

Water Collection, Treatment and Supply as an Essential Service and Engine for Sustainable and Resilient Development in Post Pandemic Period. Economic Performance vs Social Responsibility

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Abstract: Communities are becoming active partners in economic development, and increasing the quality of life is the main expectation of locals. Water supply is essential for any activity, in the business environment or at the household level. In addition, the quality of the water supplied and the price can influence the health of the inhabitants. As an essential resource during the pandemic, water distribution was one of the facilitators for observing the restrictions and maintaining the conditions of hygiene and self-protection. Using quantitative and qualitative data on the availability and efficient use of local drinking water services, in our study we found that, as an essential service, the role of water distribution companies is to find a balance between supply and demand closing the gap of market deficit at the local level and to promote the increase of social profit but not only of monetary profitability. Based on the enterprise statistics, we highlighted the economic and financial performance of the Romanian companies compared to those from other EU-27 member countries, we identified the performance adjustment factors and we formulated some policy recommendations that would allow a sustainable and resilient development during post pandemic.

Keywords: water distribution services, social profit, economic profitability, digitalization, pandemic.

1. Introduction

The provision of drinking water to households and companies is a requirement of development and quality of life, it is incident with SDGs 6, 7, 11, 12, 13 and 15. The availability and access to water resources and the water quality are among the main challenges of modern society in which climate change and pollution require additional measures (technological, organizational and financial) to ensure safe water. According to The United States Geological Society safe water means “Water that will not harm you if you come in contact with it”. In 2010 UN underlined that every person “has the right to sufficient, continuous, safe, acceptable, physically accessible, and affordable water for personal and domestic use” and states that a „better management of water resources, can boost countries' economic growth and can contribute greatly to poverty reduction”. In this context, the responsibility of local communities is to support the provision of drinking water distribution services, quality water delivery for individual consumption and in the quantities necessary for the current consumption of households and for the business environment - companies, organizations, associations, actors of civil society etc.

This type of service is characterized by a specific profile of the business environment, because the social responsibility of the companies also targets the beneficiaries of the drinking water distribution services that serve them. Quality and affordability issues are connected with particular challenges of the industry development and performance, based on climate change and water pollution.

The purpose of this paper is to highlight the performance of companies operating in the water collection, treatment and supply (WCTS) sector in Romania, in the EU-27 spatial comparative analysis over the last decade, and to identify the positive and negative externalities of water management policy. Finally, we inventoried

possible directions for sustainable development and resilience of companies, taking into account the demographic challenges, economic performance and increasing demand for drinking water, and also the social responsibility of companies for water inclusion (network expansion and affordable prices). At the same time, we highlighted some aspects related to the digital transformation of the sector, as a factor to increase the company's performance, both from the perspective of business management and the improvement of communication with customers.

2. Literature review

The market for water distribution services is an emerging one, heavily dependent on demographic growth, increasing food needs and agriculture development and of the (higher) living standards of everyone. For economic agents, this means both capital and operating expenses for the capture, treatment and transportation of water by municipal, industrial, commercial, and residential users. In this context, the economic agents dealing with water distribution services will not only have a constantly growing market, but also the requirements for clean water, distribution in the requested quantities and with affordable prices will increase. The expansion of drinking water distribution networks in rural areas, in less developed countries, such as Romania, as well as the modernization of the distribution network will be the main challenges both for the public authorities and the business sector.

In our research, we started with a literature review based on the scientific papers published in the last decade in the Web of Science database using the VoxViewer program, focusing on market (supply and demand) and water efficiency.

A bibliometric analysis on the market of the water distribution sector, *Water supply - water demand*, indicates 1681 articles published in WoS, in the last decade, of which 16% in 2021. Therefore, the interest to ensure the needs of the market and reduce the gap between the demand and supply of water management services is a constant issue of the market operators, as well as identifying the push and pull factors for economic and financial efficiency.

In addition, water efficiency has been analysed in 877 papers of which 19% published just in the last year. Main correlated keywords and content topic analysed in those papers are presented in figure 1.

Regarding the sustainability of water distribution services, the analysis of the activity is not limited only to water management (model) - water sector efficiency - water sustainability, but also takes into account the resources in correlation with climate change and water scarcity, the entrepreneurial model associated with adaptive local governance, water quality and expansion of the water transport network.

Figure 1. The topic of water distribution market and business efficiency in the specialists' research works in the last decade, based on WoS database

Topic: WCTS market: water supply and Watter demand (5)



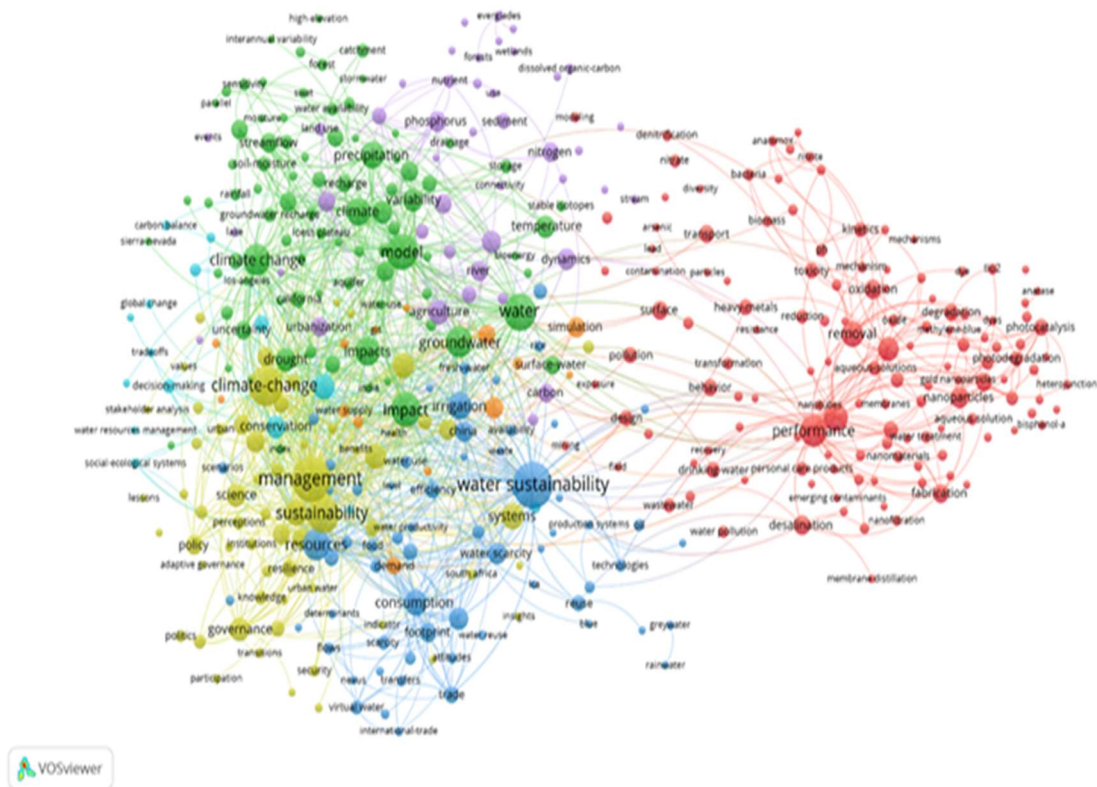
Topic: WCTS industry efficiency : water efficiency (5)



Source: Authors' contribution based on bibliometric analysis of the papers published in Web of Science database in the last decade, using VOSviewer; The WoS database was accessed on March 18, 2022

The total number of published papers in WoS identified in the last decade was 1184, of which 15% in 2021- see figure 2.

