The Last Mile
Rural Water Services Delivery in the Danube region

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Review of Rural Water Services Delivery practice in the Danube region

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Executive Summary

Rural waste service delivery is a challenge in all countries of the Danube River basin. Main reasons for this are a lack of financial, technical and staff resources, but also a lack of awareness in society. As all countries in the Danube River basin as all are either EU Member States, Candidate Countries or Potential Candidates, the EU legislation forms the basis. The recast of the EU Drinking Water Directive and of the EU Urban Wastewater Treatment Directive requires more efforts also in rural areas. However, they also provide more clear guidance for rural areas. The EU Water Reuse Ordinance provides a legal framework for reusing treated wastewater as alternative water source for irrigation in agriculture.

Operation and maintenance are key for long-term functioning water supply and wastewater treatment systems and thus has to be planned from the start of a project. Local communities should be able to operate the systems, i.e., technologies that are simple and robust and that have low operation and maintenance requirements and costs are required. Experience shows that treatment wetlands - if properly designed, constructed & operated - can achieve the same (if not a better) treatment level as technical solutions. Treatment wetlands have lower operation and maintenance requirements compared to technological solutions and can be designed for specific ware reuse requirements as defined in the EU Water Reuse Ordinance.

Financing rural water service delivery poses a significant challenge for countries. Thus, clear financing strategies and financial support for the countries would facilitate the development and implementation of national action plans to improve access to water service delivery of the rural population. Besides investment costs which are often supported in the form of subsidies, also coverage of costs for operation, monitoring and maintenance needs to be considered. Subsidies need to consider the different incomes in rural and urban areas, i.e., subsidies in rural areas that are most of the times poorer needs to be higher especially when considering the rural decentralized systems have higher costs per person connected compared to central system.

There are a number of water service delivery models that can be applied. Experience from other countries on successful models can help to develop suitable models for operation, monitoring and maintenance for specific Danube River basin countries, e.g., water and wastewater cooperatives with regional umbrella organisations and/or larger utilities that take over the operation and monitoring of small systems.

Capacity building for safely managed rural service is essential. Training of owners/operators is key for operation, monitoring and maintenance and thus to achieve safely managed rural services.,

1. Introduction

Providing water supply and sanitation in rural areas is mostly a neglected topic. In many regions, the construction of adequate water supply, and wastewater sewage collection systems and treatment facilities in small rural communities is lagging. Main reasons for this are a lack of financial, technical and staff resources, but also a lack of awareness in society.

Access to water and sanitation are recognized by the United Nations as human rights, reflecting the fundamental nature of these basics in every person's life (https://www.unwater.org/water-facts/human-rights/). The UN Sustainable Development Goal 6 (SDG 6) on "*Clean Water and Sanitation*" aims to ensure availability and sustainable management of water and sanitation for all (https://sdgs.un.org/goals/goal6).

Within SDG 6, water supply, sanitation and wastewater treatment are specifically covered by the following Targets:

- Target 6.1.: By 2030, achieve universal and equitable access to safe and affordable drinking water for all.
- Target 6.2.: By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.
- Target 6.3.: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

Figure 1 shows the proportion of population using safely managed drinking water services in the Danube River basin (DRB) countries, Figure 2 the proportion of population using safely managed sanitation services. The level of service provision in the DRB countries is different. In general, there is less service provision in rural areas compared to urban areas (World Bank Group, 2018). Numbers for drinking water service provision are higher compared to sanitation service provision (

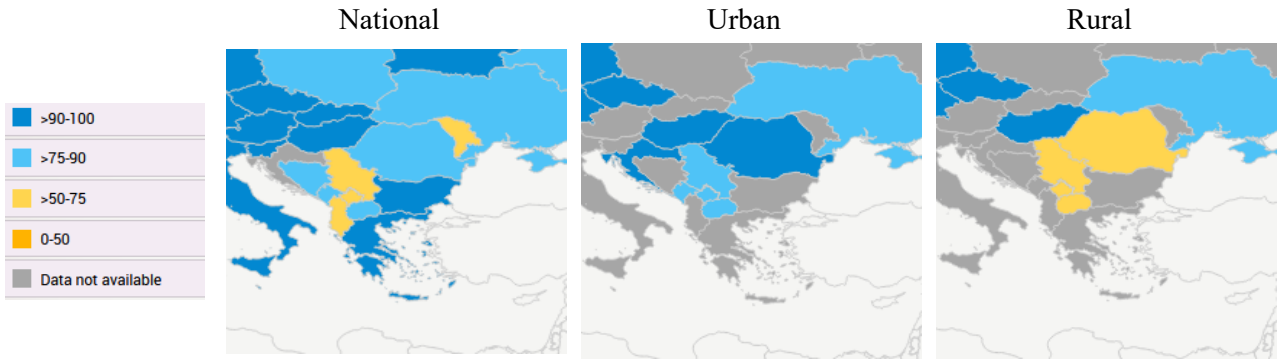


Figure 1: Proportion of population using safely managed drinking water services in countries of the Danube River basin; Left: national level; Middle: urban areas; Right: rural areas (Source: https://www.sdg6data.org/en; 2022 data).

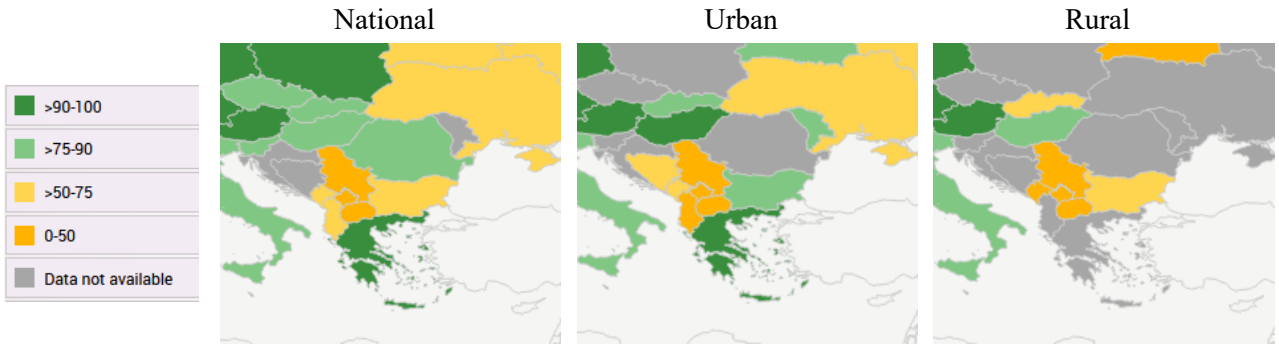
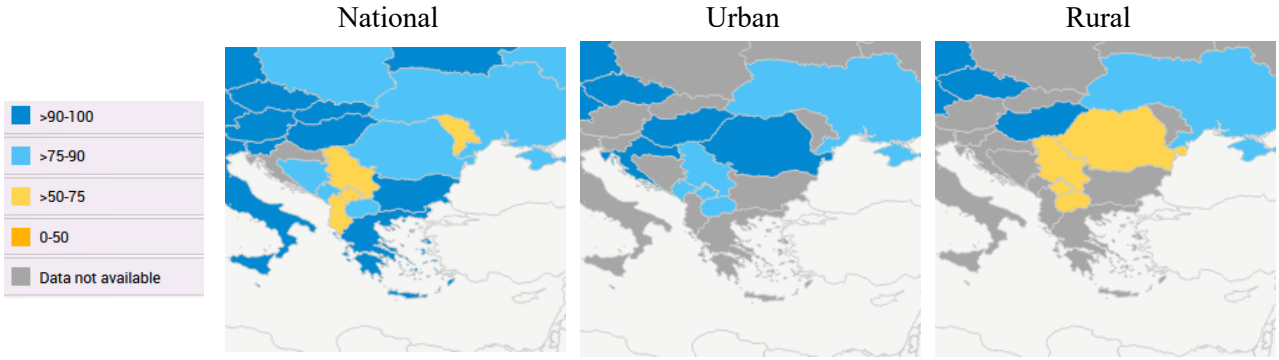


Figure 2: Proportion of population using safely managed sanitation services in countries of the Danube River basin; Left: national level; Middle: urban areas; Right: rural areas (Source: https://www.sdg6data.org/en; 2022 data).

