

Croft et al. [15] argues that the organizational context shapes the resultant position of citizens vis-à-vis decision making processes. Thereby, the organizational setting with its hierarchical or rather egalitarian culture affects public participation, becoming the first variable in government openness level.

In addition, scholars distinguish two very important rationales behind governments' pursuit of citizen engagement, namely democratic reasons and instrumental motivations [2].

Marent et al. [3] express the fact that government initiatives are presented as empowering citizens and emphasizing dialogue while serving only to increase the acceptance for a specific project or to support cost containment measures [16].

Government agents can perceive citizens as strategic partners when their purpose is pursuing democratic governance or as operational volunteers, when seeking for operational volunteers. In this line of reasoning our second variable appears - the government particular purpose for citizen engagement. It can be associated with Arnstein [7]'s ladder of citizens' participation, starting with manipulation or image improvement till democratic governance.

Nabatchi [10] explores in his typology for understanding shared decision authority a communication mode variable which is for every public service actor and impacts its openness to citizen engagement. Communication modes are our third variable and can range from one-dimensional, two-dimensional to deliberative communication. Together with communication, Nabatchi [10] also focuses on authority issues, participation being evolving with a higher level of authority shared between citizens and government actors. Authority delegation is one of the most important factors for participation influence, becoming our forth variable in government openness level.

Paskaleva and Cooper [17] describe Living Labs as new ways for citizen engagement in the quest for innovative smart city co-produced services.

These technology initiatives enable citizens to take part not only in the delivery phase of a project but in research, development and evaluation of innovative processes. Thus, the openness degree of government actors needs to take into consideration a fifth variable, the project phase citizens are engaged in. It may vary from delivery phase for most reticent government actors till all lifecycle of the project when the government openness reaches its highest level.

The five variables of the government openness level are detailed in Fig. 2.

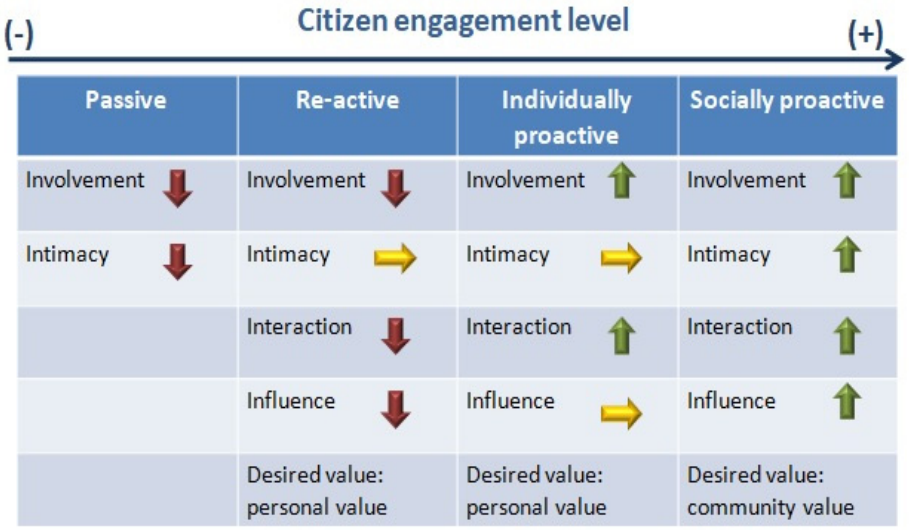

Fig. 1. Citizen engagement level based on five variables

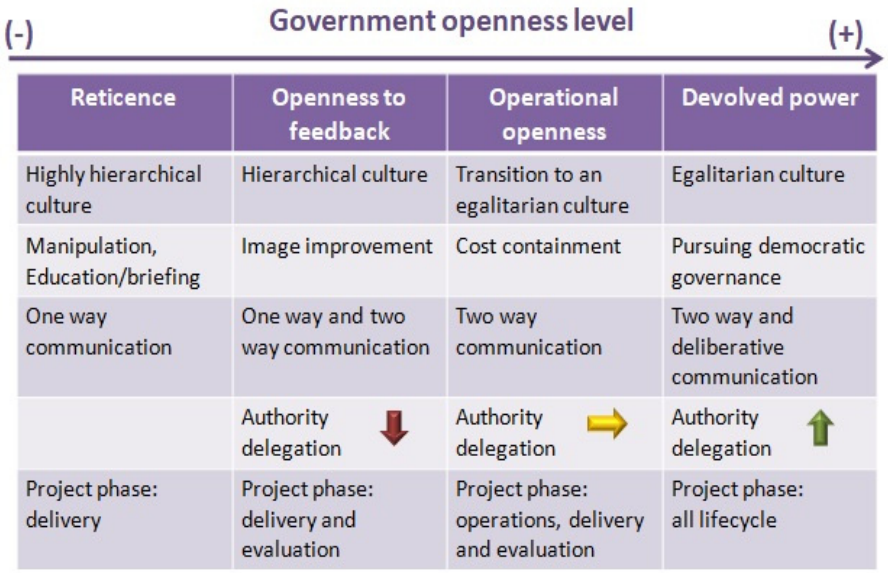

Fig. 2. Government openness level based on five variables

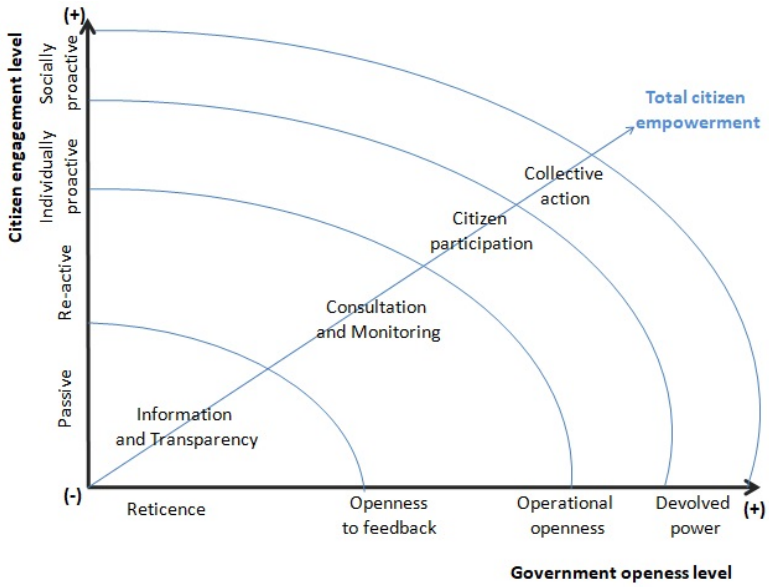

Fig. 3. A new engagement model based on citizen engagement level and government openness level

A public service provider which has a hierarchical organizational culture is unlikely to be able to engage or support citizens in collaborative projects. The more it opens and adopts an egalitarian culture, the more it will reach and positively affect its community. On the other hand, if the purpose of the government actor is to manipulate or improve its image, its actions and message will not engage citizens, solely determine a reaction from their side. The communication mode a government institution adopts relates with the other variables and scopes. A dialogue appears only when authority is delegated to a certain extent. And finally, the project phase is equally relevant. Reluctant government actions do not engage citizens in research and development phases of a project. However, if they manage to extend the project phases in which citizens have a saying, their open approach will determine positive results.

IV. THE NEW ENGAGEMENT MODEL

The five variables which influence citizen engagement level within a co-production project and the five variables managing government openness to public participation are now combined into a new engagement model (Fig. 3). The pattern thus formed visually represents all possible engagement outputs depending on the two actors' participation efforts. The final desideratum of all engagement efforts is total citizen empowerment. But it mainly remains a utopia. There have been some participatory spaces within decentralized systems of governance like the participatory budgeting in Porto Alegre, Brazil, the rural governance reform in India or the village democracy in China, however they are exceptional and limited to small communities. Many community projects are embracing citizen participation or collective action strategies.

Thus, the main goal for all citizen engagement projects is to assess the level of government openness and citizen engagement for the situation considering the five variables for each of them. After understanding the starting position in the engagement model, the project team can delineate the strategy for ascending towards a superior participation position.

The first participation stage is called information and transparency because the main focus is on the data the government actors transfer towards citizens without expecting any action from their part. It is a very comfortable stage for the institution in which they have total control of every step and circulated information. The monologue is used to manipulate or educate/inform the masses about the project only for data transparency. The outcome has no real value, the public service does not profit from the creativity and possible innovative approach of the local community and the satisfaction degree usually decreases in time.

When we transition towards the second stage called consultation and monitoring, the output changes and citizen satisfaction increases. Citizens react or even start being individually proactive due to openness to feedback from the government side. We have a small amount of authority delegation; the communication becomes two-sided and the citizen is involved in the delivery and evaluation of the project. In the upper part of this stage the government actors allow the public to become equals in the operational part of the project with the final goal to contain costs and determine volunteers to provide free labor. Some of the most known projects of this sort are citizen science crowd sourcing projects where citizens play an active role in the scientific process [6], being particularly popular within ecology, biology and environment monitoring [18].

The third citizen participation stage describes the situation when citizens are still individualistic, desiring personal value outcomes from the participation and government actors are transitioning towards an egalitarian culture, allowing the public to be proactive in many stages of the project and ceding a certain amount of power. In result, the public service becomes more attractive to the public and their satisfaction increases drastically.

The forth collective action stage is very difficult to reach because the citizen changes his or her behavior towards a more socially proactive one desiring to provide value for others in a collective effort. The government openness reaches a high level where the authority is delegated equally to the public and the organizational culture is converted towards democratic governance.

Public services face innovative shifts and they become highly attractive for the whole community. The communication remains a dialogue and sometimes becomes even deliberative, because citizens are engaged in all project phases and are accountable for their decision-making processes.