Figure 2. The topic of water distribution market and business efficiency in the concerns of specialists' research works from the last decade (5)



Source: Authors' contribution based on bibliometric analysis of the papers published in Web of Science database in the last decade, using VOSviewer; The WoS database was accessed on March 18, 2022

The reform of the entrepreneurial water management model, in the conditions of the increase of the supply deficit, of the increase of the exploitation cost and of the challenges of the COVID-19 crisis focused on two important aspects, namely: digitizing the relationship with customers and ensuring the quality of services - quantitative and qualitative, in order to respond to measures to counteract the spread of the virus.

Moreover, there has been increasing interest in water poverty analysis, of the multidimensional aspects related to households' access to water quality (Sullivan 2002, Sullivan et al, 2006; Subbaraman, 2015), for geographical distribution of water poverty as main factors for local planning development of the localities (Kini 2017; Wilk, 2013) and of inclusion measures for increasing water security, in the last two years over 35 WoS indexed articles analyzing such aspects. Water stress and scarcity have also become an issue associated with water availability and accessibility analysis, but also with development capacity, all of which have a significant impact on human development (Ladi et al 2021, Koirala 2020), of water sector planning as an integrated part of the strategic development profile at local level.

From a company perspective, water supply in the desired quantities, flow and quality requires both a high-performance technological infrastructure - the network of pipelines and treatment plants -, adequate green water treatment technology, as well as an expenditure budget and a level of unit cost of production designed to ensure a comfortable return that would allow financing the development of the business from its own resources. On the one hand, there is the cost of material and human resources and, on the other hand, the expansion of the specific market, targeting all categories of consumers, in urban and rural areas.

Even if Romania had a low level of water stress - 6% in the year 2018 (Sustainable Development Goal (SDG) 6.4.2) - comparing to the Europe and Northern America (7%), the share of the population with access to safety managed drinking water services (SDG 6.1.1.) in 2020 was much lower, of 82% against 96% for comparative region. According to UN Water 2021 report, the performances are higher for: a) water quality, with 84% as against 76% of monitored water bodies that has good ambient water quality, SDG 6.3.2.; and b) the degree of integrated water resources management implementation was little higher, 77% as against 72%, SDG 6.5.1. By the contrary, a lower economic performance was registered by Romania in 2018 at the efficiency measured as the value added from the use of water by people and economic agents, reaching only half of the regional level of 56 USD/m³, (SDG 6.4.1), (UN Water 2021).

The pandemic restrictions disrupted the technological value chain, „reducing face-to-face contact with customers, adjusting workflow to ensure social distancing” and „led to a sudden spatial and temporal shift in drinking water demand”. A qualitative research conducted by Spearing (et al, 2021) on the managers of drinking water management companies in the USA, highlighted the need to increase the resilience of the water sector to future challenges by planning to urgently solve existing problems - infrastructure modernization, employee reskilling, operational issues, funding deficit for water quality distribution, risk assessment, equity in water distribution etc. The future efficient management of water distribution involves a fair and smart use of water resources by monitoring water footprint (personal & product) and changing the model in which the water is used for different purposes.

3. Methodology and database

We conducted a statistical analysis of the main indicators that define the size and performance of the drinking water distribution sector at the level of EU member states and the comparative position of Romania. Finally, based on a qualitative assessment of the partial information available for the pandemic, we identified post-pandemic recommendations. The main limitation of the analysis is the availability of statistical data for 2020 (partially) and 2021, from Eurostat enterprise statistics, as well as the lack of detailed comparative data at micro level, for companies in the drinking water distribution sector in Romania, for the period analysed.

4. Results and comments

4.1. Business sector performance

The economic performance of the WCTS sector highlights significant differences at regional level, from different perspectives: a) in terms of supply - respectively available resources, business model and availability of financial resources of economic agents but also b) in terms of the demand, respectively of the structure of the consumers, according to the average level of consumption and their purchasing power.

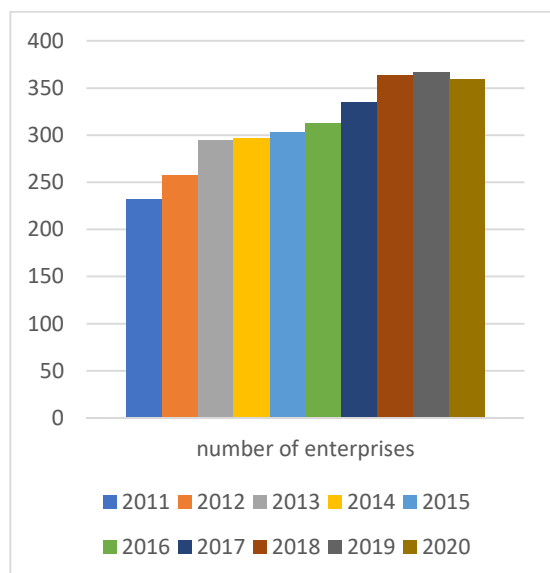
According to Eurostat database (2022), WCTS sector represents less than 1% of the total number of companies in the EU-27. In Romania, in 2020, 0.071% of total registered companies in the business sector were active in WCTS, respectively a number of 359 companies, increasing compared to 2011 by over 50%, but, against 2019 figures, their number decreased by 8.

The firms in the WCTS sector are mainly small and medium sized companies, with an average number of persons employed per enterprise in 2020, between 10 (Sweden) and 272 (Bulgaria). In Norway, Denmark, Austria and Finland the average persons employed by company in WCTS industry is even lower, with up to an average of 4 persons per enterprise. In Bulgaria, the Netherlands, Slovakia, Belgium and Hungary the average number of employees is much higher, over 100 persons, which indicates a higher number of medium and large companies.