Table 1).



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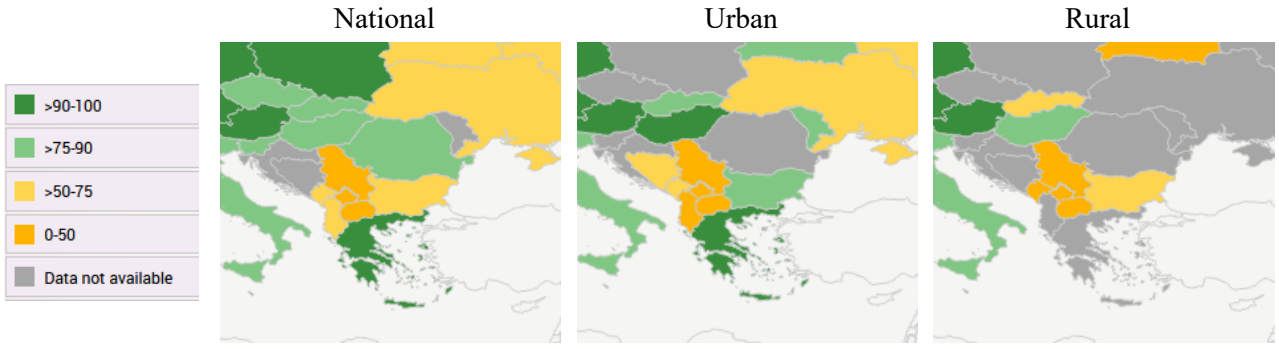


Figure 2: Proportion of population using safely managed sanitation services in countries of the Danube River basin; Left: national level; Middle: urban areas; Right: rural areas (Source: https://www.sdg6data.org/en; 2022 data).

Table 1: Proportion of population using safely managed drinking water services and safely managed sanitation services, respectively, in countries of the Danube River basin (Source: https://www.sdg6data.org/en; 2022 data for national level as well as urban and rural areas; No numbers: data not available).

Country		Drinking water			Sanitation		
		National	Urban	Rural	National	Urban	Rural
Albania	AL	71	-	-	56	50	-
Austria	AT	99	-	-	100	100	99
Bosnia & Herzegovina	BA	87	-	-	-	58	-
Bulgaria	BG	96	-	-	73	77	61
Czechia	CZ	98	98	98	90	-	-
Croatia	HR	-	97	-	-	-	-
Hungary	HU	100	100	100	88	91	81
Kosovo	KO	75	82	67	25	22	29
Moldova	MD	75	-	-	-	-	-
Montenegro	ME	85	87		57	64	41
North Macedonia	MK	80	85	74	12	8	18
Romania	RO	82	95	67	88	-	-
Serbia	RS	75	82	67	25	22	29
Slovenia	SI	98	-	-	84	-	-
Slovakia	SK	99	-	-	82	88	75

Both the Black Sea coastal area and the Danube River basin have been designated as sensitive areas. Thus, according to the EU regulation, for the about 68 million persons living in ca. 1,300 agglomerations above 10,000 persons tertiary treatment (i.e., nutrient removal) is mandatory. For the about 18 million persons living in ca. 4,400 agglomerations between 2,000 and 10,000 secondary treatment (i.e., biological treatment with removal of organic pollutants) is required (Kovacs, 2024)

The population living in small towns and villages (agglomerations below 2,000 persons) in the EU Member States in the Danube River basin was estimated to be about 16 million from in total population about 66 million, about 10 million live in agglomerations below 1,000 persons (Table 2). The number of the agglomerations below 2,000 persons was estimated to be about 55,000 and below 1,000 persons to be more than 50,000 (Table 3). The number becomes even higher when considering the EU non-Member States in the region (total population of about 20 million). It can be estimated that there are additional 5 million population living in agglomerations below 2,000 persons and about 16,000 additional agglomerations below 2,000 persons. For agglomerations below 1,000 persons, the estimation results in about 1.1 million population living in about 5,500 agglomerations below 1,000 persons. For all Danube River basin countries, about 21 million population living in agglomerations below 2,000 persons (about 11.2 million in agglomerations below 1,000 persons) and the agglomerations below 2,000 persons is estimated to be about 71,000 (with 56,000 agglomerations below 1,000 persons).

Table 2: Estimated population in EU Member States in the Danube River basin that lives in agglomerations below 2'000 persons (Source: Pistocchi et al., 2022).

Country	< 2000	2000>P≥1000	1000>P≥500	500>P≥100	100>P≥50	P<50
AT	2'018'517	626,980	476,319	623,121	161,575	130,522
BG	1'444'402	549,109	441,696	380,966	47,555	25,076
CZ	2'663'128	732,611	708,391	986,499	156,158	79,469
HR	1'004'001	254,233	238,719	365,916	88,373	56,760
HU	1'833'830	873,472	489,366	384,855	49,509	36,628
RO	4'991'716	2,091,721	1,492,159	1,202,507	124,657	80,672
SI	478'429	98,317	107,024	176,653	49,834	46,601
SK	1'552'372	686,235	481,446	342,176	29,504	13,011
Total	**15'986'395**	**5'912'678**	**4'435'120**	**4'462'693**	**707'165**	**468'739**

Table 3: Estimated number of agglomerations below 2'000 persons in EU Member States in the Danube River basin (Source: Pistocchi et al., 2022).

Country	< 2000	2000>P≥1000	1000>P≥500	500>P≥100	100>P≥50	P<50
AT	10'900	447	667	2,812	2,299	4,675
BG	4'037	397	624	1,495	643	878
CZ	10'584	533	1,009	4,280	2,166	2,596
HR	5'278	179	345	1,668	1,245	1,841
HU	4'829	603	677	1,546	692	1,311
RO	12'700	1,495	2,094	4,645	1,741	2,725
SI	3'461	72	155	843	717	1,674
SK	3'295	486	679	1,274	409	447
Total	**55'084**	**4'212**	**6'250**	**18'563**	**9'912**	**16'147**

For the wastewater treated, only national data are available. In general, numbers are low (Figure 3). It can be expected that numbers for rural wastewater treatment are lower compared to national values.

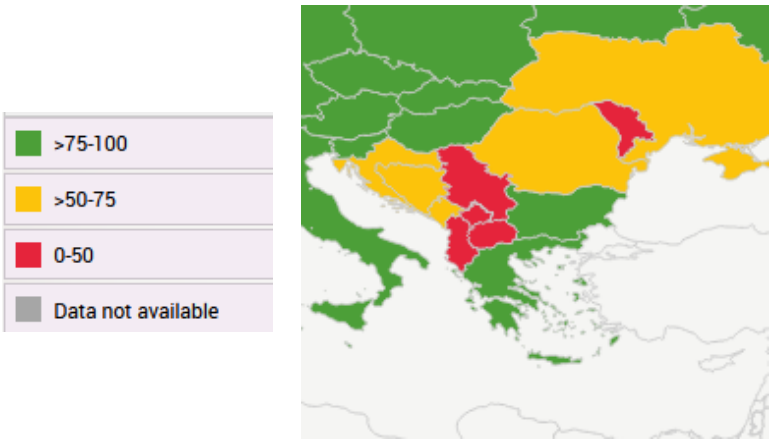


Figure 3: Proportion of wastewater flow delivered to treatment on national level (Source: https://www.sdg6data.org/en; 2022 data).

Figure 4 showy the population connected to at least secondary wastewater treatment for EU Member States and selected other European countries. Secondary treatment requires that wastewater from

urban or other sources is treated by a process generally involving biological treatment with a secondary settlement or other process that removes organic material and reduces its biochemical oxygen demand in 5 days (BOD_5) by at least 70 % and chemical oxygen demand (COD) by at least 75 % (Eurostat, 2023). The population connected to at least secondary wastewater treatment is increasing in most Danube region countries, however, there is still a high proportion of wastewater that is not adequately treated in many countries.