V. CONCLUSIONS

The present paper explores the citizen engagement concept and proposes a new model which envisions the relevant stages a public participation project can focus upon depending on the current citizen profile and organizational culture of the government actor. The five variables for each of them provide relevant factors government managers need to think about when designing participatory strategies.

Why do we need to engage citizens in public service improvement projects? Because co-production is the future for all smart city services, Voorberg et al. [19] argues that the most under-used road to innovation is through asking citizens not just to assess how services are delivered but also to help co-produce them. Active, proactive and productive citizens seem to be the right alternative for service development and the traditional approaches in this light no longer appear suitable [17].

How can we engage citizens in public service projects? There are several ways, depending on the position of

the project in the engagement model. If the project has a collaborative and open government institution and citizens are individually proactive, the alternative is to design strategies for transforming citizens into community driven value seekers and thus ascending to a collective action plan.

If the current situation envisages reluctant and passive actors, the project managers need to assess the actual position in the model and depict the right strategies to determine an increase in openness and proactive behavior, as the case envisions.

The variables are key for the analysis and design steps of the project. Future research will focus upon case studies for the final scope of evaluating the proposed framework.

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Water Governance and Its Effectiveness

Mihaela BORAN[1]

Abstract – Water governance refers to the political, social, economic and administrative systems in place that influence water's use and management. Essentially, who gets what water, when and how, and who has the right to water and related services, and their benefits. It determines the equity and efficiency in water resource and services allocation and distribution, and balances water use between socio-economic activities and ecosystems. Governing water includes the formulation, establishment and implementation of water policies, legislation and institutions, and clarification of the roles and responsibilities of government, civil society and the private sector in relation water resources and services. The outcomes depend on how the stakeholders act in relation to the rules and roles that have been taken or assigned to them. The water sector is a part of broader social, political and economic developments and is thus also affected by decisions by actors outside of the water sector. New forms of governance focusing on process-oriented societal co-steering through, for example, formal and informal networks, partnerships and dialogue, have emerged within the water sector. The governance transformation is intrinsically linked to the increasing focus on the complexity of water management and the multifunctional character of water and the search for alternative forms of organisation.

Keywords: Dialogue; Governance; Integrated Water Management; Participation

I. INTRODUCTION

The restoration and preservation of freshwater ecosystems is a worldwide multifaceted challenge, but, as well as the complexities of the water systems and the behavior of natural life within those systems, there are also multiple societal and institutional drivers that add to this complexity (e.g., [5, 15]). As water is such an important carrier of planetary life, the restoration and preservation of freshwater ecosystems is one of the *United Nations Sustainable Development Goals*, which aim to protect and restore water-related ecosystems by 2020 (referring to SDG 6, available at www.un.org/ sustainabledevelopment/.)

In Europe, the ecological ambitions for water were set out in the *European Water Framework Directive* (WFD, 2000/60/EC), which referred to water as 'a heritage which must be protected, defended and treated as such' (2000/60/EC, recital 1). Member States were told to achieve a "*good ecological and chemical status*" for all their waters by 2015, focusing on specific elements like the integrated river basin approach, the role of stakeholders and the importance of balancing the costs and benefits of water services.

These objectives are in line with SDG 6 although with a different timeframe. If the WFD objectives could not be met by 2015, the WFD sets out a strict set of conditions for exemptions running until 2027: technically unfeasible within the timescale, disproportionately expensive, or natural conditions do not allow timely improvement (2000/60/EC, Article 4, sub 4) [21].

Unbalanced costs and benefits of water services, however, would only be accepted as an exemption if the WFD objectives had already been met [22]. To date, it can be concluded that most member states are struggling to realize the ecological ambitions of the WFD (Article 4) [1, 2, 4, 6, 15, 16, 17] and thus SDG 6. The European Commission (EC) reports that "*in one third of the member states more than 50% of all natural surface water bodies have good or high ecological status and in 20% of the member states less than 20% of water bodies have a good ecological status*" [9]. Scholars offer different explanations for this result. For instance, there is a lack of comparable data on both ecological status and the effect of measures at both the national and EU level, which hampers the formulation of effective measures [1].

Policy-makers demonstrate limited ambitions because of uncertainties about the implications [4, 19] and member states interpret their legal obligations in different ways, which results in different levels of water quality [10]. These issues can be identified all over Europe and beyond [10, 13, 24].

Yet, where does that leave the policy-maker and the water manager who must decide how to respond to the stagnating ecological ambitions? Governance approaches, with the involvement of multiple actors at multiple levels, are often regarded to be more effective in dealing with complex water issues,

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compared to conventional legal frameworks with top-down central steering mechanisms [11, 20, 25].
In this context, governance is defined as a process of interaction between public and/or private actors ultimately aiming at the realization of collective goals [18]. The challenges set by these multi-actor, multi-level governance approaches have been described extensively in literature (e.g., [3, 7, 9, 13, 24]).

Furthermore, governance addresses linkages and processes between and within organizations and social groups involved in decision-making, both horizontally across sectors and between urban and rural areas, and vertically from local to international [23]. Governance is not limited to "government" but also includes the private sector and civil society. The character of relationships (and the formal and informal rules and regulations guiding such relationships) between different social actors and organizations is an important feature of governance.
Though the water sector has lagged in explicitly addressing water challenges in a governance framework, "fixing" various water related challenges, such as dwindling water resources, insufficient services and pollution, is now increasingly seen in terms of getting the "right" governance system in place. The question of "getting it right" will mean different things in different countries.
The water sector has traditionally been, and still is to a great extent, driven by investments in technological innovations and development of infrastructure to increase water supply. In many instances this has allowed many people to benefit more in terms of access to water. However, there have also been many instances where infrastructure did not operate in an effective manner, or where the benefits of appropriate technology were not fully realized [12].
The way societies govern their water affairs has profound impacts on livelihoods, yet governance has not received the same attention, within the water sector, as technical and infrastructure developments have. Any water governance system must be able to allocate water to ensure food and urban security, but also be able to assess for whom and for what purposes water is provided. In practice, tough trade-offs must be made and allocation of benefits and costs have to be clarified. Governance is essentially about such processes of making choices, decisions and trade-offs.

II. A DEBATE ON THE NOTION OF WATER GOVERNANCE

Water governance refers to the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society [8].
Water governance has been defined as "... the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society" [23].
The notion of governance for water includes the ability to design public policies and institutional frameworks that are socially accepted and mobilize social resources in support of them. Water policy and the process for its formulation must have as its goal the sustainable development of water resources, and to make its implementation effective, the key actors/stakeholders must be involved in the process. Governance aspects overlap with technical and economic aspects of water, but governance points us to the political and administrative elements of solving a problem or exploiting an opportunity. Governance of water is a subset of the more general issue of the creation of a nation's physical and institutional infrastructure and of the still more general issue of social cooperation.
Water governance is concerned with those political, social and economic organizations and institutions (and their relationships), which are important for water development and management.
Water governance is concerned with the functions, balances and structures internal to the water sector (internal governance). It includes the framing of social agreements on property rights and the structure to administer and enforce them known as the law. Influences also come from civil society and from the "current" government and these are considered parts of the external governance of water, which will be discussed later. Effective governance of water resources and water service delivery will require the combined commitment of government and various groups in civil society, particularly at local/community levels, as well as the private sector.

2.1. Achieving Effective Water Governance

Today, we know a lot more about what constitutes bad government than we do about achieving good government [14].
We are talking today more and more about that the governance of water resources and water services functions more effectively with an open social structure which enables broader participation by civil society, private enterprises and the media, all networking to support and influence government [14].
It is acknowledged that development in poorer countries is dependent on infrastructure and innovative technological development. Establishing effective water governance is complementary to this and provides the environment to ensure that the equally important investment in physical works is appropriate, long-lasting and effective. It is also recognized that governance requires change, which is often resisted, and by its nature it involves political debate.
There is no single model of effective water governance. Indeed, to be effective governance systems must fit the social, economic and cultural particularities of each country.

2.2. Principles for Effective Water Governance

There are some basic principles or attributes that are considered essential for effective water governance [23]:

- Open and transparent: Institutions should work in an open manner. They should use language that is accessible and understandable for the general public to increase confidence in complex institutions. Good governance requires that all policy decisions are transparent so that both insiders and outsiders can easily follow the steps taken in the policy formulation
- Inclusive and communicative: The quality, relevance and effectiveness of government policies depend on ensuring wide participation throughout the policy chain – from conception to implementation
- Broad participation is built on social mobilization and freedom of association and speech, as well as capacities to participate constructively. Transparency and accountability are built on the free flow of information.
- Coherent and integrative: Policies and action must be coherent. The need for harmony and coherence in governance is increasing as the range of tasks has grown and become more diverse. For ensure a consistent approach within a complex system, coherence requires political leadership and a strong responsibility on the part of the institutions at different levels.
- Equitable and ethical: All men and women should have opportunities to improve or maintain their well-being. Water governance must be strongly based upon the ethical principles of the society in which it functions and based on the rule of law. Equity between and among the various interest groups, stakeholders, and consumer-voters needs to be carefully monitored throughout the process of policy development and implementation

The role of governance mechanisms outside the water sector is critical to the success of water governance within the sector. To achieve more effective water governance, it is necessary to create an enabling environment which facilitates efficient private and public sector initiatives.

The way societies govern their water affairs has profound impacts on livelihoods, yet governance has not received the same attention, within the water sector, as technical and infrastructure developments have. Any water governance system must be able to allocate water to ensure food and urban security, but also be able to assess for whom and for what purposes water is provided. In practice, tough trade-offs have to be made and allocation of benefits and costs have to be clarified. Governance is essentially about such processes of making choices, decisions and trade-offs.