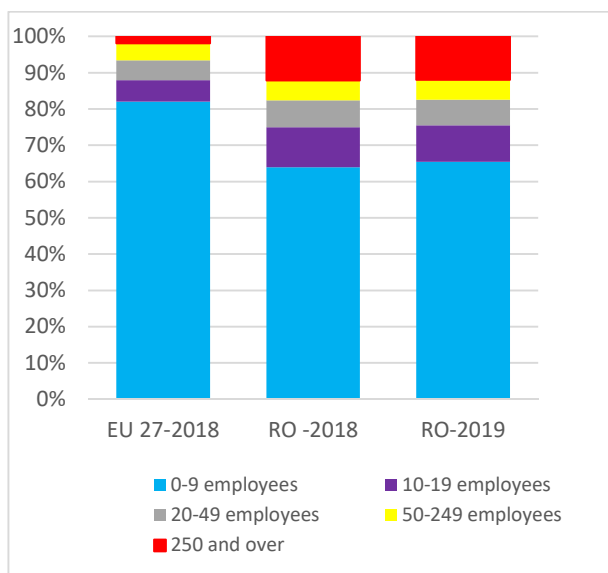
In Romania, the average number was around 150 people in 2011 and decreased below 100 in 2020, with a structure based more on medium and large enterprises, respectively with 17.5% of companies with over 50 employees (at the level of EU-27, their share is below 7%) - Figure 3.

Figure 3. WCTS sector, by firm number and structure

Dynamics of the number of companies in WCTS industry, in Romania, after 2011



WCTS sector, by companies' size, last available data, in Romania and at EU-27 level



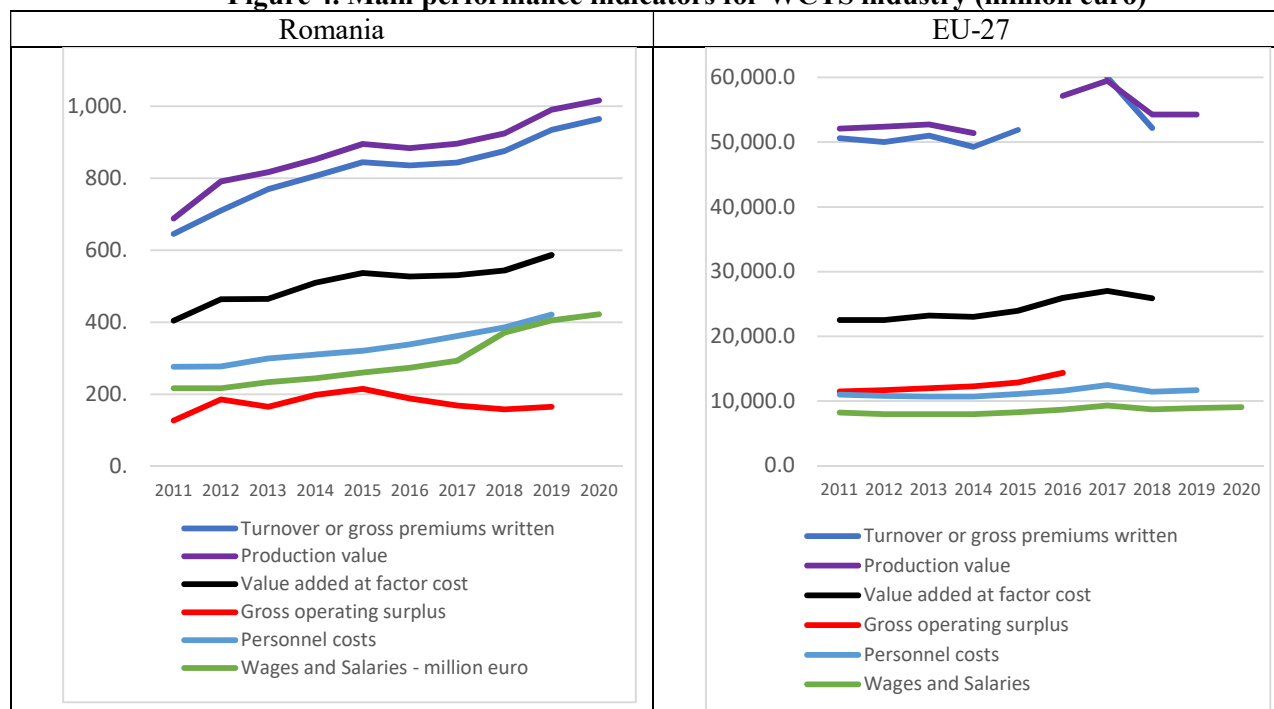
Source: Eurostat database, Annual enterprise statistics by size class for special aggregates of activities, accessed on March 19, 2022

The Eurostat database allows us a comparative analysis of the main performance indicators, of the activity results, of the main cost components and of some efficiency rates.

If we analyse the main result indicators, respectively turnover and production value, we find that their dynamics was more accentuated in Romania than on the EU-27 as a whole, evolution justified by the extension of the distribution network and the increase of consumption (figure 4).

It is found that Romania has a model of cost structure different from other EU-27 countries. On average, the ratio between added value and production value is higher for Romania which means less material consumption, that could be explained by different technologies for water treatment and / or different maintenance cost for tangible assets. Another difference is related to the ratio between gross operating surplus and labour force cost, in Romania wages and total personnel cost are higher than at EU-27 average. This could be explained by a higher number of people employed in this sector in Romania than at EU-27 level, which demonstrated that the technology is less efficient and / or that for the maintenance of equipment (capture, water treatment and transport) more employees are needed, the repair and maintenance activities being carried out mainly on their own (without or with a lower degree of outsourcing of these services).

Figure 4. Main performance indicators for WCTS industry (million euro)



Source: Eurostat database, Annual enterprise statistics by size class for special aggregates of activities, accessed on March 19, 2022

The following aspects also support these assessments:

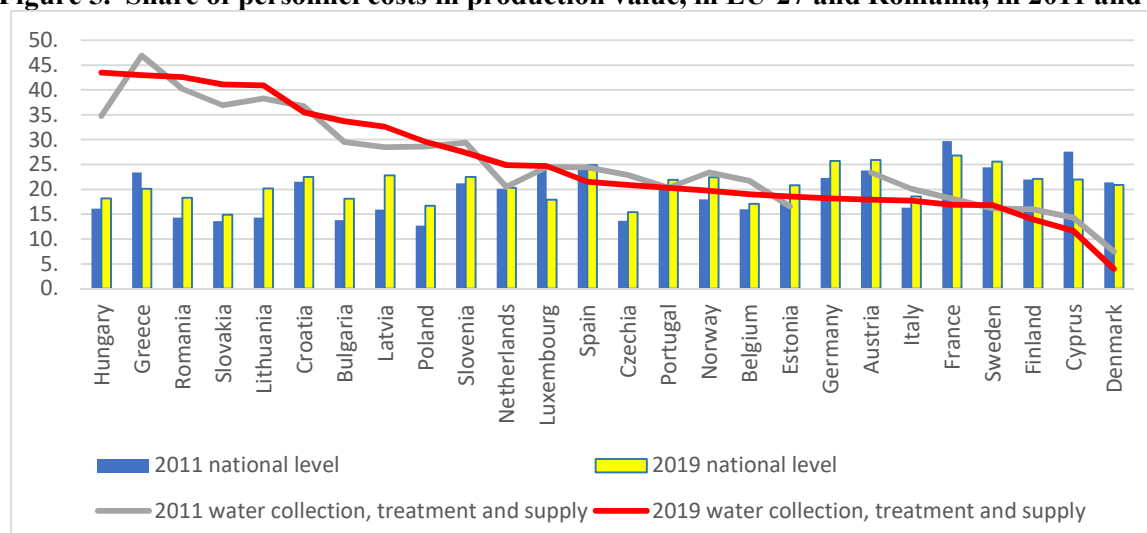
- The average number of persons employed per company at EU-27 was in the period analysed on average of 24 persons but in Romania the registered number was substantially higher - about 6 times higher in 2011, it was reduced in the analysed period to a rate from 1 to 4. Therefore, the average number decreased from about 153 people in 2011 to 98 in 2020 but is not associated proportionally with investments in technology, as we will see later.