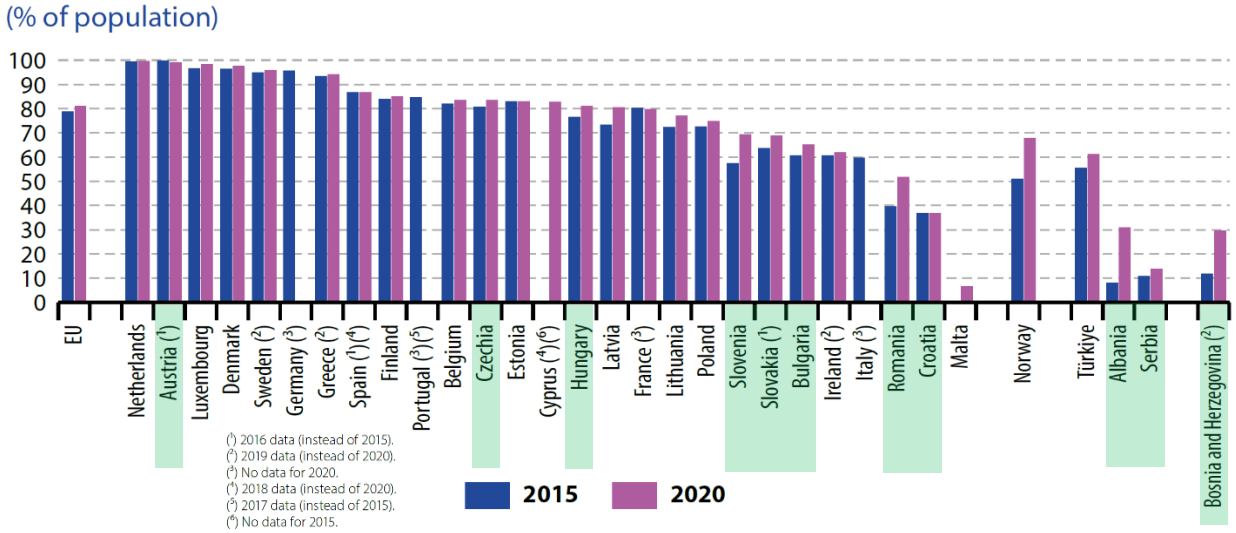


Figure 4: Population connected to at least secondary wastewater treatment, by country, 2015 and 2020; countries in the Danube region are marked in green (adapted from Eurostat, 2023).

The lack of provision in rural areas and the high number of small agglomerations and people living in rural areas show that there is a high demand for sustainable and affordable service delivery models for rural areas.

2. Water service delivery models and recommendations for sustainable rural water service delivery

The term service delivery model goes beyond the management model of the service provider. In general, a number of relatively common approaches a can be found at the service provider level. According to the World Bank Group (2017), the most common models include:

- *Community-based management*. Where communities have been delegated responsibility to operate and manage water facilities; this option includes many variations, from purely voluntary committees, to those with systematic support, to those outsourcing tasks to individuals and even private companies, but where the community retains governance and oversight.
- *Direct local government provision*. Where local governments are non-corporatized service providers for rural communities and directly carry out these services; this is also sometimes referred to as "direct municipal services (which may also include other services such as electricity)"; this model excludes municipal enterprises or corporations, which are classified under public utility provision.
- *Public utility provisio*n. Where a separate public entity is assigned and/or established, which may be at central, regional, or municipal level, to provide management of services for communities or small towns in their assigned service area, which can vary from larger regions to the territory of smaller municipalities. This group includes deconcentrated government entities, government-owned utilities and parastatal companies operating on a more commercial basis.
- *Private sector management*. Where private operators either own water assets and manage the services, or have been delegated responsibility for operation and management of publicly owned water systems through public-private partnership (PPP) arrangements, increasingly under contract of local governments. PPPs may or may not involve private capital investment to build or extend assets.
- *Supported self-supply*. Where households, or small clusters of households, provide their own solutions to water supply; this form of management is most typical in highly dispersed communities. This is still a common option in many developed countries for remote rural populations, as well as in countries where state provision through other management models has not reached very far or services are perceived to be inadequate. This study refers to "supported self-supply" when the approach is formally recognized by government and they have adopted programs of structured support to accelerate and improve service delivery under this model.

Each of these models can be applied in urban and rural settings. Within each typology there can be variations and hybrids depending on context. Additionally, these models may have different "labels" in different countries; there are also a number of different hybrids or variants under this main taxonomy.

The review of the World Bank Group (2017) provides recommendations for the five main building blocks for sustainable rural water service delivery:

1. Institutional capacity
2. Financing
3. Asset management
4. Water resource management
5. Monitoring and regulation

These recommendations for national level, service authorities and service providers are summarised in the following tables.

Table 4: Recommendations for Institutional Capacity (Source: World Bank Group, 2017).

Level	Recommendations
National	- If needed, clarify and define institutional mandates for rural service delivery and oversight - Staff and train national institutions to oversee rural water services - Organize the formation of post construction support systems and identify predictable funding streams - Train technical assistance providers and monitor their effectiveness - Regularly update or develop new national planning, policy and legal frameworks, including for rural PPPs
Service authority	- Limit overlaps between service authorities' functions and central government institutions and clarify responsibilities between all tiers of governments - Staff and train service authorities to fulfil their functions, based on assessment of capacity - Explore mechanisms to create economies of scope and scale in the execution of complex tasks, for example, asset management through third party contracts or delegation to public entities
Service provider	- Assist service providers to be organized into legally recognized entities - Roll out ongoing capacity development programs to build adequate technical, financial, and managerial skills - Create access to regular post construction support services

Table 5: Recommendations for Financing (Source: World Bank Group, 2017).

Level	Recommendations
National	- Identify investment needs and develop investment plan for the rural water sector - Dedicate national funds (taxes, transfers) in support of service authorities - Set up a national tariff policy for rural water supply, with cost recovery provisions for different contexts and pro-poor measures - Explore innovative mechanisms to finance capital maintenance, for example, options such as pooled funding and insurance schemes - Improve public-private partnership (PPP) framework to attract private actors in the rural water sector
Service authority	- Support service authorities in preparing realistic plans, budgets, with multiple funding sources for capital costs, recurrent costs, asset maintenance (if the latter is assigned) - Where possible introduce earmarking for financing major repairs and asset maintenance - and if necessary, in extremely poor contexts for operation and maintenance (O&M), to ensure predictability
Service provider	- Ensure that tariffs at local level are set based on relevant policy and guidelines, taking into account operational costs and requirements for asset maintenance and renewal - Where feasible, support service providers to access commercial finance by strengthening their technical, financial and commercial capacity, support project preparation including due diligence

Table 6: Recommendations for Asset Management (Source: World Bank Group, 2017).

Level	Recommendations
National	- Ensure that national legislation and policies assign ownership of rural water assets to specific entities - Carry out nationwide asset inventories, under leadership of national agencies, as a pre-condition for asset management, to inform evidence-based investment planning - Define the costs for the regular updating of water asset inventories and assign responsibilities to do so - Provide national guidelines and template agreements between service providers and service authorities that clarify responsibilities for asset operations and maintenance
Service authority	- Ensure that asset ownership is clear for service authorities through communications on national policy - Ensure that service authorities have a good knowledge of the water assets (by supporting the development of inventories and maps) - Support service authorities to sign agreements or contracts with service providers that: o specify asset ownership o define responsibilities for maintenance and replacement regimes (distinguishing between minor and major repairs) o identify the source of financing for asset maintenance (as per tariff guidelines) - Roll out adequate planning tools, guidance, and training for service authorities
Service provider	- Reinforce service providers' technical capacity to operate and maintain assets and develop O&M and asset management plans - Build capacity of service providers to implement agreements and execute their asset management plan. This is to make sure that revenues and subsidies (if available) for capital maintenance cover all O&M costs including major repairs (and generate profits for private operators)

Table 7: Recommendations for Water Resources Management (Source: World Bank Group, 2017).