III. RESULTS OF WATER GOVERNANCE IN ROMANIA

3.1. Ensure availability and sustainable management of water and sanitation for all

On July 28, 2010, the UN General Assembly declared clean and safe drinking water as well as sanitation a human right, essential to the full respect for the human right to life and all of its other rights. The UN General Assembly expressed their deep concern that approximatively 900 million people in the world (figure suggested by WHO/UNICEF in the joint monitoring program) do not have safe drinking water. Subsequently, at the fifteenth session of the United Nations Human Rights Council, in September 2010, there has been stipulated that the right to water and sanitation is derived from human right to an adequate standard of living, so ”for the UN, the right to water and sanitation is included in the existing treaties on human rights and is therefore legally binding”. Even if we are still facing many of the traditional water supply challenges, sewerage and water quality protection, new challenges such as adaptation to climate change, rising food and energy prices, obsolete and insufficient infrastructure are now increasing, which also increases the complexity and financial burden of the water management. From an economic and pragmatic point of view, Romania's capacity to provide efficient infrastructure and services in the field of environmental protection, both at national and local level, is also an important factor in the development of the private sector. At the same time, public capital investments have a particularly important role in the market economy, because some public infrastructure facilities are inputs for private sector activity and contribute to increasing the marginal productivity of private capital. With the transition to a market economy and a democratic political system, after more than four decades of centralized management, Romania decided to return to the principle of autonomy through decentralization and the transfer of major and concrete responsibilities to local public administrations. The Law on public administration, No. 215/2001 republished, refers to the obligation of local governments to organize their operations effectively and adequately, in order to provide public services. Under this law, local governments have the right to associate with the goal of developing efficient public services for the common/regional interest. The need to reform, modernize, develop and restructure the water sector has become even more stringent and obvious once Romania became a member of the EU, having to comply with the European Directives 98/83/EC on drinking water quality (by 2015) and 91/271/EC on wastewater treatment (by the end of 2018). For the above reason, Romania is constantly pursuing the achievement of those investments needed in order to comply with the water quality indicators imposed by the European Union. Besides that, by the end of 2015,

263 urban agglomerations with more than 10,000 population equivalent (p.e.) should have met the wastewater collection and treatment targets and by the end of 2018, 2,346 agglomerations between 2,000 to 10,000 population equivalent (p.e.). In order to achieve these ambitious targets, Romania implemented pre-accession programmes (PHARE, ISPA), the Sectoral Operational Programme Environment (SOP Environment) 2007-2013 and the Large Infrastructure Operational Programme (LIOP) 2014-2020.

The Sectoral Operational Programme Environment (Environment SOP) 2007-2013 took into consideration the strategic objectives for the financing of the environmental infrastructure, being fully in line with the strategic national objectives set up through the National Development Plan for 2007-2013 (NDP) and the National Framework Strategic Plan (NFSP) that take into account the objectives, principles and practice of the European Union. One of the specific objectives of SOP Environment was to improve the quality and access to drinking water and wastewater collection and treatment infrastructure, providing drinking water and wastewater collection and treatment services in line with EU policies and practice, in a most of the urban areas by end of 2015 and to develop regional structures to manage the drinking water and wastewater collection and treatment services. The implementation of the Large Infrastructure Operational Programme (LIOP) 2014-2020 is ongoing. LIOP includes the Priority Axis 3 – Development of environmental infrastructure based on an efficient management of resources, with an allocated amount of EUR 2.892.443.785,00, and is focusing on the programme area 3.2 Improving the level of wastewater collection and treatment in urban areas, as well as improving the level of population access to drinking water services. The investments provided by this programme area aim to ensure the progress towards the compliance with the environmental acquis and, implicitly, to reduce the disparities between Romania and the other Member States in this particular area. Likewise, the Governance Programme 2016-2020 provides for 5,000 new investments for drinking water, wastewater collection and treatment infrastructure, financed from the state budget, through engagement credits, and European funds. Also, establishing the regional operators (RO) and delegating the management of water and sanitation services to them is an essential process to ensure compliance with the deadlines and, at the same time, for building the absorption capacity of the EU structural funds and to implement the future investment projects. The association of a number of territorial-administrative units in order to conjunctively delegate their water and sanitation services management has also to respond to the need of reducing the development disparities between the territorial-administrative units and is an application of the solidarity principle as one of the fundamental values of the European Union, with positive effects for the users. Currently, the regionalization process of water services, which aims to overcome the excessive fragmentation of the sector and achieve economies of scale, is almost over. The above-mentioned programmes, namely the pre-accession programmes (ISPA, PHARE), the SOP Environment 2007-2013 and the LIOP 2014-2020 are co-financed by the state budget and cover all 42 counties in Romania, so that at present there are 42 regional water companies (in general, at county level) and the water company of Bucharest Municipality.

3.2. The analysis of the current state of development and of the recent evolution of the Romanian water sector

The costs for alignment of drinking water supply and wastewater collection, treatment and disposal to the standards required by the EU environmental acquis were estimated at approximately 15 billion euros, by the end of 2018. Those costs are, first of all, investment costs for the development of infrastructure for drinking water distribution networks, wastewater collection systems and wastewater treatment plants.

Public Drinking Water Supply Network - As regards the supply of drinking water, a national report established that only 65% of Romania's population is connected to the public drinking water network, out of which 98% is urban population and only 33% rural population (3.4 million inhabitants).

Romania is in a rather unfavorable position compared to the rest of Europe, where 96-100% of the population is connected to the drinking water distribution network, 100% in urban areas and 87% in rural areas. According to this report, there were only 4 countries in Europe reporting that they did not have full coverage of drinking water and sanitation services, Romania being the least developed from this point of view. However, drinking water distribution networks have expanded continuously, especially as major cities have developed, so that the network's length (about 50,000 km) was 55% higher in 2009 compared to 2001. At present, 86% of the population resident in 256 urban localities (11,551,096 inhabitants) benefit from running water through public networks. 55 urban localities have 100% population connected to the public drinking water distribution network.

Relevant statistical data ar presented in Table 1 and Figure 1, provided by the Romania's Statistical Yearbook 2018.

Table 1. Drinking water supply network and volume. (according to the Romania's Statistical Yearbook 2018)

a. Public sewerage

Localities with public sewerage installations (number) / of which at Municipalities and towns:

2011	**2012**	**2013**
861 / 309	926 / 310	982 / 310
2014	**2015**	**2016**
1071 / 311	1122 / 313	1184 / 313

Total simple length of public sewerage pipes (km)

2011	2012	2013
23137,2	24789,8	26559,6
2014	**2015**	**2016**
28659,5	31702,6	34353,4

b. Drinking water supply network and volume

Number of localities1) with installations (end of year) / of which at municipalities and towns:

2011	2012	2013
2304 / 317	2328 / 317	2367 / 317
2014	**2015**	**2016**
2447 / 317	2474 / 317	2506 / 317

Simple total length of drinking water supply network (km) / of which at municipalities and towns:

2011	2012	2013
65900,9 / 27474,3	68299,3 / 27680,2	71513,7 / 27828,7
2014	**2015**	**2016**
74263,2 / 28321,9	76945,0 / 28778,7	79677,6 / 29476,7

Drinking water supplied to the users (million m3) / of which: for household use

2011	2012	2013
1002 / 677	1035 / 695	1014 / 690
2014	**2015**	**2016**
995 / 684	744 / 561	741 / 563

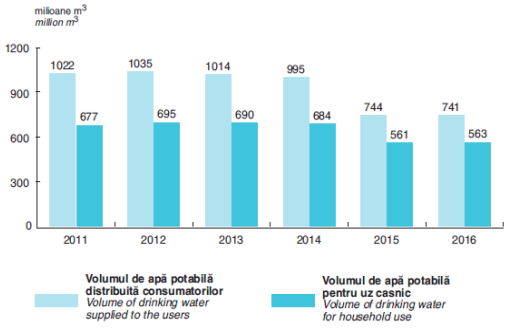

Fig. 2. Volume of drinking water supplied to the users (according to the Romania's Statistical Yearbook 2018)

An interesting fact is the year-on-year decrease in the total volume of drinking water distributed to consumers across the country (1,064.8 million m³ in 2009, over 50% less than in 1995), at the same time with the increase in the share of drinking water consumed for household use (57% in 2005, 64% in 2009), due to the reduction and restructuring of the industrial activity in the last 10 years, the economic crisis in 2009 (when the quantity of water distributed decreased by 1% compared to 2008) as well as consumption, the metering of the consumption and education of the citizens on reducing consumption/eradication of waste. The 2009 reference year is taken into account in the context of the economic crisis. In 2014, 62.4% of the country's population was a beneficiary of the public water supply system.

Romania has also undertaken other actions in order to improve water quality and access to water supply infrastructure, during 2009 - 2017, so 317 cities and municipalities out of 320 and 2189 villages out of a total of 2861, at the end of 2016, were connected to the public drinking water network. However, only 65.4% of Romania`s population was conected to the public drinking water system in 2016, so that Romania was the least developed country in this respect. Romania's situation is comparable to other EU countries in terms of connection rate within urban areas (99% in Romania and 96-100% in the other EU States). Instead, in the rural area the connection rate to water supply infrastructure is below the EU average. In 2016, qualitatively 66.14 % of water bodies which have been taken stock of achieved a good or a very good ecological status (2002 waterbodies), 33.33% which means (1009 waterbodies) with a moderate condition, and (2 waterbodies) in a poor state, and (8 waterbodies) in a bad condition, all represents under 1%. 6 water bodies were not been taken stock of.