- Apparent labour productivity calculated as gross value added per person employed is significantly lower in Romania WCTS industry than at EU-27 level, even if, in the analysed period, it increased by 60%. At the level of 2019 the apparent labour productivity in Romania was less than 40% of the EU-27 level, i.e. the value was 20.2 thousand euro per person employed in Romania and, respectively of 52.1 in EU-27

- Turnover per person employed was more than 6 times lower in Romania for the entire analysed period, but with a slight closing gap, from 1: 6.85 in 2011 to 1: 6.11 in 2018. It should be noticed that the production factor remuneration policy is different at EU-27 country levels.

If we analyse the share of personnel costs in production in 2019, we find that it was between 4.0 percent in Denmark and 43.5 percent in Hungary. The evolutions in 2019 compared to 2011 are different by country, with dynamics in both directions, determined by factors such as the level of economic development and the social model, transposed into policy measures. The differences between the national level, respectively “total business economy; repair of computers, personal and household goods; except financial and insurance activities” (Eurostat database) and WCTS industry is explained not only by the technological level and the specific model of combining the factors of production, but also by the salary policy on trades and professions promoted in each country, and / or depending the level of the minimum wage negotiated at the level of the activity sector.

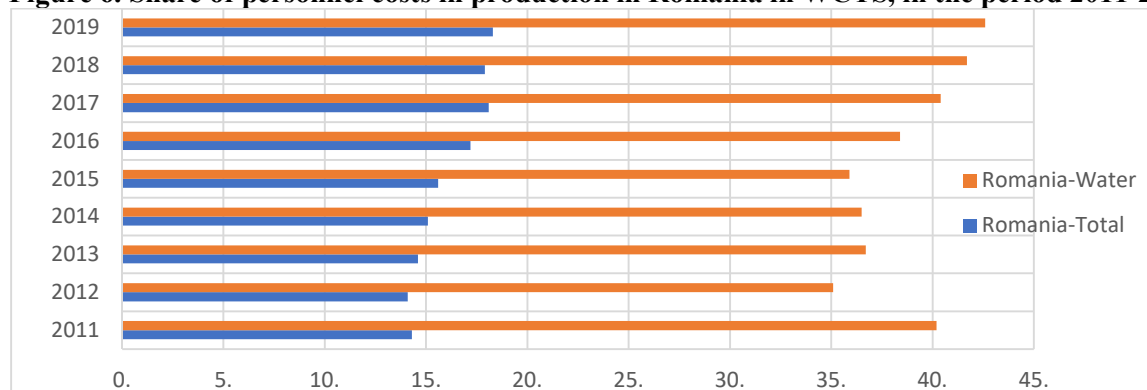
Figure 5. Share of personnel costs in production value, in EU-27 and Romania, in 2011 and 2019 (%)



Source: Eurostat database, Annual enterprise statistics by size class for special aggregates of activities, accessed on March 19, 2022

In Romania, the share of personnel costs in WCTS is almost double the national average (figure 6), a situation similar to most of the less developed countries in the EU (figure 5). The positive dynamics of personnel costs in the period 2012-2019 was mainly due to the increase in the national minimum wage, on the background of a relatively sustained economic growth, based on consumption. The local monopoly position of WCTS companies and the relatively high costs for investments in facilities that provide individual sources of water capture and treatment have allowed companies to negotiate quite differentiated salaries. It is one of the reasons why the tariffs for these services differ quite a lot by companies and geographical areas. For example, at present, according to ANRSC (National Romanian Regulator for Public Services), the tariff for water distribution services differs from a maximum of RON 6.88 / m³ - around 1.4 euro / m³ (SC AQUAVAS SA Vaslui) to a minimum of 3.75 RON / m³ (around 0.75 Euro / m³) (COMPANIA DE APĂ SOMEȘ SA Cluj Napoca)

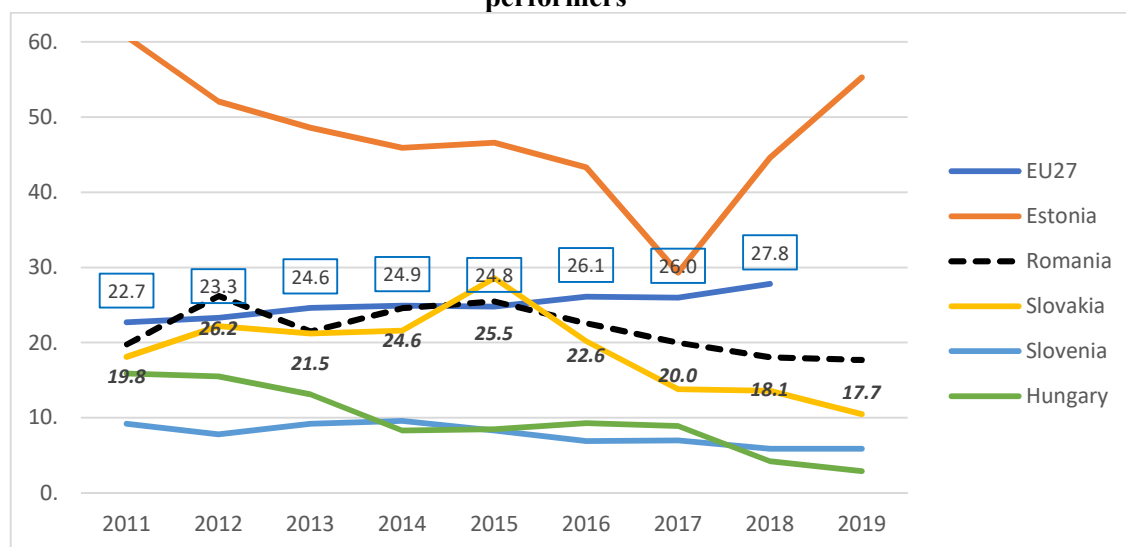
Figure 6. Share of personnel costs in production in Romania in WCTS, in the period 2011-2019 (%)



Source: Eurostat database, Annual enterprise statistics by size class for special aggregates of activities, accessed on March 19, 2022

In the last decade, gross operating rate measured as ratio between gross operating surplus and turnover at EU-27 level increased with around 5 p.p., reaching 27.8% in 2018. By countries, the rate fluctuated in both directions, respectively increased by more than 10 p.p. in Italy, Belgium and France, and decreased with 13 p.p. in Hungary, which in 2019 registered the lowest gross operating rate, of 2.9 percentage. Romania, with 17.7 percent is among the poorest performing countries (along with Slovakia, Slovenia and Hungary), and in the analysed period the situation has deteriorated, registering a reduction of 2 pp in 2019 compared to 2011 (Figure 7).