Level	Recommendations
National	- Ensure that water allocation policy and legal frameworks are in place, defining priority for domestic drinking supplies - Support water resources management institutions with licensing and permitting instruments and monitoring tools - Improve compliance of rural water sector actors with water abstraction and licensing requirements
Service authority	- Strengthen representation of the interests of rural water supply users in sub-basin or local water management bodies - Support the coordination between local stakeholders responsible for rural water supply, agriculture, livestock, and other relevant water using sectors as part of water catchment management plans and local water management initiatives - Involve service authorities (and service providers) in these platforms to improve planning, allocation, and management for different competing water uses, especially in water-scarce areas with groundwater supplies
Service provider	- Provide technical support to service providers and service authorities to obtain water permits and participate in local water management initiatives - Train service providers in undertaking catchment protection measures and water safety planning

Table 8: Recommendations for Monitoring and Regulatory Oversight (Source: World Bank Group, 2017).

Level	Recommendations
National	- Designate a national entity in charge of monitoring and regulatory oversight for rural water services - Merge or aggregate project-based information systems into one comprehensive system at national level, allowing for resources and capacity development over time to progressively include: o Service levels, functionality, and water system performance parameters o All service delivery models, even lower complexity schemes, for example, point sources o Sustainability indicators on the effectiveness of technical assistance providers and service Authorities - Implement a national system of benchmarking the performance of all service providers, and set and review performance targets in planning documents - Adapt regulatory requirements to the rural context, so they are not too onerous for rural providers, at least initially, as this can act as a disincentive
Service authority	- Ensure that service authorities are mandated to monitor and oversee rural services - Allocate sufficient resources, provide tools and capacity building for monitoring functions of service authorities, linked to planning of post construction support - Capacity building to support authorities in implementing rural tariff guidelines, or oversee contractual arrangements with private sector (when relevant)
Service provider	- Provide reporting templates and schedules to service providers and include monitoring assistance as part of post construction support - Capacity building on tariff determination as per rural tariff guidelines

3. EU legislation and practice relevant for rural water service delivery

3.1. EU legislation

3.1.1. Relevance of the EU regulation for the Danube region

Water management across the EU must respond to a number of legislative acts which lead to concrete actions and investments in the Member States. EU regulation is relevant for all countries in the DRB as the DRB only comprises EU Member States, Candidate Countries (Albania, Bosnia and Herzegovina, Moldova, Montenegro, North Macedonia, Serbia, Ukraine) and one Potential Candidate country (Kosovo) (https://europa.eu/european-union/about-eu/countries_en).

The main EU directives relevant for rural water service delivery are the EU Drinking Water Directive (DWD, 2020) and the revised EU Urban Wastewater Treatment Directive (UWWTD, 2024). Besides these two directives that will be described in more detail below, the EU Water Reuse Ordinance (2020/741; EU, 2020) might be of relevance (Lohaus, 2024). This Regulation lays down minimum requirements for water quality and monitoring and provisions on risk management, for the safe use of reclaimed water in the context of integrated water management. The purpose of this Regulation is to guarantee that reclaimed water is safe for agricultural irrigation, thereby ensuring a high level of protection of the environment and of human and animal health.

3.1.2. Drinking Water Directive

The EU Drinking Water Directive (DWD, 2020) aims to protect human health from potential dangers arising from the quality of drinking water. Main pillars of EU drinking water policy are (https://environment.ec.europa.eu/topics/water/drinking-water_en):

- to protect human health by ensuring the quality of water intended for human consumption,
- to ensure that drinking water quality is controlled through standards based on the latest scientific evidence,
- to secure efficient and effective monitoring, assessment and enforcement of drinking water quality,
- to provide Europeans with adequate, timely and appropriately information and
- to improve access to water intended for human consumption.

Compared to the 1998 version of the DWD, key features of the revised Directive are (https://environment.ec.europa.eu/topics/water/drinking-water_en):

- reinforced water quality standards, in line or, in some cases, even more stringent than the World Health Organisation (WHO) recommendations,
- tackling emerging pollutants, such as endocrine disruptors and PFAs, as well as microplastics,
- a preventive approach favouring actions to reduce pollution at source by introducing the risk-based approach,
- measures to ensure better access to water, particularly for vulnerable and marginalised groups,
- measures to promote tap water, including in public spaces and restaurants, to reduce (plastic) bottle consumption,
- harmonisation of the quality standards for materials and products in contact with water, and
- measures to reduce water leakages and to increase transparency of the sector.

The EU Drinking Water Directive (DWD, 2020) was published on 23 December 2020 and EU Member States had to transfer the regulations in their national law until 12 January 2023. EU Drinking

Water Directive is the basis for up to now three delegated acts from the EU Commission (Lohaus, 2024):

- On 19 January 2022, the first watch list was adopted. This means that drinking water across the EU will have to be monitored more closely for the potential presence of two endocrine disrupting compounds (beta-estradiol and nonylphenol) throughout the whole water supply chain.
- On 23 January 2024, the Commission adopted new minimum hygiene standards for materials and products that come into contact with drinking water. They will apply from 31 December 2026 to materials and products used in new installations or when older ones are renovated or repaired.
- On 11 March 2024, the Commission adopted a Delegated Decision on a methodology to measure microplastics in water intended for human consumption (available in all languages). This methodology will allow Member States to measure microplastics in drinking water in a harmonised way. The establishment of an EU harmonised methodology by the Commission will support Member States in gaining knowledge about the presence of microplastics in their water supply chain.

3.1.3. Urban Wastewater Treatment Directive

The EU Urban Wastewater Treatment Directive (UWWTD, 1991) regulates the treatment of wastewater from agglomerations larger than 2'000 population. According to Article 2(4), 'agglomeration' means "*an area where the population and/or economic activities are sufficiently concentrated for urban wastewater to be collected and conducted to an urban wastewater treatment plant or to a final discharge point*".

Fulfilment of the UWWTD requires that member states ensure that urban wastewater

- is collected in all agglomerations larger than 2'000 PE (UWWTD Article 3)
- is treated according to the requirements given in the UWWTD (UWWTD Article 4), and
- is more stringently treated in sensitive areas (UWWTD Article 5).

General required treatment levels for wastewater treatment plants (WWTPs) larger than 2'000 PE as well as more stringent treatment levels for sensitive areas are defined in the annex of the UWWTD.

The revision of the UWWTD is ongoing but almost completed. In early 2024 the Council and Parliament found a provisionally agreed on the new UWWTD and this passed the European Parliament on 10 April 2024. Thus, only the formal approval by the Council is pending and the new directive is expected to enter into force end of 2024.

Main changes within the new EU UWWTD are as follows (adapted from https://www.consilium.europa.eu/en/press/press-releases/2024/01/29/urban-wastewater-council-and-parliament-reach-a-deal-on-new-rules-for-more-efficient-treatment-and-monitoring/):

- *Scope of the directive*: To address pollution from small agglomerations, the co-legislators extended the scope of the directive to **include all agglomerations of 1,000 PE and abov**e, as opposed to the 2,000 PE in the current directive.
- *Wastewater collecting systems and management plans*:
  - urban wastewater **collecting systems** should be extended to all agglomerations of 1,000 p.e. or more.
  - If the establishment of a collecting system is not justified, feasible or cost-effective, member states can use **individual systems** to collect and treat urban wastewater.
  - For agglomerations of over 100,000 PE, **integrated urban wastewater management plans** have to be established.