Role of the Protocol on Water and Health in achieving the 2030 Agenda - Successful cooperation between stakeholders involved in achieving the 2030 Agenda, through the Inter-ministerial Committee for the Coordination of the Integration of Environmental Protection into Sectoral Policies and Strategies at National Level led by the Minister of Environment. During the sessions of the Open Ended Working Group (OEWG) for drafting Romania's VNR under the Inter-ministerial Committee, there has been strong cooperation between Protocol on Water and Health, in Romania, led by the Ministry of Environment, Ministry of Health and the Ministry of Waters and Forests, to fill the SDGs Matrix (including MEAs), all 169 targets - mapping the main processes and actions by each target. The links between the Matrix of SDGs and Template of PoW Report, and how the connected data has been used in preparing the Voluntary National Review Romania 2018, support of the High Level Political Forum 2018, New York.

In Romania, targets have been set and approved under the Protocol, and now, this kind of work is useful to setting national targets for SDG 6 and others in Voluntary National Review Romania 2018. At the same time, the Voluntary National Review Romania 2018 offers the opportunity to review Protocol targets to check their relevance, comprehensiveness and appropriateness and to update priorities in the context of SDGs and other relevant global and regional commitments. Romania ratified the Protocol Water and Health (PoW) by Ordinance No. 95/29 August 2000, approved by Law No. 228/30.11.2000. The Protocol is the first international legal instrument that promotes at national and international levels the protection of human health and well-being in the framework of sustainable development, by improving the water management, including protecting the aquatic ecosystems, and by preventing, controlling and reducing water-related diseases. At the same time,

the Protocol introduces a social component in the cooperation on water management. Water resource management must link the social and economic development of society and the protection of natural ecosystems. Moreover, the improvement of water supply and sanitation is the decisive factor in interrupting the vicious cycle of poverty. For more than 17 years, the Protocol on Water and Health has proven its effectiveness as an enabler for sustainable development, for improving the water supply, sanitation and public health in Romania.

Also, Romania is a member of the Bureau of the Protocol on Water and Health, which is a coordinating mechanism for implementing measures in this field. The Protocol is the mechanism to advance and operationalize progress on the goals and targets related to water, sanitation, hygiene and health. In Romania, the responsibility for implementing the Protocol on Water and Health is shared between the Ministry of Waters and Forests, as main coordinating body, and the Ministry of Health. Romania participated to the reporting cycles in 2010, 2013 and 2016, but the process of setting targets according to the Protocol has started back in 2009. The reporting is based on the yearly reports elaborated by the National Administration "Romanian Waters", the competent authority for UWWTD Reporting to EU and RBMP 2015-2021, based on information provided by the water services operators. Regarding the information and public participation, the work under the Protocol have been published on the Ministry of Environment, Waters and Forests website: Public participation is an important tool in national, regional or local development activities, imparting quality in decision-making and strengthening the authority of decisions through public support in their implementation. Countries with democratic tradition use this instrument efficiently by always refining their legislative framework to expand public participation to the highest levels of decision-making or state policy formulation, aware of the benefits of public support. Current environmental policies promote an integrated approach in which the public is a key actor in achieving the objectives of any sectoral policy. This approach has been promoted in the overall process initiated by the United Nations, following the Rio de Janeiro Summit in 1992, where the States Parties signed the Declaration on Environment and Development, recognizing that "one of the main elements indispensable to the achievement sustainable development is public participation in decision making "(Chapter 23 of Agenda 21). In 1998, on 28 July in Aarhus, the European Union and other 39 countries adopted the UNECE Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters. Romania ratified the Convention by Law No.86/2000. The Romanian Constitution stipulates that the state is obliged to take measures in order to assure the hygiene and public health. Hence, the actions of the Romanian authorities are oriented to the extension of the centralized drinking water supply and sanitation systems, including those within the disadvantaged areas. The specific legislation on water and sanitation require the access and participation of population to the decision-making process. For example, according to the provisions of the Drinking Water Quality Law, the authorities with attributes in the field of drinking water supply should ensure the adequate and updated information on the quality of water intended for human consumption. The access to information and to the decision-making process is also provided by the Water Law and is available for all the population groups. ***The development of environment infrastructure*** requires major investments for extending of water and wastewater networks, the construction and rehabilitation/ upgrading of treatment plants, sewerage networks and wastewater treatment plants. Thus, on SO 3.2 from LIOP, 70 projects were submitted for a total amount of 1,500.9 million Euro (66 projects were contracted for a total amount of 1,474.3 million Euro), out of which: 35 technical assistance projects (32 contracted projects), 5 new integrated projects for developing water and wastewater infrastructure (all of them contracted) and 30 integrated phased projects for developing water and wastewater infrastructure (29 contracted projects).

Regarding the Environment Fund financing, through the Program of Water Resource Protection, Integrated Water Supply Systems, Treatment Plants, Sewerage and Wastewater Treatment Plants, 130 water and sewerage projects were finalized, with a financing value of 462.15 million Lei (41 projects finalized in 2017, with a funding value of 182.16 million Lei and one project finalized in 2018, with a funding value of 5.65 million Lei). At the national level, at the end of December 2017, 1,732 sewer networks were inventoried, out of which 1,052 were functional and 680 at different stages of execution. With regard to sewage treatment plants, in December 2017, there were 1,055 treatment plants, out of which 782 were functional and another 273 new treatment plants, completed, to which the population had not yet been connected or in technological trials/decommissioned. The degree of coverage with wastewater collection systems corresponds to a biological load of approx. 66.32% of equivalent inhabitants, and the degree of coverage with sewage treatment plants corresponds to a biological load of approx. 63.73% of equivalent inhabitants. The investments made during 2007 - 2017 for the wastewater infrastructure amount to approx. 5,708 million Euro, out of which 53.68% for the rehabilitation and extension of sewerage networks and 46.32% for the rehabilitation and construction of new wastewater treatment plants. Works to improve flood protection systems continue in a fast pace. By the end of 2017, the following facilities were achieved: shore consolidation on 28.13 km; dams on 11.26 km, 281 preparations of bottom sills and falls on the riverbed, a polder and 12 km of riverbed recalibration. Procurement of technical assistance services for

design continues to be funded by LIOP. Until the end of 2017, 164 municipalities and 2,166 administrative territorial units received various works to address the threat of flooding. Complementary, 13 simulation exercises on flood defenses were held in 108 settlements in Q2/2017. 22 roundtables/ seminars were organized at regional and local level, to put forward flood risk solutions and to exchange information on best practices for flood risk management. An important contribution to tackling climate change and improving the state of the Romanian infrastructure is also provided by sub-measure 7.2 of the 2014-2020 NRDP for projects concerning road and water/wastewater infrastructure projects. EAFRD 2014-2020 finances investment projects to modernize secondary irrigation infrastructure, buildings associated to the pumping stations and/ or connection to utilities, including modernization of collecting and storage tanks of irrigation water165. The public non-reimbursable support is 100% of the total eligible expenditure and may not exceed 1 million Euro per project for irrigation systems for pressure pumping stations and access roads and 1.5 million Euro for irrigation systems related to pumping and re-pumping stations, as well as forest roads. At the same time, the investment projects for the development of the main irrigation infrastructure are supported through the national budget, within the National Programme for Rehabilitation of the Main Irrigation Infrastructure in Romania.

IV. CONCLUSIONS

Worldwide, countries face the multifaceted challenge of restoring and preserving aquatic ecosystems in accordance with one of the UN Sustainable Development Goals (SDG 6). Over the last few decades, governance approaches have often been used to realise these ambitions. So far, scholars have identified that it is difficult to relate governance approaches to water quality improvement and have offered several different explanations for this. As ecological, legal and social-economic scholars may hold different perspectives regarding the effectiveness of a governance approach, we have analysed these perspectives, how they interact and how these interactions affect water quality governance. To this end we built a conceptual framework to explain these interactions and carried out a systematic literature review to identify the current level of understanding of these interactions and identify any possible gaps.

Ecological, legal and social-economic perspectives on the effectiveness of water quality governance have both similarities and differences. Potentially conflicting characteristics are: the difficulty of setting objectives (many unknowns) and adequate measures from the ecological perspective, the limited adaptive capacity of the legal framework once set in place and the focus on decision-making processes rather than water quality improvement from the social-economic perspective. All three perspectives are relevant to the governance approach to water quality improvement and have to interact.

The presented analysis of the current state of development and of the recent evolution of the Romanian water sector has support the debate on the practical implementation of the theoretical issues that has been debated. The practical analysis has been based on the public data and analysis availble at the Mistry of Environment and it shows that to ensure the availability and sustainable management of water and sanitation for all citizens there are needed a lot of investments in the infrastructure of the water sector in Romania.

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The Efficiency of the Irrigation Systems Investment

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The scope of the paper is to analyze the efficiency of investment in irrigation project. Specific themes analyzed are related to the study of irrigation investments and the efficiency of their settlement. Another nowadays problem is linked by major climate change that affect agriculture sector efficiency in general. Finally, the paper aims recommendation and solutions for financial and project management and for increase public administration efficiency facing worldwide major problems regarding scarcity and resources.

Keywords: Financial Management, Project Management, Efficiency, CPM Method, PERT Method, Climate Change, Irrigation.

I. INTRODUCTION

The management concept, as process, function and interest, is related to activities of leading, controlling, organizing, training, assessment, administration and foresight a business [3], like in Figure 1.