Figure 7. Gross operating rate of WCTS sector in Romania and EU-27, the first and the last 3 performers



Source: Eurostat database, Annual enterprise statistics for special aggregates of activities (NACE Rev. 2), accessed on March 19, 2022

All these results show the strong dependence of the development of the WCTS sector on the local conditions and the national policy for the development of services of public interest, but also on the power of the local authority to promote a model of services of local interest based on large providers or, on the contrary, on the encouragement of small businesses and local competition.

4.2. Digital transformation impact on business model

The economic performance of the business environment in today's society is based on two technical-organizational pillars, on the one hand, on the modernization of specific technologies to ensure the comparative advantages between the partners on the specific market and, on the other hand, on the promotion of a competitive business model, with as low managerial costs as possible. In both cases, the digital transformation can provide cost savings at the company level and facilitate the application of modern business management methods by refining the principles of total quality management and adapting successful management models in this field of water management, such as the Lean 6 Sigma method or using artificial intelligence techniques. (Tsironis et al, 2016; Miguel et al, 2014; AlDairi, 2021; Xiang 2021, Naeemah, 2021). According to the MKPR 2021 study, about 1/3 of Romanian companies had benefits from digitizing some activities „the turnover increased by 10-19%”, i.e. financial performance in cost reduction and increased in turnover or profit. The availability of financial resources for digital infrastructure and reskilled human resources were the main challenges, but the pandemic accelerated the reshaping of the digital side of the business model.

The first results showed that the investment efforts can be amortized in the medium term, and the post-pandemic benefits can be maintained, including with the consolidation of the market segments gained during the pandemic. If the pandemic forced digitalization, according to the same study, the capitalization of digital reform at the company level can be achieved by continuing investments in digital technology and the gradual development of a “digital ecosystem based on specific functionalities of digitalization solutions, communication platforms and internally develop digitalization solutions tailored to specific business needs”. According to McKinsey analysis (Novak et al 2018) automatization potential in utilities, process monitoring, e-commerce for services and advanced analytics for decision making could be drivers for increasing financial performance and also competitiveness at firm’s level (Valoria Study, 2020), including for business sector in water management.

The Covid crisis has accelerated digitalisation and the pace of change in the business model and also in labour market jobs structure. Generally, the digital transformation makes life easier, increases the security of service quality, eliminates time-consuming repetitive activities and saves resources, facilitates the increase of time for personal life, increases the quality of life as a whole.

Even in some industries the transformation is limited, this fundamentally changes the company's cost structure and job categories. New jobs will emerge, routine jobs are at risk and reskilling / upskilling the soft skills will be necessary for all categories of labour force (FEPS, 2022). Is a good opportunity to change, adapt /

reshape also the business model. From the perspective of water distribution services, the digital transition means at least three levels of intervention: a) digital monitoring of technological processes of water treatment, but also of the operation of the distribution network, with permanent quality control of the transport network functionality, to limit the effects on costs of the malfunctions in operation; b) reorganization and optimization of jobs, by promoting hybrid work, where possible, and reducing the total cost of company staff - digitization of administrative services - accounting, staff, etc.; c) reshaping the relationship with the clients, by gradually switching to digital communication, for the entire flow of relationships - from the selection of the service contract to the payment and the monitoring of the quality of the services.

The cost management and the increase of profitability in terms of ensuring access to affordable water services from a financial point of view, for all categories of consumers, are dependent on both internal and external factors. Internal factors take into account:

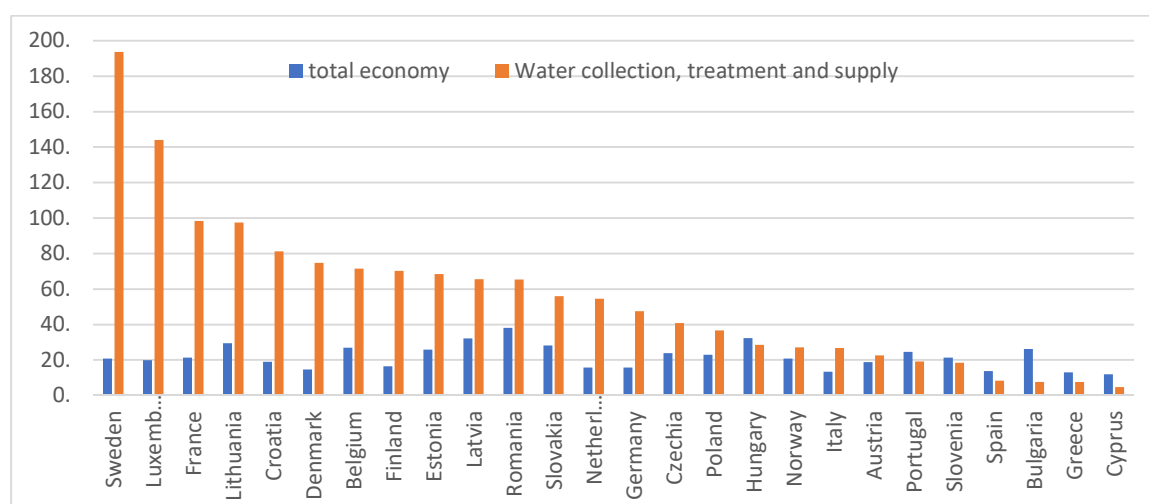
- Technological modernization of the systems for monitoring the processes of capture, treatment, distribution, purification and verification of water quality, including through digital monitoring
- Reducing the costs of technical interventions in case of network failures through digital surveillance - minimizing water losses in case of technological failures by reducing response time
- Diminishing the costs of managing the relationship with customers, industrial or domestic, by differentiating contract management services by customer categories - from the application of classic methods of collaboration in the case of elderly and / or poor customers, without access to digital services, up to complete digitization of contractual relations, in the case of industrial and domestic consumers with full access to digital services.
- Digitization of customer relationship management at company level and operational monitoring of payments for services, with the promotion of billing discounts or other facilities for payment of services and reducing the physical circulation of documents - digital invoices, online payment, etc. that should involve consistent alternative clients centred business model which involves transparency, accountability, different choices, open-source software and better standards for users.
- Expanding the network of service beneficiaries by increasing competitiveness based on digital platform development for customers.