- *Wastewater treatments*:
  - extended the obligation to apply **secondary treatment** (i.e., the removal of biodegradable organic matter) to urban wastewater before it is discharged into the environment to all agglomerations of 1,000 p.e.
  - thresholds and timelines for **tertiary treatment** (i.e., the removal of nitrogen and phosphorus) and **quaternary treatment** (that is, the removal of a broad spectrum of micropollutants) in larger plants of **150,000 PE** and above.
- Extended producer responsibility:
  - in line with the 'polluter pays principle', producers of pharmaceuticals and cosmetics leading to urban wastewater pollution by micropollutants would need to contribute a minimum of 80% of the costs of this additional treatment, through an **extended producer responsibility** (EPR) scheme.
- Energy neutrality and renewables:
  - an **energy neutrality target**, meaning urban wastewater treatment plants will have to produce energy from renewable sources, based on regular energy audits, with progressive intermediate targets.

3.2. Relevance for rural water service delivery

3.2.1. Drinking Water Directive

The impact of the new EU Drinking Water Directive (DWD, 2020) on small suppliers has been a topic strongly discussed during the revision of the DWD. Several requirements such as more frequent monitoring and additional parameters to be analysed are a financial burden especially for small suppliers. For the key features of the revised Directive listed above, the following comments regarding small water supplies can be made:

- New water quality standards:
  - Relevant for all suppliers
- Frequency of monitoring:
  - for water supplies < 10 m³/d: the Member States have to define the frequency
  - for water supplies between 10 m³/d and 100 m³/d: full list of parameters has to be analysed every 6 years.
- Risk-based approach:
  - for water supplies < 100 m³/d the monitoring in the risk management plan can be reduced, however, a risk assessment is required for all suppliers.
- Information of public:
  - all water suppliers have to provide information on water price per m³ and information on water consumption.

The World Health Organisation (WHO) Guidelines for Drinking Water Quality (WHO, 1997) form the basis for EU Drinking Water Directive. Recently, WHO published two documents to support small water supplies (De France, 2024)

- "*Guidelines for drinking-water quality: small water supplies*" (WHO, 2024a): These Guidelines, specifically tailored to small water supplies, build on over 60 years of guidance by the World Health Organization (WHO) on drinking-water quality and safety. They focus on establishing drinking-water quality regulations and standards that are health based and context appropriate; on proactively managing risks through water safety planning and sanitary inspections; and on carrying out independent surveillance. The guidance is intended

primarily for decision-makers at national and subnational levels with responsibility for developing regulatory frameworks and support programmes related to these activities. Other stakeholders involved in water service provision will also benefit from the guidance in this document. Designed to be practical and accessible, these Guidelines offer clear guidance that is rooted in the principle of progressive improvement. State-of-the-art recommendations and implementation guidance are provided, drawn from a comprehensive evidence review and established good practices. Additionally, case examples are provided from countries and areas around the world to demonstrate how the guidance in this publication has been implemented in practice in a wide variety of contexts.

- "*Sanitary inspection packages – a supporting tool for the Guidelines for drinking water quality: small water supplies*" (WHO, 2024b): This publication presents the WHO's sanitary inspection packages. These packages update the sanitary inspection forms in WHO's 1997 Guidelines for drinking-water quality (WHO, 1997) With more than 25 years of practical experience with the application of sanitary inspections, these packages have been developed from a comprehensive evidence review and established good practices. Each package includes a sanitary inspection form, supported by technical guidance and management advice to help ensure the ongoing safe management of small water supplies.

3.2.2. Urban Wastewater Treatment Directive

As already mentioned above, the scope of the revised EU Urban Wastewater Treatment Directive (UWWTD, 2024) was extended and includes now all agglomerations of 1,000 PE and above. This is will be specified in the new Article 3 in which also agglomerations are defined as areas where the wastewater generated is concentrated, i.e., > 10 persons per hectare. In these areas, it is mandatory to connect to a sewer system (if it exists).

"*Individual systems*" are defined in Article 4 of the revised UWWTD (2024). Article 4(1) defines that "*Member States may derogate from Article 3 only if the establishment of a collecting system or the connection to a collecting system is not justified either because it would produce no environmental or human health benefit, or it is not technically feasible, or because it would involve excessive cost. If derogating from Article 3, Member States shall ensure that individual systems for the collection, storage and/or when applicable, treatment of urban wastewaters are used in agglomerations of 1,000 PE and above, or part of these agglomerations*."

Based on the numbers presented in Chapter 1 Introduction, extending the applicability of the UWWTD from 2,000 to 1,000 PE, effects about 10 million population in the Danube River basin living in about 15,000 agglomerations between 1,000 and 2,000 population.

"*Member States shall ensure that the individual systems […] are designed, operated and maintained in a manner that achieves the same level of human health and environmental protection as the secondary and tertiary treatments […]*" in larger agglomerations (Article 4(2)).

For individual systems that are used in agglomerations of 1,000 PE and above, Article 4(3) required that 1) these systems have to be registered in a registry; and 2) regular inspections or other means of regular checks or control of those systems are carried out by the competent authority or other body authorised at national, regional or local level.

Article 4(4) states that the "*Commission is empowered to adopt implementing acts to ensure uniform application of this Directive by specifying minimum requirements for:*

a. *the design, operation, and maintenance of individual systems referred to in paragraphs 1 and 2 and;*

b. *the regular inspections referred to in paragraph 3, including the establishment of a minimum frequency of such inspections depending on the type of individual systems, and based on a risk-based approach.*"

Additionally, Article 4(5) requires that "*Member States that use individual systems to collect and/or treat more than 2 % of the urban wastewater load at national level from agglomerations of 2,000 PE and above"* have to justify why individual systems are used and have to prepare reports to the Commission.

4. Technologies for rural wastewater treatment

A high number of technical solutions are available for rural wastewater management. According to the report from the January 2021 on-line workshop on "*Beyond Utility Reach? How to Close the Rural Access Gap to Wastewater Treatment and Sanitation Services*" (ICPDR & IAWD, 2021), these technologies can be classified as follows:

- On-site collection with off-site treatment
  - Cesspits (with transport to next WWTP or faecal sludge treatment unit)
- Soil as recipient of treated (or partially treated or untreated) wastewater
  - Soak pits, leach fields, etc.
- Solutions with less than secondary treatment
  - Septic tanks, etc.
- Solutions with at least secondary treatment
  - Technological solutions with suspended biomass (e.g., conventional activated sludge plants, SBR – Sequencing Batch Reactor, MBR – Membrane BioReactor)
  - Technological solutions with fixed biomass (e.g., Trickling filter, RBC – Rotating biological contactor, filtration systems)
  - Nature-based solutions (e.g., treatment wetlands)

It is generally agreed that technologies that are simple and robust and that have low operation and maintenance requirements and costs are most suitable for rural areas. Design standards for small WWTPs that allow reaching country specific discharge limits facilitate their implementation.

On-site collection in water-tight cesspits with transport to next to off-site treatment is generally the most expensive solution. On-site treatment is usually the cheaper option.

The discharge level for WWTPs < 2'000 PE defines which technologies can be applied. Most Danube countries require at least secondary treatment, i.e., biological treatment with a secondary settlement or other process that removes organic material by at least 70 % and 75 % for BOD_5 and COD, respectively. In the case of NH_4-N discharge limits, the technology selected needs to be capable of biological treatment including nitrification.

Solutions with less than secondary treatment and with soil as recipient for untreated wastewater might be applied in selected regions if there is no threat of pollution of surface water and groundwater, respectively. If such technologies can be applied depends on the national legislation in the Danube region countries.

In the following tables, main technologies with at least secondary treatment usually applied in rural wastewater management are briefly described. Table 9 describes technological solutions often applied for small WWTPs. In Table 10 the main types of treatment wetlands applicable for secondary treatment of wastewater, the fourth main type, Free Water Surface wetlands, is usually applied as polishing stage (Dotro et al., 2017).

Table 9: Technological solutions with at least secondary treatment often used for small WWTPs (schematics taken from the SSWM Toolbox, SSWM, 2021).