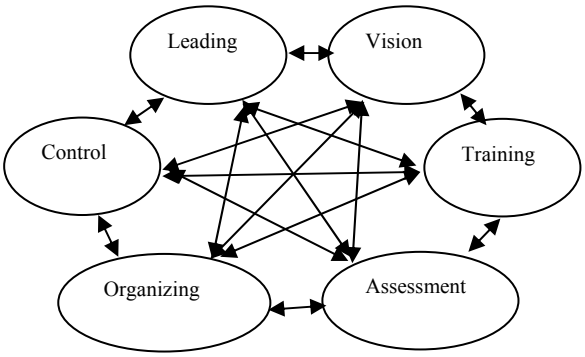

Fig. 1. Management concept
Source: by author using [3]

Project management activity concerns public or corporate finance management, as part of business management from public and corporate management (Figure 2), in order to increase competitive advantage in the market.
Corporate Finance Management is related to the decisions company takes in investing and financing operational activity both in public and private markets as Financial Management drives the activity of a private or public company to their financial and operational goals using accounting and financial data.
An investment is a financial and accounting process, through company follows to obtain probably profit (interest) or future cash-flow. In investment process three issues are considered:

1. The decision to invest,
2. Ąe selection of the investment projects,
3. The settlement of indebt firm policy and company productivity.

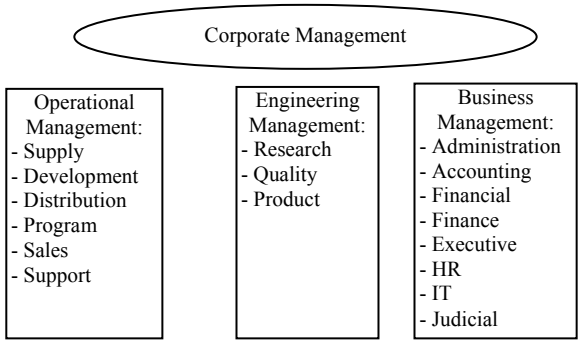

Fig. 2. Corporate Management System
Source: by author using [1]

The decision to invest is the most important financial decision a Chief Financial Officer (CFO) and manager must take, because of the amount of many implicated, the period and the high level of risk.
In the frame of environmental resources management, the water is considered not just a commercial product, but a heritage people must protect for the future of mankind.
The investment in water management system may be represented by [8]:
a) Equipment for water caption: plugs with pumping and/or gravitational, pipes, forage pits, aspiration and suppressing basins, defense and consolidation of (water) banks, works for conducting the water currents, with the assembly of the proper equipment;

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b) Equipment for water adduction and distribution: pipes, canals, hydrotechnical nods, dams, constructions of passage and under-passage, pumping stations, aspiration and suppressing basins, consolidations, stuffs, with the assembly of the proper installations;
c) Equipment for internal settlement: canals and underground pipes, which are feeding with water the irrigation installations and as it is the case, the assembly of the mobile pumping aggregates and of the proper installations, works of land levelling;
d) The assembly and fixing of the irrigation installations and of the pumping mobile aggregates;
e) Equipment for the water evacuation in case of damages: canals, pipes, evacuators, dams, with the proper installations;
f) Manufacture of irrigation equipment and installations.
The motivations of decision to invest in such irrigation equipment are related to the following reasons:

- For to rise and enhance the quality and quantity of the crop (agriculture production) according to present challenges (the overgrowing population and health risk and food security);
- For to grow up production capacity in order to satisfy the agriculture products and services demand;
- For to keep or develop the advantages comparing with the competitors;
- For to maintain or increase the market share of the company;
- For to explore and use the advantages of the new technologies;
- For to save the more and more scarce water resource;
- For to ameliorate the use of the land production factor;
- For to be prepared in case of emergency or natural disasters in the existing environment challenges (climate change, global warming, precipitation and temperature modification, water security alert and health risk, droughts conditions, environmental and soil degradation, wastage in using the clean water, increasing poor rainfall, depletion of ground water resources, greenhouse gas) and to reduce the loss.

The right decision supposes

1. To run certain steps of work (activity): to determine the cost of the investment, to find the financial sources, to foresee cash-flow, to determine the total cost of the investment, to compare the total cost with the estimated cash-flow;
2. To establish the methods used in project selection: with considering present value (net present worth method) or without considering present value (the time the investment is recovered). The method used take into consideration the liquidity, the time and the risk;
3. To evaluate the risk of the investment (Table 1) depending by the investment scope being well known that a high risk of a project supposes high level of the profit and reverse.

Table 1. Risk evaluation table

Scope	Product/Market	Risk degree
Crop rising	Same/same	low
Distribution enlargement	Same/same	Low
Production diversification	New/same	low
Crop rising	New/same	Medium
Crop rising	New/new	medium
Production diversification	New/new	high
New technologies	New/new	high

For a successful project, the project managers create a risk control list giving marks for every type of factors [6].

II. METHODOLOGY

The methodology used in project management is from network analysis. The method in network analysis are focused on computing and optimizing the critical path between the activities [4]. The basic network analysis methods include Critical Path Method (CPM), Critical Chain Method (CCM), Program Evaluation and Review Technique (PERT), Graphical Evaluation and Review Technique (GERT), Metra Potential Method (MPM) [5]. CPM and PERT Methods will be aplied to solve the irrigation project management proposed in this paper.

III. IRRIGATION PROJECT DESIGNING USING PERT AND CPM METHOD

The project represents a sequence of certain activities (that can be thousand as number), well determined on time, with the purpose to create a new product or technology. The difficulty of the project implementation depends also on the number of activities. The present paper is referring to a project of implementing a new irrigation equipment and technology.
The first step is to describe the project crystal clear for people implicated in the project: the list of all activities and time required, the sequences of the activities and the dependencies between them, the model of the network (the network between the activities.
If the project is at first time, it is recommended to use Program Evaluation and Review Technique Method (PERT Method), with periodically actualization of the project. In the case the time for the activities of the

project can be expressed more preciously it is recommended to use Critical Path Method (CPM).
In the frame of this paper we call "work" the process of implementation or manufacturing activities targeted towards execution and setting the irrigation investment. The work has more activities. An activity represents the sum of rather homogeneous operations, which participate to the achievement of a part of the work. The model is the network diagram formed by arches (represented by the activities) and nodes (represented by the start-end events).
The program represents the sequence of activities executions, so that the whole work finishes in planned terms, without surpassing the resources allocated. Every activity is formed by a set of events and the event means the stage an activity can be at a certain moment. Any activity is between two events: starting and ending ones [10]. If the investment's work (W) has n activities then (1):

$$A=(a_1, a_2, \ldots, a_i);\ i=1\ldots n \qquad (1)$$

Where A is the set of activities,
a_i - the activity number i
PERT Method supposes to create the draft of the network activity, to estimate (optimistic, realistic and pessimistic) the time of each activity, to compute time statistics (using beta distribution, equation 2), to determine the critical path, and to analyze the probabilities.

$$\bar{d}_n = \frac{a+4b+c}{6} \qquad (2)$$

Where $\bar{d}_n$ is the investment shared average period of time
a – optimistic time,
b – realistic time,
c - pessimistic time.
The main difference between CPM and PERT Methods consists in the evaluation of the duration for executing certain activity: In CPM the period of time is evaluated in a certain number of days, but in PERT Method the period of time is appreciated in three situations: optimistic (the shortest, "a"), pessimistic (the longest, "c") and probable ("b"). The average value is calculated with relation 2.
The dispersion is computed with equation 3 and the average squared deviation with equation 4 [2]:

$$\sqrt{\sigma^2} = \frac{c-a}{6} \qquad (3)$$

$$z = \frac{d_p - \bar{d}_n}{\sigma^2} \qquad (4)$$

Where $\sqrt{\sigma^2}$ represents Average Squared Deviation,
σ^2 - represents Dispersion,
z – represents probability factor,
d_p – represents planned duration of investment.
Furthermore, it is necessary to introduce a succession relation between all activities.
In irrigation investment project, we suppose that there are identified 7 activities, from a_1 to a_7 (Table 2).

Table 2. Investment activities and execution time

Activity symbol (a)	Start-end of a	Name of a	Time for a (in days)	Symbol of previous activity
a_1	1,2	Project execution draft	18	-
a_2	2,3	Work space organization	3	a_1
a_3	3,5	Equipment 1 acquisition	36	a_2
a_4	2,4	Equipment 2 acquisition	3	a_1
a_5	4,5	Equipment 3 acquisition	30	a_4
a_6	5,7	Equipment assembling	6	a_3
a_7	2,6	Prepare for manufacturing	36	a_1

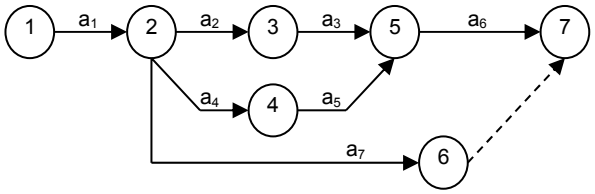

Fig. 3. Work graph for irrigation investment

The graph of investment activities and events (networks system of oriented arches, bordered by nodes) is illustrated in Figure 3.
Looking Figure 3, we can notice that there are more paths from event 1 to event 7: P_{12357}, P_{12457} and P_{1267} (so called full paths), the longest full path is called critic path:

P_{12357}=18+3+36+6=63 days (5)
P_{12457}=18+3+30+6=57 days (6)
P_{1267}=18+36+0=54 days (7)
P_{cr} =max (P_{12357}, P_{12457}, P_{1267})= P_{12357}=63 days (8)

The longest path is called critical. In our example, P_{12357} is the critical path (P_{cr}) because it has the longest length (equations 5, 6, 7). Thus, the uncritical path has time reserves (represents the difference between maximum terms till activity execution is accepted and possible minimum terms). There are four moments: the earliest time to start the activity (t_i), the earliest time to finish the activity (T_i), the latest time to start the activity (t_j), and the latest time to finish the activity (T_j).
The minimum and maximum terms are established using optimality principle (relations 9 and 10).

$$t_i = maxP_{1i} \text{ and } t_j = maxP_{1j} \qquad (9)$$

$$T_i = P_{cr} - maxP_{in} \text{ and } T_j = P_{cr} - maxP_{jn} \qquad (10)$$

Where n represents the final event of the work

Using minimum and maximum term of the events we may calculate time reserve for each activity. Thus, we obtain:

$t_1 = 0;$

$t_2 = maxP_{12} = P_{12} = 18$ *days;*

$t_3 = maxP_{13} = P_{123} = 18+3 = 21$ *days;*

$t_4 = maxP_{14} = P_{124} = 18+3 = 21$ *days*

$t_5 = maxP_{15} = max(P_{1235}; P_{1245}) = max(18+3+36; 18+3+30) = max(57;51) = 57$ *days*

$t_6 = maxP_{16} = P_{126} = 18+36 = 54$ *days*

$t_7 = maxP_{17} = max(P_{12357}, P_{12457}, P_{1267}) = max(18+3+36+6, 18+3+30+6, 18+36) = max(63, 57, 54) = 63$ *days*

$T_7 = P_{cr}-0=63$ *days*

$T_6 = P_{cr}-P_{67} = 63-0 = 63$ *days*

$T_5 = P_{cr}-P_{57} = 63-6 = 57$ *days*

$T_4 = P_{cr}-P_{47} = T_5-P_{45} = 57-30 = 27$ *days*

$T_3 = P_{cr}-P_{37} = T_5-P_{35} = 57-36 = 21$ *days*

$T_2 = min(T_3-P_{23}; T_4-P_{24}; T_6-P_{26}) = min(31-3; 27-3; 63-36) = min(18; 24; 27) = 18$ *days*

$T_1 = T_2-P_{12} = 18-18 = 0$ *days*

If planned term of investment execution is 36 days, the probability factor is 0.127 (using relation 4).
Using Laplace function and interpolation methods it is obtained the probability of 54.09% that indicate a proper programming (under 25% it means very short term and above 60% indicates many time reserves, so it will be redacted), see Table 3.

Table 3. Average Squared Deviation and Dispersion

a_i	Activity duration				$\sqrt{\sigma^2}$	σ^2
	a	b	c	$\bar{d}_n$		
1	2	3	4	5	6	7
a_1	16	17.5	22	18	1	1
a_2	2	3	4	3	0.33	0.11
a_3	30	36	42	36	2	4
a_4	2	3	4	3	0.33	0.11
a_5	25	29	39	30	2.33	5.43
a_6	4	6	8	6	0.67	0.45
a_7	30	36	42	36	2	4
Total.	52	62.5	76	63	4	16

After program is finished in its optimum variant, Gantt graph will be elaborated.
A very important facility of this method is that prolonging execution dates of some activities, in the framework of time reserves, it is possible to obtain cost reduction linked by the work deployment [1]. Therefore, this model is known in scientific literature as cost-time function optimization (Figure 4). In some condition, the investment execution period can be shorted, but this supposes cost increase (urgency cost). But also, an exaggerated prolonging can produce certainly cost increases.
After the convenient variant is chosen, and after all terms was established, we go to the investment launching process, re-drawing Gantt graphic depending by chosen variant, needed resources and mean for achieve any activity in established terms, passing, step by step Gantt graphic.
Any modification in the system leads to the program re-optimization.

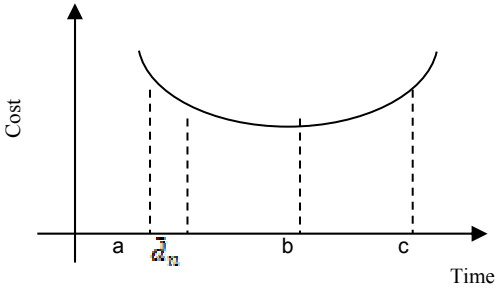

Fig. 4. Cost-time evolution

IV. CONCLUSIONS

In planning and designing irrigation investment project in good conditions, we use Critical Path Methods. First, we ordered different sequential activities so that the results to correspond with the main target of the project, from terms and resources allocation points of view [10]. The designing process supplies data about economic and technical optimum and the planning process bunches economic and technical optimum with social optimum. In conclusion both methods of network analysis have been successfully applied in the paper. For a successful economy it must be created successful new projects or to develop the existent project properly.

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Irrigation Investment and Agricultural Efficiency

Mihaela VARTOLOMEI[1]

Abstract – The main scope of the paper is to make an empirical analysis regarding the relationship between irrigation and efficiency in agriculture sector, the use of water in irrigation and the share of agriculture sector in GDP related to European and world environmental policies, in the frame of water resource management and climate change conditions. We concluded there is a shy relationship between irrigation and agriculture crop. Furthermore, irrigation has no significant effects on GDP. The study is based on data collection using EUROSTAT and Romanian databases. We conclude that water management reform is necessary.

Keywords: Climate Change, Economic Efficiency, Irrigation System

I. INTRODUCTION

The objective of the paper is to analyze the sustainability of irrigated agriculture in European countries in the context of post-Agenda 2000 Common Agricultural Policy Reform and of Water Framework Directive and the responses of agricultural irrigated systems to environmental policies [3].

Table 1. Indicators for sustainable agriculture

Domain	Indicator
Economic balance	Farm income
	Farm contribution to GDP,
	Public support
Social impact	Farm employment
	Seasonality
Landscape and biodiversity	Genetic diversity
	Soil cover
Water use	Irrigation technology
	Water use
	Marginal value of water
Nutrients and pollutants	Nitrogen balance
	Pesticide risk
	Energy balance

Source: adapted from Europe 2020 strategy [5]

OECD [6] has proposed a set of indicators to check the sustainability of agricultural practices, from which we may mention the following indicators (Table 1):

- Economic balance: Farm income, Farm contribution to GDP, Public support.
- Social impact: Farm employment, Seasonality.
- Landscape and biodiversity: Genetic diversity, Soil cover.
- Water use: Irrigation technology, Water use, Marginal value of water.
- Nutrients and pollutants: Nitrogen balance, Pesticide risk, Energy balance.

Theoretically, economic efficiency level is represented by the point where marginal cost equals marginal benefits. However, but irrigation water pricing may include transfer of water rights (technical efficiency), may exclude water rights (allocative/economic efficiency based on opportunity cost of water), or may include environment cost (ecological/environmental efficiency and sustainability).

In order to measure the economic activity in the agricultural sector there were identified a lot of indicators such as: Gross Domestic Product (GDP per capita, GDP at market prices), agriculture production value (gross value added of the agricultural industry), agricultural land (total agriculture area), number of holdings, utilized agricultural area (UAA), arable crops (crop output, cereal crops), irrigation indicators (share of irrigable and irrigated areas in the utilized agricultural area), number of farms, productivity of production factors and resources (energy consumption by agriculture, water resource productivity, agriculture labor productivity), international trade activity (food trade turnover – retail trade turnover, extra-EU food trade – share of foods in imports), agriculture-environment relationship (gross-nutrient balance, pesticides sales, consumption of inorganic fertilizers, air pollutant, estimated soil erosion by water, greenhouse gas emission by agriculture sector).

The main scope of the paper is to make an empirical analysis regarding the relationship between irrigation and efficiency in agriculture sector, the use of water in

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irrigation and the share of agriculture sector in GDP related to European and world environmental policies, in the frame of water resource management and climate change conditions. Also, irrigation has a major role in food security, water save and agriculture sector independence in the context of quickly rise in population, climatic changes, and agriculture sector activities. In this area research, literature is poor.

II. METHODOLOGY

The findings and data are very poor from main European and world database Eurostat. From this reason, paper's methodology is classic one, based on comparative analysis between European countries and consists in analyzing economic activity, comparisons (between European countries) and synthesis of available information.

III. PLEA FOR IRRIGATED AGRICULTURE

The water used in agriculture can come from natural rain or from irrigation systems. The climate change challenges (irregular rainfalls, dry times or drought, global warming, etc.) can produce huge damages to the farmers` crop with grate implication over the market price of the foods. Irrigation represents the artificial use of water in agriculture field, through many and different systems of tubes, pumps, and sprays. The basic methods of irrigation system (Figure 1) are: surface irrigation (using gravity and no mechanical pump), sprinkler irrigation (using high-pressure sprinklers or guns from fixed or moving platforms) and drip irrigation (deliver the drop of water near the root of the plant). But also, it can exist localized irrigation, center pivot irrigation, lateral move irrigation, sub-irrigation, and manual irrigation.

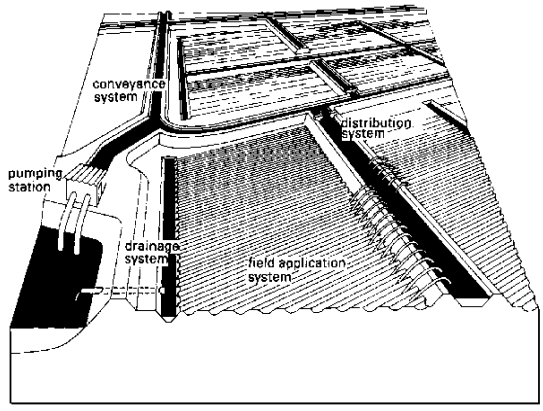

Fig. 1. Irrigation system [2]

Specific reports and studies from around the year 2000, mention that irrigated agriculture obtained a third of world's total food supply, and about 40% from world cereals production come from irrigated agriculture [7] and it was used in 18% of arable area of the planet increasing slowly at 20% in this moment (from the 1.5 billion hectares of arable land almost 300 million hectares are irrigated). USA, India and China hold together a half of total irrigated land in the world. Furthermore, irrigation and irrigated lands contribute in 30% to the people employment. It is noticed that the grow rate of irrigation settlements fell from 3% in `80s to 0.6 in 2010.

According to specialist`s work in order to produce a single kilo of wheat, it is necessary to use from 400 to 2,000 liters of water from the sowing till crop, depending on the dryness of the land.