Such transformations at company level are also dependent on a series of external factors, among which: a) financial inclusion; b) the level of economic and social development of the localities served; the existence of water resources and accessibility to other sources of drinking water - individual deep wells, financial capacity for local / individual water capture and treatment plants, water transport networks etc.; c) the policy of the local authority to support the distribution of drinking water through common networks, managed by specialized companies; d) the real-life, day-to-day implementation of the EU Declaration on digital principles (EC, 2022), i.e. accessible and human-centric digital services and of the 2030 European Digital Compass (EC, 2021), based on digital business enforcing.

If we position ourselves at the level of companies, it is important to ensure the sustainability of the business and the resilience of companies by financing the modernization of infrastructure, as the main component that determines water quality and decent tariffs, facilitating the reduction of water footprint and water inclusion, in the conditions of supporting the digital transition.

As future development programs for sustainable business we can consider the investment rate, calculated as share of the investments in value added at factor cost. According to available data for 2019, the investment effort of the analysed activity is much higher than the average at national level in Sweden and Luxembourg, and less than half of national level in Bulgaria and Cyprus with just 2/3 in Greece and Spain. In Romania, the investments are 1.7 times higher than average economy level, but even so, the water infrastructure is old and the water quality is affected in many cases (Figure 8.).

Figure 8. Investment rate in EU countries, in 2019 (%)



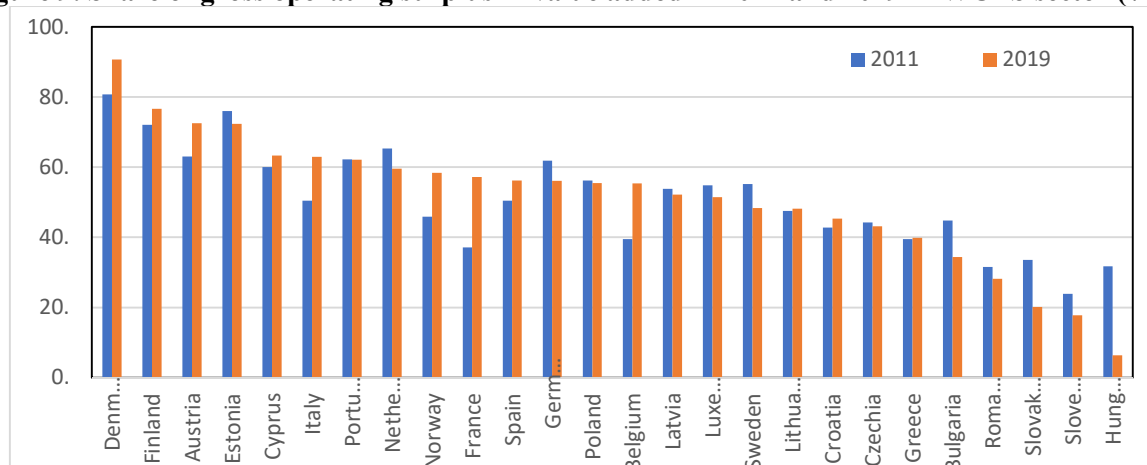
Source: Eurostat database, Annual enterprise statistics for special aggregates of activities (NACE Rev. 2), accessed on March 19, 2022

Under these conditions, it will be difficult to ensure the modernization of the water transport and treatment network, but also to expand the network, according to the future demand for services.

External sources of financing (loans) are generally expensive and therefore two can be sources of financing, namely the addition of capital by attracting external investors (FDI) or from own sources, respectively from profit. Another possible source is non-reimbursable financing, through structural funds or other lines of financing that support social objectives such as social and societal inclusion for all i.e. Green Deal or Horizon Europe Program

The share of gross operating surplus in total value added we have to mention that for all countries in water sector registered higher share than the national average level for all activities, in 2019 against 2011, except several new member state Czech Republic, Bulgaria, Slovakia, Slovenia, Hungary and Romania. It is worth mentioning the big differences between the countries, which can be explained by the technological level, the degree of automatization and the managerial model, but also depending on the level of personnel expenses (salaries and contributions) and the purchasing power of the beneficiaries. An increase of 10-20 p.p. have been registered in developed EU countries - France, Belgium, Italy, Norway, Denmark and Austria- figure 9.

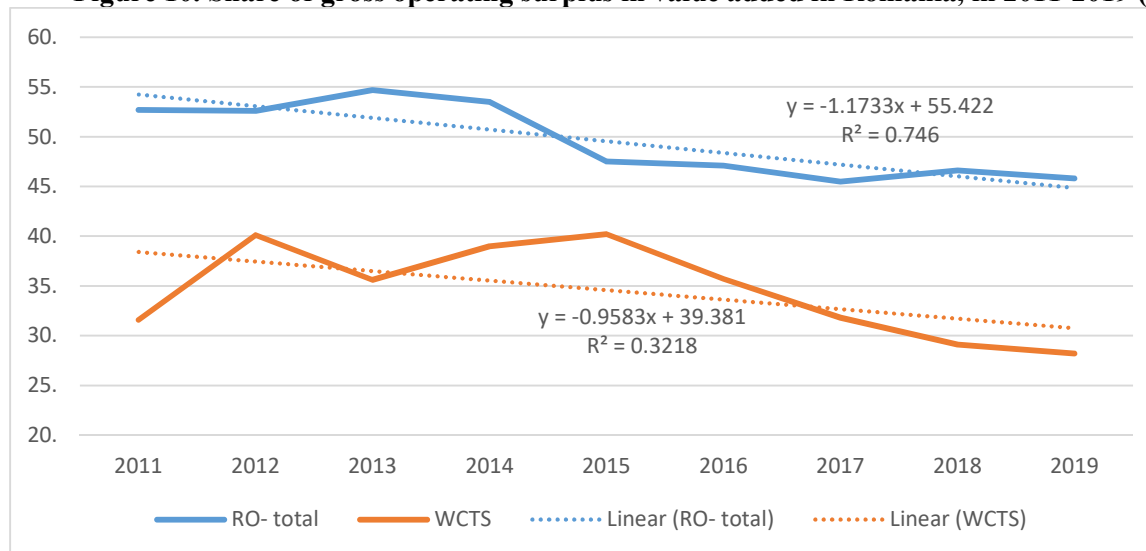
Figure 9. Share of gross operating surplus in value added in 2011 and 2019 in WCTS sector (%)



Source: Authors selection based on Eurostat database, Annual enterprise statistics for special aggregates of activities (NACE Rev. 2), accessed on March 19, 2022

If we analyse the level and evolution of capital remuneration, measured as share of gross operating surplus in value added for Romania, we find that in the period 2011-2019, in WCTS industry there are 2 distinct and opposite stages as dynamics, with a general downward trend- figure 10.