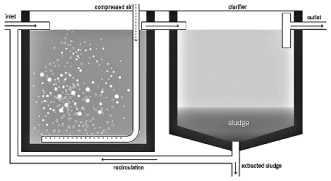
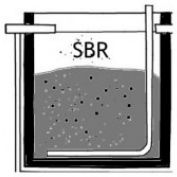
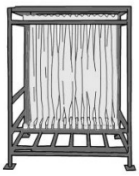
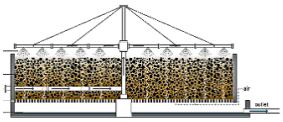
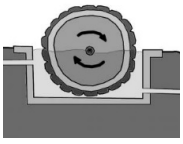
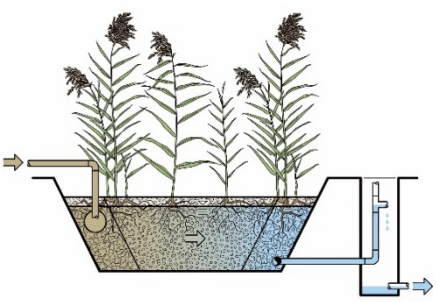
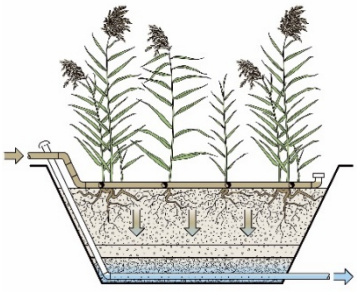
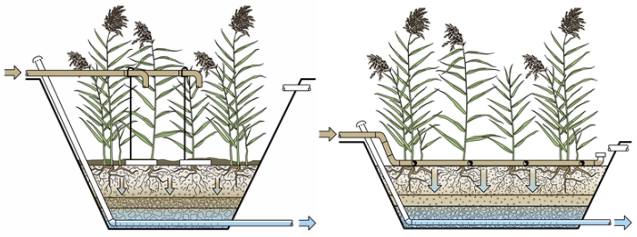
Technological solutions	Short description
Conventional activated sludge (CAS) 	– Biological treatment & secondary clarification in two separated reactors – Continuous flow of wastewater to and from the CAS – Less operational flexibility – Excess sludge has to be managed
Sequencing Batch Reactor (SBR) 	– Equalization, primary clarification, biological treatment & secondary clarification in one single reactor – Effluent is released in batches, i.e., this might cause hydraulic stress for small receiving waters – Operational flexibility but more complex control is required for larger units – Higher level of operation and maintenance required – Excess sludge has to be managed
Membrane Bio-Reactor (MBR) 	– Secondary clarifiers and tertiary filtration processes are eliminated, thereby reducing plant footprint. – High-quality treated effluent, also for reuse in irrigation – However, higher operating costs due to membranes and need of chemical flocculants to produce settling of biosolids – Lower excess sludge production
Trickling filter 	– Fixed-bed, biological reactor that operates under (mostly) aerobic conditions. Pre-settled wastewater is continuously ‘trickled’ or sprayed over the filter – Can be operated at a range of organic and hydraulic loading rates – Primary treatment and treatment of excess sludge required
Rotating biological contactor (RBC) 	– Fixed-bed reactors consisting of stacks of rotating disks mounted on a horizontal shaft. They are partially submerged and rotated as wastewater flows through – Low operational and maintenance requirements – Less operational flexibility but high process stability, resistant to shock hydraulic or organic loading

Table 10: Treatment wetland main types used for secondary treatment of wastewater (adapted from Dotro et al., 2017).

TW type	Short description
Horizontal flow (HF) wetland 	– Wastewater flows horizontally through a sand or gravel-based filter whereby the water level is kept below the surface. – Due to the water-saturated condition mainly anaerobic degradation processes occur. – Effective primary treatment is required to remove particulate matter to prevent clogging of the filter. – Emergent plants (macrophytes) are used. – Are used for secondary or tertiary treatment. – Area requirement: ≤ 4-10 m²/PE
Vertical flow (VF) wetland 	– Wastewater is intermittently loaded on the surface of the filter and percolates vertically through the filter. – During two loadings air re-enters the pores and aerates the filter so that mainly aerobic degradation processes occur. – Effective primary treatment is required to remove particulate matter to prevent clogging of the filter. – Emergent macrophytes are used. – Area requirement: ≤ 2-5 m²/PE
French VF wetland 	– Are VF wetlands for treating screened wastewater. – Two stages of VF wetlands operate in series and in parallel. – Provide integrated sludge and wastewater treatment in a single step. – No primary treatment unit is required. – Area requirement: ≤ 1.5-2.5 m²/PE

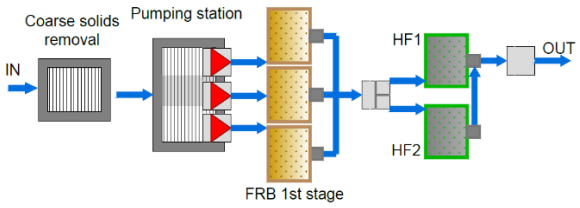
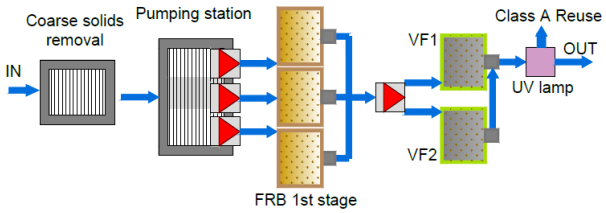
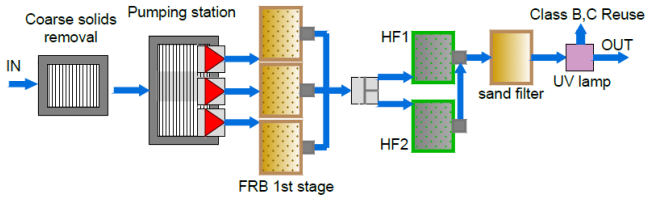
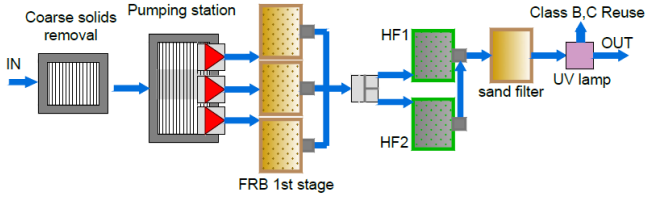
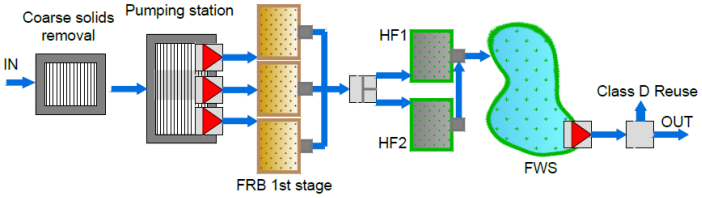
Several studies suggest that nature-based solutions such as treatment wetlands shall be favoured for wastewater treatment facilities with secondary treatment. Pistocchi et al. (2020) present a study focussing on wastewater treatment in Danube region countries. In a feasibility study, various wastewater treatment solutions for three Slovenian villages (with population of 220, 300 to 820, respectively) have been designed and evaluated against costs, social acceptability, technical issues and ecosystem services by experts and stakeholders. The considered technologies included technical solutions, treatment wetlands, enhanced treatment wetlands and solutions with reuse and resource-utilisation in mind. It has to be noted that not all technologies investigated result in the same treatment level. The outcomes of the study suggest that there are considerable advantages of nature-based solutions, i.e., treatment wetlands, for wastewater treatment in rural areas and small agglomerations, throughout the Danube region countries. Treatment wetlands offer significantly higher cost-effectiveness than more "technological" and centralized solutions, particularly because it can significantly reduce the O&M costs compared to technical solutions.

It is generally known that treatment wetlands if properly designed and constructed can achieve the same if not better treatment levels as technical solutions such as activated sludge plants. Treatment wetlands have significantly lower O&M costs and can achieve required level of pollution reduction

with smaller per PE costs (Umweltbundesamt and IOW, 2017). There is also a high level of knowledge regarding implementation and performance of treatment wetlands at the expert and scientific levels in central and eastern European (CEE) countries. However, the transfer into practice is insufficient, and there is low awareness and recognition of treatment wetlands at the institutional and administrative levels (Bodík et al., 2012; Istenič et al., 2016).