The decision to invest and use irrigation equipment could take into consideration some aspects such as: the type of the crop, the water resource necessity and accessibility (from surface water through the rivers, lakes, reservoirs, channel, basin; from groundwater through springs or wells; or from other sources such as treated wastewater or desalinated water, etc.), the type of the soil, the energy source (motor pump, power generator, etc.), and financial implications (for initial investment and for maintenance).

The difference between profit and loss in irrigation practice is made by a proper timetable for irrigation and the economic use of water (regarding the consume of the two resources: water and energy).

IV. EU COUNTRIES COMPARATIVE ANALYSIS

In Romania, the development of big irrigation infrastructure (375 big systems of irrigation) started to the end of the year 1945, increasing a lot in the period 1970–1989, when it was built big irrigation system by pumping in crop of maize, wheat, and sunflower and of sugar beet, as well as vegetables and rice. In this period, it was endowed with irrigation systems a total area of almost 3.1 million hectares, meaning 20% of the used agricultural area (UAA) existing on national plan. The most of irrigation systems (2.7 million ha) had equipment of watering with manual movement, by aspersion [4].

Table 2. Share of irrigable areas in UAA by regions

GEO/TIME	2005	2007	2010	2013
Romania	5.8	4.5	3.1	1.8
North-West	0.1	0.0	0.0	0.0
Centre	0.1	0.0	0.1	0.0
North-East	2.5	2.4	0.3	0.2
South-East	16.6	12.8	12.6	8.1
South - Muntenia	8.7	7.6	3.8	1.7
Bucharest - Ilfov	13.2	5.3	0.4	0.7
South-West Oltenia	9.1	6.2	2.6	0.8
West	0.5	0.1	0.2	0.2

Source: Eurostat

The data available from Eurostat for the period 2005 and 2013 about irrigable and irrigated area are presented in Table 2 and 3, for the regions of Romania (NUTS 2 regions) regarding the share of irrigation (irrigable areas equipped for irrigation) and

irrigated areas (the land irrigated) in utilized agriculture area (UAA) expressed in percentage of total UAA (almost 14,000,000 ha according to available data 2003-2007). Romanian irrigation infrastructure right now corresponds to 700,000 hectares, but even half of it is not irrigated because of very high utility cost. World Bank report shows Romania can repair irrigation infrastructure for 800,000 hectares, but specialists advise small farmers to use small irrigation equipment because they are more efficient.

Table 3. Shares of irrigated areas in UAA by regions

GEO/TIME	2005	2007	2010	2013
Romania	0.6	1.3	1.0	1.2
North-West	0.0	0.0	0.0	0.0
Centre	0.0	0.0	0.1	0.0
North-East	0.1	1.5	0.1	0.1
South-East	2.0	4.0	4.3	5.8
South - Muntenia	1.0	1.8	1.2	1.0
Bucharest - Ilfov	1.2	0.2	0.2	0.2
South-West Oltenia	0.7	0.9	0.4	0.3
West	0.3	0.0	0.1	0.1

Source: Eurostat

Table 4. Share of irrigable areas in UAA for EU

GEO/TIME	2005	2007	2010	2013
Belgium	1.6	1.7	1.0	1.5
Bulgaria	4.1	3.4	3.1	2.5
Czechia	1.3	1.1	0.9	1.0
Denmark	16.6	16.4	18.2	16.8
Germany	:	:	3.8	4.1
Greece	40.0	38.2	25.1	31.2
Spain	15.1	14.7	15.1	29.0
France	9.8	9.7	8.4	10.1
Croatia	:	2.8	1.7	1.6
Italy	31.3	31.0	29.1	33.1
Cyprus	30.3	31.4	34.0	34.8
Hungary	3.6	3.3	5.0	5.6
Malta	29.5	31.0	27.5	38.6
Netherlands	20.8	23.9	26.0	27.0
Austria	3.7	3.6	3.2	4.4
Poland	0.8	0.7	0.6	0.5
Portugal	16.8	16.8	14.7	15.2
Romania	5.8	4.5	3.1	1.8
Slovenia	0.9	0.8	1.1	0.9
Slovakia	9.6	9.5	5.7	5.2
Finland	3.1	3.3	3.0	4.5
Sweden	5.2	5.1	5.4	5.1
United Kingdom	1.3	0.9	0.6	0.7

Source: Eurostat

It is noticed that for Romania the irrigation decreased constantly, and the irrigated area increased a little (Table 4 and 5). Bulgaria is a similarly case but with a little slow decreasing of irrigation area and the general trend is the same with few exceptions (Malta, Italy, Spain, and Austria).

Table 5. Shares of irrigated areas in UAA for EU

GEO/TIME	2005	2007	2010	2013
Belgium	0.2	0.4	0.3	0.4
Bulgaria	2.0	2.4	2.0	2.1
Czechia	0.5	0.6	0.6	0.5
Denmark	9.7	9.5	12.1	9.2
Germany	:	:	2.2	2.2
Greece	32.9	31.4	19.8	24.0
Spain	13.5	13.1	12.8	:
France	6.1	5.5	5.7	5.1
Croatia	:	0.9	1.1	0.9
Italy	20.6	20.9	18.7	23.7
Cyprus	22.0	21.4	23.9	22.6
Hungary	1.8	2.1	2.4	3.0
Malta	24.0	27.2	24.7	33.6
Netherlands	4.8	10.6	7.3	5.5
Austria	1.2	1.4	0.9	1.9
Poland	0.5	0.5	0.3	0.3
Portugal	12.3	12.1	12.7	13.1
Romania	0.6	1.3	1.0	1.2
Slovenia	0.5	0.3	0.3	0.5
Slovakia	2.4	2.0	0.8	1.3
Finland	0.0	0.0	0.6	0.4
Sweden	1.5	1.7	2.1	1.7
United Kingdom	1.3	0.9	0.4	0.3

Source: Eurostat

In 2005-2013 the share of arable land in UAA for Romania (the ninth country by total area in EU-28) was almost 63% (the fourteenth country by arable land in EU-28), according to Eurostat, as the same figures (between 50% - 70%) with Austria (50%), Netherlands (57%), Latvia (64%), Italy (56%), Croatia (56%), France (67%), Estonia (66%), Belgium (62%). Countries with low values (between 20% - 50%) are: United Kingdom (37%), Slovenia (36%), Portugal (30%), Luxemburg (45%), Spain (48%), Greece (38%), Ireland (21%). Countries with high values (over 70%) are: Sweden (84%), Finland (99%), Poland (75%), Malta (80%), Hungary (81%), Lithuania (79%), Cyprus (73%), Germany (71%), Denmark (92%), Czechia (72%), Bulgaria (71%).
Cereal crop (including seeds) in Romania in 2013 (the final year the irrigation data are available) was 3,316 million euro (at basic price), on the seventh place in EU-27, after Germany (7,128 million euro), Spain (3,607 million euro), France (11,253 million euro),

Italy (4,233 million euro), Poland (3,545 million euro), United Kingdom (4,092 million euro).
Cereal crop (including seeds) in Romania in 2015 was 3,316 million euro (at basic price) with the main contribution of Macro-region II (North-West and South-East), staying on the same seventh place in EU-27, after Germany (7,400 million euro), Spain (3,607 million euro), France (10,766 million euro), Italy (3,995 million euro), Poland (3,546 million euro), United Kingdom (4,094 million euro). But in 2017 Romania jumped on the third place in EU-28 with a cereal crop by 4,203 million euro after France (9,676 million euro) and Germany (6,322 million euro).
A good indicator for this analysis is water use by agriculture (in million cubic meters), but unfortunately the Eurostat available data are shy (data for Romania include 2012 till 2015). According to these data, Romanian water consumption was 3.1 in 2012, 1.4 in 2013, 5.6 in 2014 and 1.6 in 2015. Data for Germany, France (first and second places in cereal crop), Italy, and Poland are not available. But Spain data released 34 in 2012, 23 in 2013, and 25 in 2014. United Kingdom only reported 120 water use in 2011. According to water productivity (how much economic output is produced per cubic meter of fresh water abstracted from any fresh water including mine water, drainage water [2], and precipitation, expressed in euro/cubic meter), Romania figures float around 20 value between 2005 and 2015, comparing with Germany (around 80 in 2007 and 2010), France (60-70), Spain (around 30), Poland (around 30) and Great Britain (between 175 and 275 value between 2005-2015 years), and Italy (no reported data). The best results of water productivity Luxembourg (1017 in 2015). Thus, we ca not conclude something about the relationship between water consuming, irrigation and cereal crop.
Regarding the total energy used in agriculture for all energy uses (expressed in KgOE, called kg of oil equivalent per capita), the figures from Eurostat show that in 2005 Romanian energy consumption for agriculture had the lowest level from EU (15) comparing with the highest level of energy consumption by Netherland (2016). France energy used was around 130 along the considered years (2005-2015), Italy around 200, Spain 100 and UK around 50. Germany has no reported data. In 2016 energy used in Romanian agriculture was 33.54 (the lowest from EU-28).
Finally, the paper concentrated over economy output, represented by the gross domestic product (GDP), expressed in euro per capita, for the considered years (2005, 2007, 2010, 2013), and the figures show Romania has the lowest level of GDP per capita (5,100) after Bulgaria (4,200) in 2005, competing just only with Bulgaria for all considered years (2007, 2010, 2013). The higher level is 76,500 in 2005 hold by Luxemburg, followed by Denmark, Ireland, Netherlands around 40,000; then Germany, France, Belgium, Italy, Austria, Finland, Sweden and UK around 30,000 euro per capita, and the EU-28 average being 24,800 euro per capita.
Nevertheless, the share of agriculture in GDP represents a small part in all EU-28 countries, under 4.5%, the greater level by Denmark in 2015 (Romania case being 4.2%), and less than 2.6% get by Spain in 2017. In Romania the share of agriculture in GDP was 3.9%. Romanian agriculture crop output at basic prices – the price received by the producer after deduction all taxes – (expressed in million euro) registered in 2013 the value of 12,185 million euro, on the sixth place in EU-28, after France (41,284), Italy (31,652), Germany (28,509), Spain (25,896), and Netherlands (13,489). The figures are almost the same for 2017 year.