Figure 10. Share of gross operating surplus in value added in Romania, in 2011-2019 (%)



Source: Authors contribution based on Eurostat database, Annual enterprise statistics for special aggregates of activities (NACE Rev. 2), accessed on March 19, 2022

Until 2015, there is an oscillating evolution with an increasing trend that means a volatility of performance and prices, and after 2015, a reduction of the general profitability, mainly due to the increase of the minimum wage and of the other operational costs.

4.3. The effects of the pandemic on essential services. Peculiarities for the WCTS sector

The pandemic had disproportionate effects on economic activities, affecting individuals, households and businesses. If some activities were able to be reduced, temporarily closed or closed during the lockdown period, the essential services continued their activity, some of which also had an increase in demand. This is also the case for drinking water distribution services. Pandemic restrictions have imposed strict sanitary rules that have generated increased water consumption for repeated disinfection, cleaning services, etc. Also, the structure of water consumption by categories of consumers has changed significantly, there have been reductions in the case of economic activities and a general increase in the case of households (Kalbusch et al, 2020; Brauer et al, 2020; Cahill et al, 2022; Campos et al, 2021).

The period of the already two years of pandemic reiterated the importance of water supply inclusion as a driven factor for economic development and quality of life improvement. The pandemic has shown the higher importance of water supply management but also companies and households ability to cope with pressure for affordability prices for these services. It is mainly about ensuring cost-benefit efficiency in drinking water distribution services on the one hand, and the ability of consumers to pay, on the other hand.

According to the literature analysis, the pandemic has changed consumer behavior for drinking water use - laundry and higher consumption of cleaning materials, washing food with plenty of water, as a precaution against the risk of infection, reducing water consumption in households in the morning and the increase throughout the day, especially in the case of the workforce working remotely, the increase in consumption in residential areas during the week and the reduction during the weekend; the increase of consumption in the agglomerated residential areas and only a slight change in consumption in the more isolated inhabited areas, without important human interaction.

All of these changes have highlighted the volatility of the water consumption pattern and its strong dependence on unforeseen events, such as the pandemic. Its also highlighted the increasing trend of water dependence, such as the correlation with changes in ambient temperature - global warming, or depending on changed employment model (hybrid or remote) and / or related to household structure, which supports the model of water demand future increase for ordinary events and water consumption practices.

Regional differences and by categories of consumers will be maintained and will even increase if no measures are initiated to close the regional gaps regarding the access and price of water management services. The post-pandemic period may lead to a reduction in water consumption for the financially vulnerable, even if the general trend of water consumption remains on the rise.

5. Conclusions and policy recommendations

The need for drinking water is essential, and the pandemic highlighted the importance of the three factors analysed in the paper - quality and affordable services for all, digital & financial inclusion, business management innovation. Ensuring these components at the company level in the WCTS industry requires micro-level measures to reduce costs, financial performance to facilitate infrastructure investments and personal reskills for soft competences able to facilitate full digital communication with customers.

The digital transformation of drinking water distribution services will determine a positive outcome for firms and citizens i.e. access and affordable essential services, saving time with managing contractual relations, lower costs and quality of water consumed. From the perspective of WCTS industry in Romania and the analysis of the economic performance of the companies active in this sector, a series of recommendations are necessary, namely:

a) Proposals for the modernization of the digital management of water services through: artificial intelligence to monitor the technological process of supplying drinking water - surveillance of water processes and distribution; managing customer relations with facilitation provided by the use of database and cloud-computing capabilities; promoting affordable tariffs for services provided through consumer-centred contracts and discount for digital and advance payments

b) Stimulating FDI in water supply services based on the expected outcomes in distribution network investment for replacement / modernization and in the implementation of good practices in digitalized systems for monitoring the state of the network and water quality;

c) Cost benefit analysis at firm level and increasing companies' social responsibility.

d) Providing public-private partnership in the local strategy for increasing the quality of living condition in the locality, based on access for all for WCTS services, in the benefit for the future generation and a greener environment for all.

In order to increase the efficiency and accessibility of water services, a change of approach is needed, a fundamental shift in how companies / providers understand, values and manage water resources.

Policy orientation for the post-pandemic better normal targeting closing water inclusion and demand and supply gap are oriented, among others, toward:

a) Extending the water distribution network to reduce the market gap between supply and demand

b) Identification of alternative water sources to meet the needs of industrial and domestic consumption in parallel with ensuring the quality of distributed water

c) Promoting affordable prices for consumers to increase access to quality water sources, including vulnerable groups, poor households or those located in hard-to-reach geographical areas

d) Increasing the internal efficiency of the companies that manage the water supply by adjusting the business model, with the promotion of digital transformation and / or hybrid system activities, development of water distribution monitoring services to reduce the risks of water transport or network failures;

e) Flexible working arrangements and hybrid employment; closing access gender gap to decent employment / jobs; digital inclusion and financial inclusion of all categories of customers; reduced informal employment and a wider cover by job retention schemes for the youth in local essential jobs employment such in WCTS sector;

f) Promoting the public-private partnership in the management of drinking water distribution services and attracting foreign direct investment for the modernization of the water transport network, the technological upgrade of the water capture and treatment plants.

The limits of the present research are given by the lack of microdata for the last years for the comparative analysis of the economic-financial performances of the companies operating in WCTS sector at regional level in Romania and for a detailed correlation analysis based on territorial gaps in network development, companies' efficiency and supply deficit, considering the geographical boundaries, operating cost restrictions and affordability prices for services. In future research we will focus on comparative analysis at the regional level, as well as on the analysis of externalities generated by the pandemic period on the digitalization of relations between water service providers and beneficiaries, including the analysis of the financial impact.