The EU Water Reuse Ordinance defines four classes of anticipated reuse of the treated wastewater in agriculture. IRIDRA et al. (2022) showed that with wetland technology it is able to achieve all reuse classes as defined by the EU Water Reuse Ordinance (EU, 2020). Table 11 shows the wetland technologies selected to achieve specific treatment goals related to reuse.

Table 11: Wetland technology selection related to anticipated reuse of treated water. FRB = French Reed Bed, i.e., first stage of a French VF wetlands; HF = Horizontal Flow Wetland; VF = Vertical Flow Wetland; FWS = Free Water Surface Wetland (adapted from IRIDRA et al., 2022).

Reuse class	Treatment line	Schematics
No reuse, only discharge	FRB + HF Gross area: 28,900 m²	
Reuse, class A	FRB + VF + UV lamp Gross area: 34,550 m²	
Reuse, class B	FRB + HF + sand filter + UV lamp Gross area: 28,850 m²	
Reuse, class C	FRB + HF + sand filter +UV lamp Gross area: 28,850 m²	
Reuse, class D	FRB + HF + FWS Gross area: 56,300 m²	

5. Situation of rural water service delivery in the Danube River basin countries

5.1. Access to water supply and sanitation

Figure 5 and Figure 6 show the 2015 data of the share of population in the Danube region with piped water sewer connection, respectively. It is quite obvious that in almost all countries the share of population in rural areas that has access to services is lower than the share of population in urban areas. The difference for sewer connection is much higher compared to access to piped water.

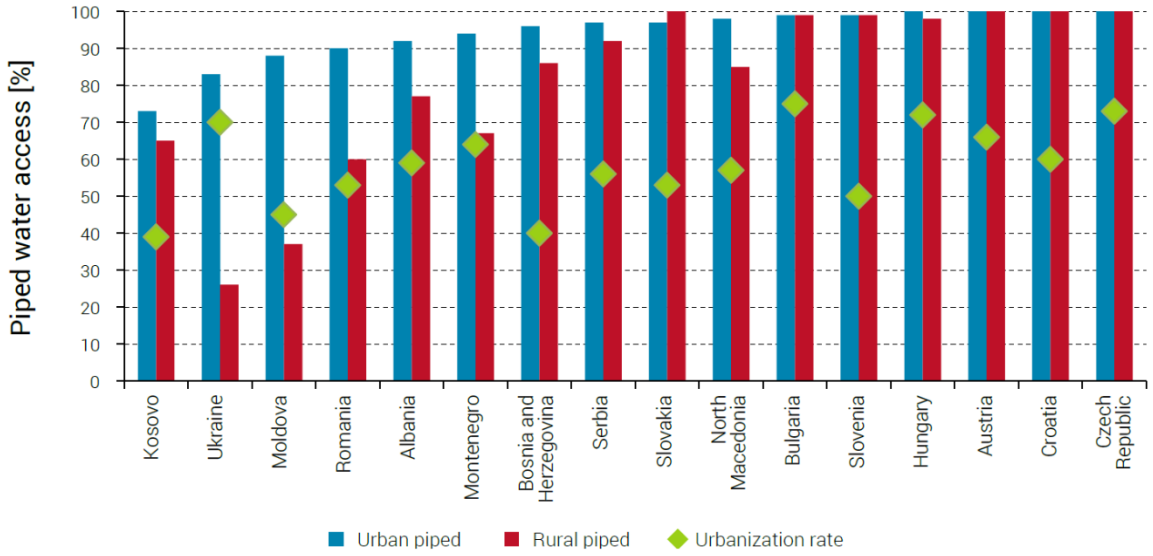


Figure 5: Share of population with piped water in the Danube region, 2015 (Source: World Bank Group, 2019).

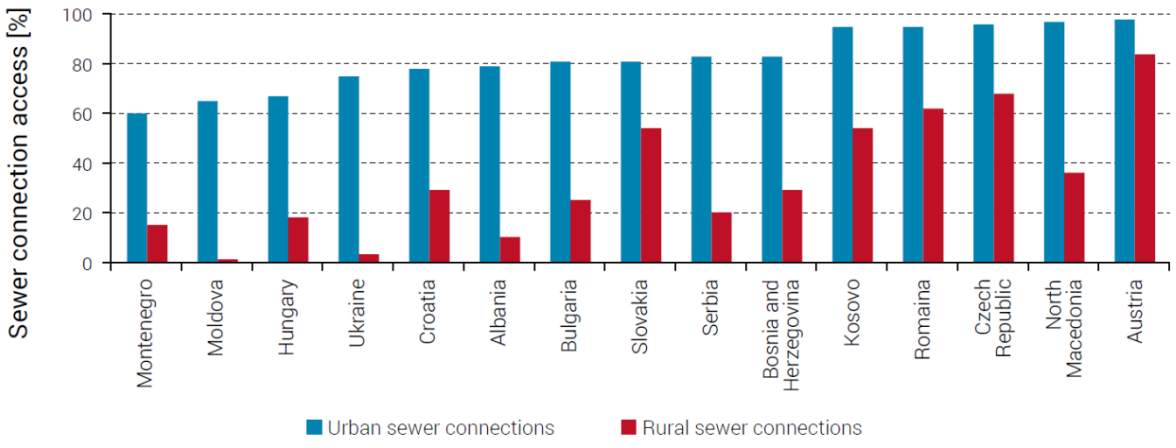


Figure 6: Share of population with sewer connection in the Danube region, 2015 (Source: World Bank Group, 2019).

The water service providers' distribution in the Danube region is shown in Figure 7. The average values over all countries show the following distribution:

- Self or informal providers: 18 % or ca. 24.3 million persons served;
- Municipal providers: 28 % or ca. 37.4 million persons served;
- Private providers: 11 % or ca. 44.7 million persons served;
- Small formal providers: 6 % or ca. 8.4 million persons served; and

- Regional providers: 37 % or ca. 48.9 million persons served.

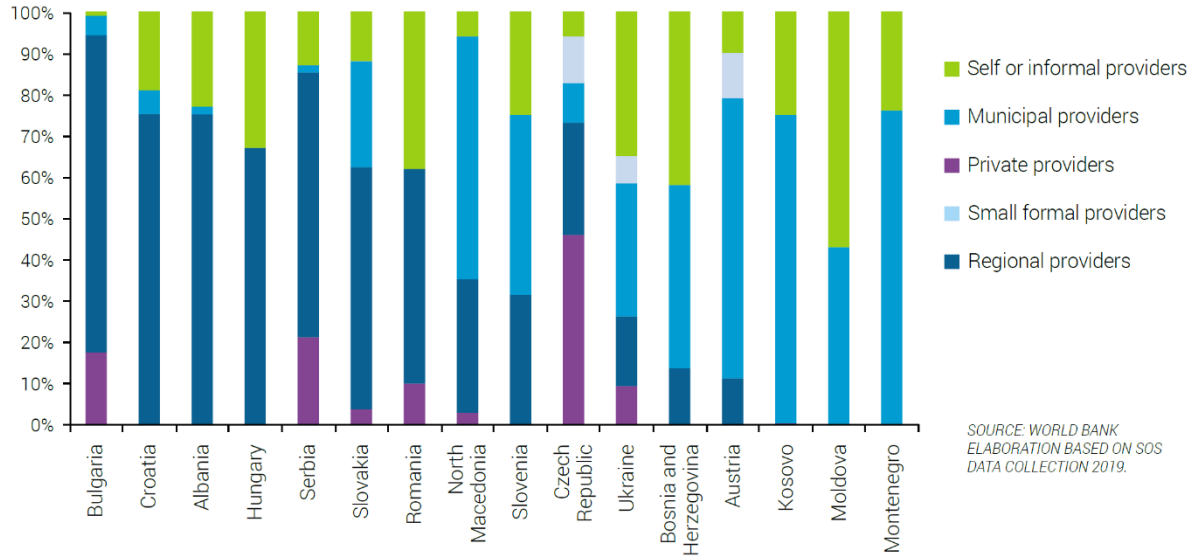


Figure 7: Water service providers' distribution in the Danube region by country, 2018 (Source: World Bank Group, 2019).