V. RESULTS AND CONCLUSION

In conclusion, even if Romanian agriculture is not based on irrigation (table 1, 2, 3, 4) comparing with EU-28 countries, the agriculture crop is high, but the productivity is less. Furthermore, the relationship between GDP and irrigated agriculture is not so relevant, due to the small share of agriculture sector in GDP. We conclude that even if the empirical results are week, it is necessary to continue with water management reform [1] and European environmental policy. The responses of agricultural irrigated systems to horizontal policies are significantly different. The different results depend on economic context, environmental fragility they must face, water demand, socio-environmental performances, regional culture and environmental habit and education.

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Possibility of Using Sewage Sludge in Agriculture

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Abstract – The use of sewage sludge through its use in agriculture is considered to be a good practical option for the environment, being promoted and encouraged by the European and national legislation in force.
The use of sewage sludge in agriculture has created some concerns about their possible harmful effect. Studies have shown that these fears are unjustified. Although the results obtained so far are more than encouraging, the actual interest in using sludge in agriculture is still quite low. The involvement of public administration in this process could favor this activity.

Keywords: Sewage, Sludge, Agriculture, Administration

I. INTRODUCTION

The use of sludge from sewage sludge in agriculture is one way of capitalizing on their content of organic matter and nutrients [1, 3, 4]. Sewage sludge can be used in agriculture for: sustainable development of the environment benefiting both the sludge producer and the farmer [2, 7, 8].
Sewage sludge, a common by-product of the municipal wastewater treatments, contains macronutrients and micronutrients essential for plant growth and is a potentially valuable source of organic matter for most agricultural soils. The application of sewage sludge to agricultural land is of importance about metropolitan areas, where soils have been intensively cultivated for centuries and have typically low fertility and organic matter content. Although several studies on reuse of municipal sewage sludge in agriculture have been reported, the adoption of a plan for applying organic amendments to agricultural soils requires information regarding the effect of such amendments on any crop or environment. However, in the literature is a large debate on European regulations concerning the management of sewage sludge. Thus, it is becoming an issue of growing importance. In all countries of the European Union, directives are introduced based on which each member state has to create relevant. According to European regulations management methods involving storage are now being replaced by methods leading to waste stabilization and safe recycling. legislation, programs and developmental strategies. Their aim is, amongst other things, to promote pro-ecological management of sewage sludge. Management methods involving storage are now being replaced by methods leading to its stabilization and safe recycling. These methods may consequently lead to the recovery of valuable raw materials from potentially dangerous materials, processing them in order to enable their use in agriculture, various branches of industry or heat and energy recovery [1, 2, 3, 4, 7, 8]. At each stage of sewage sludge processing, its characteristics change.
During the disinfection process, the microflora of sludge is changed; the methane fermentation process leads to a decrease in overall carbon content, while thermal processing, depending on the temperature, may result in densification of sludge or even transformation of all organic matter into inorganic compounds. Therefore, many various kinds of processed sewage sludge are generated and each of them have a different chemical composition. They may also vary in the physical properties, consistency or even parameters such as toxicity or stability of pollutants. All those factors may decide whether the material will be classified as safe or unsafe. Determined values of parameters, mentioned above, may influence on changes in processing technology in order to develop other methods of management.
Therefore, it is important that at every stage of processing of this type of waste, the resulting material should be subjected to a comprehensive chemical analysis. Due to their diversity, other methods and analytical techniques will be useful in each case. Therefore, the choice of a suitable analytical method depends on the planned method of sewage sludge management, which to some extent determines the technology used for processing them.

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The purpose of this study was to investigate and debate the use of sewage sludge through its use in agriculture. The main topics that are discusses are related to the following statements:

- The use of sewage sludge in agriculture has created some concerns about their possible harmful effect. Studies have shown that these fears are unjustified.
- Although the results obtained so far are more than encouraging, the actual interest in using sludge in agriculture is still quite low. The involvement of public administration in this process could favor this activity.

II. MATERIALS AND METHODS

From a technological point of view sludge is considered as the final stage of water purification, which includes products of metabolic activity and / or raw materials, intermediate products and finished products of industrial activity [9, 17].

The amount of sludge generated by the treatment plants currently depends on: the population connected to the sewage system; the input of industrial waters collected through the sewerage system; technology applied to the treatment of wastewater (primary or secondary treatment) and the yields obtained in operation; Accurate quantification of the amount of sludge produced is difficult because one part is lost in sewer networks or transport operations. The main options for sewage sludge recovery are as follows: use in agriculture; composting; anaerobic fermentation; incineration [5, 6].

The condition of promoting sludge as a fertilizer in agriculture is that the soil is not adversely affected by its components. Often due to the content of heavy metals, nitrogen compounds, etc. no sludge recovery in agriculture is made. The sludge can be used in agriculture only if the legal provisions of the Joint Order of the Ministry of Environment and Waters and the Ministry of Agriculture no. 344/2004 for the approval of technical norms regarding the protection of the environment and especially the soil when the sludge is used in agriculture [11].

According to this order, for sewage sludge to be used in agriculture, the maximum admissible values for: heavy metal concentrations in sludge soils, heavy metal sludge concentrations, the maximum annual quantities of heavy metals that can be introduced into agricultural land [12, 13, 14].

The limits allowed for sludge to be used in agriculture are shown in the Table 1.

From a technological point of view sludge is considered as the final stage of water purification, which includes products of metabolic activity and / or raw materials, intermediate products and finished products of industrial activity [15, 16].

Table 1. Allowed limits for sludge to be used in agriculture

Elements	Limit	Unit
Pb	900	mg/kg DS
Cd	10	mg/kg DS
Cr	100	mg/kg DS
Cu	800	mg/kg DS
Ni	200	mg/kg DS
Hg	8	mg/kg DS
Zn	2500	mg/kg DS
PCB	0.2	ng/kg DS
PCDD	100	ng/kg DS

III. RESULTS AND DISCUSSIONS

Sewage sludge has 97% water content. By centrifugation or filtration, the water content can be reduced to 70 - 80%, for this reason the dehydration process is a prerequisite for economical transport and possible storage / disposal [18]. Reusability requirements in agriculture require a drying level of more than 90% to ensure that sludge is not fermentable and can be stored in silos until reuse [17].

Currently sludge from sewage treatment plants are most often removed / transported to existing waste landfills, so we cannot talk about a treatment / recovery, not even using it as a fertilizer in agriculture, except in a limited number of cases of exceptionally nature, such as except the sludge from the Sewage Treatment Plant - Sfantu Gheorghe, Galati or Arad.

The case study was conducted in Arad. The average daily quantity of sludge from Arad is 20 tons. If the sludge is not used for fertilization, the operator moves it to landfill or by incineration. After the conclusion of a collaboration agreement with the Water Company, Arad farmers can benefit from free sludge; Water Company is the one who transports and spreads sludge on farmland.

The experimental study was done in the experimental block:

(1) three experimental variants of inert slag and fly ash topsoil fertilized with slaughterhouse sludge type in quantity of 3.0, 6.0 and 9.0 t ha–1, variants referred to as: VA 1, VA 2, and VA 3, respectively;

(2) three experimental variants of inert slag and fly ash topsoil fertilized with sewage sludge type in quantity of 3.0, 6.0, and 9.0 t ha–1, variants referred to as: VS 1, VS 2, and VS 3, respectively.

The experiment was carried out in pots with 6.0 kg of soil. In the pots, 5 g per pot of seeds from the Lolium perenne plant species were planted. Each experimental variant was done in three replicates [10].

The use of biodegradable waste, sewage sludge and slaughterhouse sludge, led to the settling of a stable and healthy vegetation cover over a long period of time (2 successive years of culture with Lolium perenne species). The amount of harvested biomass increased by 35,6% in the 2nd year of culture compared to the amount harvested in the first year. To obtain a vegetative cover with a decisive role in the ecological

restoration/phytoremediation of the landscape destroyed by this ash and slag dumps and a maximum amount of seeds, a minimum amount of 3 t ha–1 of fertilization agent (slaughterhouse sludge or sewage sludge) was enough. Biomass and/ or harvested seeds for optimum ecological restoration/phytoremediation variant of slag and fly ash dump will be directed to different sectors after an assessment on metal accumulation in tissues, according to national regulations.

Being a good source of macro and micronutrients, sludge from sewage treatment can be used in agriculture as it reduces production costs and improves soil quality; It brings a nutrient and organic matter input to organic farming, while improving humanity's ability to survive.

IV. CONCLUSIONS

The use of sludge from sewage sludge in agriculture is one way of capitalizing on their content of organic matter and nutrients. Sewage sludge can be used in agriculture for: sustainable development of the environment benefiting both the sludge producer and the farmer; increasing crop yields; reducing the use of agricultural fertilizers; improving the physical and organic soil properties through the intake of nutrients, trace elements, organic compounds; water retention in soil; improving microbial activity in soil; rehabilitation of degraded lands by improving soil texture; low cost; simple technology.

The use of sewage sludge in agriculture has created some concerns about their possible harmful effect. Studies have shown that these fears are unjustified. Although the results obtained so far are more than encouraging, the actual interest in using sludge in agriculture is still quite low; An involvement of public administration in this process could favor this activity.

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