References:

- [1] AlDairi, J.S. and Badr, A. (2021), *Management of Water Losses in Water Distribution Systems Using Lean Six Sigma Framework*, in *Towards a Sustainable Water Future*, January 2021, 91-101, ISBN 978-0-7277-6525-3 <https://doi.org/10.1680/oicwe.65253.091> ICE Publishing
- [2] Apostu, S-A, Vasile, V., Veres, C. (2021), *Externalities of lean implementation in medical laboratories. Process optimization vs. adaptation and flexibility for the future*, International Journal of Environmental Research and Public

- Health, eISSN1660-4601, Special Issue - Lean Six Sigma in Healthcare, 18(23), 12309; <https://doi.org/10.3390/ijerph182312309>
- [3] Brauer M., Zhao J. T., Bennitt F. B. & Stanaway J. D. (2020), *Global access to handwashing: implications for COVID-19 control in low-income countries*. Environmental Health Perspectives 58, 057005-1–057005-6. <https://doi.org/10.1289/EHP7200>
- [4] Cahill, J; Hoolohan, C; Lawson, R; Browne, A (2022), *COVID-19 and water demand: A review of literature and research evidence*, Wiley interdisciplinary reviews-water, Volume 9, Issue1, Article Number1570, DOI10.1002/wat2.1570
- [5] Campos, M., Carvalho, S., Melo, S., Goncalves, G., Dos Santos, J., Barros, R., Morgado, U., da Silva Lopes, E., & Abreu Reis, R. (2021), *Impact of the COVID-19 pandemic on water consumption behaviour*. Water Supply, ws2021160. <https://doi.org/10.2166/ws.2021.160>
- [6] Kalbusch A., Henning E., Brikalski M. P., De Luca F. V. & Knorath A. C. (2020), *Impact of Coronavirus (COVID-19) spread-prevention actions on urban water consumption*. Resources, Conservation and Recycling 163, 105098. <https://doi.org/10.1016/j.resconrec.2020.105098>
- [7] Kini J (2017), *Inclusive water poverty index: a holistic approach for helping local water and sanitation services planning*, Water Policy (2017), 19 (4): 758–772, <https://doi.org/10.2166/wp.2017.075>
- [8] Koirala, Saroj, Yiping Fang, Nirmal M. Dahal, Chenjia Zhang, Bikram Pandey, and Sabita Shrestha (2020), *Application of Water Poverty Index (WPI) in Spatial Analysis of Water Stress in Koshi River Basin, Nepal*, Sustainability 12, no. 2: 727. <https://doi.org/10.3390/su12020727>
- [9] Miguel, P.A.C. and Monteiro de Carvalho, M. (2014), *Benchmarking Six Sigma implementation in services companies operating in an emerging economy*, Benchmarking: An International Journal, Vol. 21 No. 1, pp. 62-76. <https://doi.org/10.1108/BIJ-03-2012-0014>
- [10] Naeemah, AJ ; Wong, KY (2021) Selection methods of lean management tools: a review, International journal of productivity and performance management, DOI10.1108/IJPPM-04-2021-0198, Early Access OCT 2021
- [11] Novak, J Spiridon, D., Purta, M., Marciniak, T., Ignatowicz K., Rozenbaum K., Yearwood K., (2018), *The rise of Digital Challengers. How digitization can become the next growth engine for Central and Eastern Europe. Perspective on Romania*, Digital McKinsey, https://digitalchallengers.mckinsey.com/files/Rise-of-Digital-Challengers_Perspective-on-Romania.pdf
- [12] Spearing, L.A., Thelemaque, N., Kaminsky, J.A., Katz, L.E., Kinney, K.A., Kirisits, MJ., Sela, L and Faust K.M., (2021), *Implications of Social Distancing Policies on Drinking Water Infrastructure: An Overview of the Challenges to and Responses of U.S. Utilities during the COVID-19 Pandemic*, ACS EST Water 2021, 1, 888–899, <https://pubs.acs.org/doi/pdf/10.1021/acsestwater.0c00229>
- [13] Subbaraman R, Nolan L, Sawant K, Shitole S, Shitole T, Nanarkar M, et al. (2015), *Multidimensional Measurement of Household Water Poverty in a Mumbai Slum: Looking Beyond Water Quality*, PLoS ONE 10(7): e0133241. <https://doi.org/10.1371/journal.pone.0133241>
- [14] Sullivan, C. (2002), *Calculating a water poverty index*, World Development Journal, 30, 1195–1210
- [15] Sullivan, C., Meigh, J.; Lawrence, P. (2006), *Application of the Water Poverty Index at Different Scales: A Cautionary Tale: In memory of Jeremy Meigh who gave his life's work to the improvement of people's lives*, Water Int. 2006, 31, 412–426.
- [16] Tahmineh Ladi, Asrin Mahmoudpour, Ayyoob Sharifi (2021), *Assessing impacts of the water poverty index components on the human development index in Iran*, Habitat International, Volume 113, 2021, 102375, <https://doi.org/10.1016/j.habitatint.2021.102375>.
- [17] Tsironis, L.K. and Psychogios, A.G. (2016), *Road towards Lean Six Sigma in service industry: a multi-factor integrated framework*, Business Process Management Journal, Vol. 22 No. 4, pp. 812-834. <https://doi.org/10.1108/BPMJ-08-2015-0118>
- [18] Xiang, XJ; Li, Q; Khan, S; Khalaf, OI (2021), *Urban water resource management for sustainable environment planning using artificial intelligence techniques*, Environmental impact assessment review, Volume86, Article Number106515, DOI10.1016/j.eiar.2020.106515
- [19] Wilk, J., Jonsson, A.C. *From Water Poverty to Water Prosperity - A More Participatory Approach to Studying Local Water Resources Management*. Water Resources Manage 27, 695–713 (2013), <https://doi.org/10.1007/s11269-012-0209-8>
- [20] EC 2021-2030 *Digital Compass: the European way for the Digital Decade*, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Brussels, 9.3.2021, COM(2021) 118 final, https://ec.europa.eu/info/sites/default/files/communication-digital-compass-2030_en.pdf
- [21] EC 2022 *European Declaration on Digital Rights and Principles for the Digital Decade*, European Commission, Brussels, 26.1.2022, COM(2022) 28 final, <https://digital-strategy.ec.europa.eu/en/library/declaration-european-digital-rights-and-principles#DeclarationEurostat> database, (2022) online data code: SBS_SC_SCA_R2 https://ec.europa.eu/eurostat/databrowser/view/SBS_SC_SCA_R2__custom_87577/bookmark/table?lang=en&bookmarkId=b60cc6ea-fbd6-431b-b608-4325c87b74ed, accessed on March 19

- [22] FEPS 2022 *Progressive Yearbook 2022*- Foundation for European Progressive Studies, https://www.feps-europe.eu/attachments/publications/progressive_2022_plus_cover.pdf
- [23] UN 2010 *UN Resolution 64/292 - The human right to water and sanitation*, <https://documents-dds-ny.un.org/doc/UNDOC/GEN/N09/479/35/PDF/N0947935.pdf?OpenElement>
- [24] UN Water 2021- *Progress on Water-Use Efficiency – 2021 Update*, IMI-SDG6 SDG 6 Progress reports, <https://www.unwater.org/publications/progress-on-water-use-efficiency-641-2021-update/>
- [25] MKOR 2021 *Digitalization in Romanian companies*, https://www.becketal.ro/images/2021/research_about_companies_digitalization_in_Romania.pdf
- [26] Valoria study (2020) - *Barometrul digitalizării. Studiu despre percepția managerilor cu privire la impactul digitalizării asupra companiilor din România*, Ediția 2020, https://valoria.ro/wp-content/uploads/2022/01/Studiu_Barometrul-digitalizarii-2020_RO.pdf