5.2. Service provision in rural areas

Table 12 shows data on access to rural water supply in seven selected countries in the Danube region, Figure 8 the share of self-supply households and their service level characteristics by management models. Across the seven countries, around 60 percent of all self-supply households have high levels of accessibility through indoor piped taps, which is an important determinant of better hygiene practices. Most self-supply households in Albania, Bosnia and Herzegovina, Croatia, and Kosovo have self-invested in a piped conveyance and storage system so that pressured water is delivered into their homes. Water supply reliability is high among self-supply households in the region, with, on average, around one in four households reportedly experiencing a service outage over the past year (World Bank Group, 2018). The World Bank Group (2018) study revealed that i) accessibility levels are much higher for connected households: 92 percent of connected households have access to piped water in the home, compared to 60 percent of self-suppliers; and ii) self-supply households are more satisfied with reliability than connected households; only 29 percent of self-suppliers have experienced water outages in the past year compared to 52 percent of those connected.

Table 12: Access to rural water supply in the Danube region (Source: World Bank Group, 2018).

Country	Rural population (millions)	Rural piped access on premises (%)	Rural piped access by utilities (%)	Rural piped access by local operators (%)	Rural piped access by self-supply (%)	Rural non-piped access by self-supply (%)
Albania	1.2	81	24	57, split not known		19
Bosnia and Herzegovina	2.1	88	20	16	52	12
Croatia	1.7	98	67	8	23	2
Kosovo	1.1	70	55	15	10	20
Moldova	1.9	46	1	30	15	54
Romania	8.9	60	17	23	20	40
Ukraine	13.5	34	0	34, split not known		66

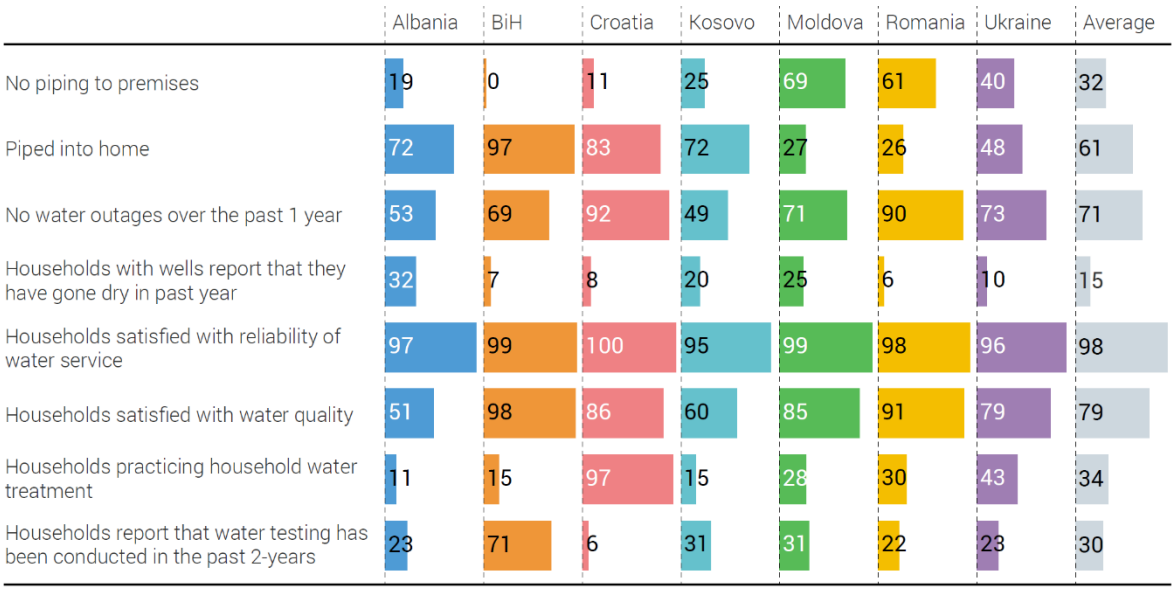


Figure 8: Share of self-supply households and their service level characteristics by management models and by country (Source: World Bank Group, 2018).

In most countries, satisfaction with the water quality of self-supply is generally high (Figure 9), although households are neither testing their water quality frequently, nor treating the water at home before consumption. Self-suppliers have similar satisfaction levels with water quality (79 %) as households reached by service providers (77 % to 84 %, respectively), except for those served by standalone systems under regional utility management (64 %). However, perceptions may not match actual water quality; public health risks may be highest for self-suppliers and those served by local operators due to weak water quality treatment. With rural households using their own, often untested sources for drinking, household water treatment becomes a potentially important protective measure to ensure the safety, particularly regarding microbiological contamination. In most countries, the public accessibility, availability, quality, and coverage of groundwater data are poor, and public health risks for self-suppliers in Moldova, Romania, and Ukraine are not well understood. For countries where self-supply is likely to be an important part of the solution to universal access, a systematic "supported self-supply model" that addresses water safety concerns and improves water accessibility in the home may be considered.

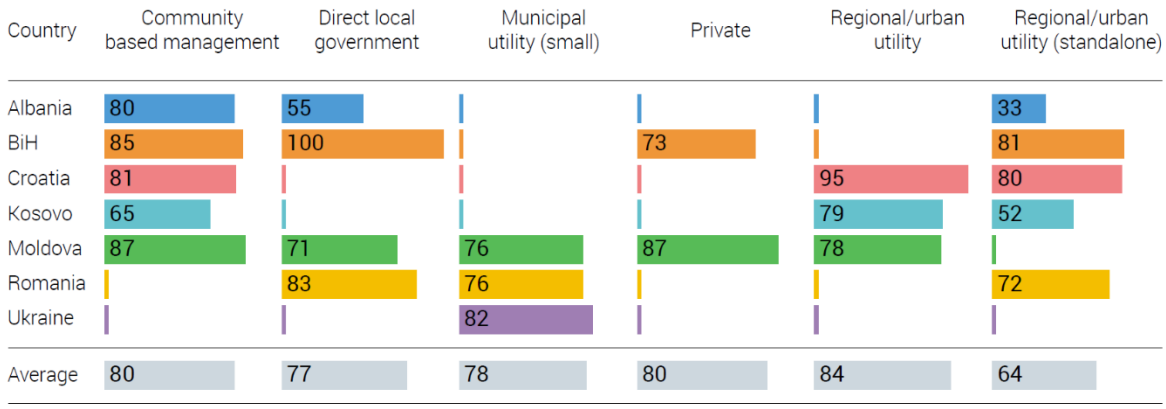


Figure 9: Share of connected households satisfied with water quality (Source: World Bank Group, 2018).

Local service providers, such as small municipal enterprises, local government units, and private operators, have well-established payment practices, just like regional and urban utilities. Community-

based operators are less likely to collect payments from users. While urban and regional utilities typical issue invoices, this is suboptimal for stand-alone systems managed by RWCs in Kosovo and utilities in Albania. Local operators, especially community operators, have weak invoicing practices. Consistent meter reading and volumetric billing (not flat rates) are issues to be addressed for rural schemes under regional and urban utility management; this may help curb illegal connections. Figure 10 shows the share of connected households that report for paying for water having a water meter.

Country	Community based management	Direct local government	Municipal utility (small)	Private	Regional/urban utility	Regional/urban utility (standalone)
Albania	66	77				90
BiH	75	100		100		97
Croatia	100				100	92
Kosovo	29				83	77
Moldova	80	100	97	98	100	
Romania		99	99			98
Ukraine			93			
Average	70	94	96	99	94	91

Country	Community based management	Direct local government	Municipal utility (small)	Private	Regional/urban utility	Regional/urban utility (standalone)
Albania	56	48				78
BiH	59	100		84		94
Croatia	73				99	99
Kosovo	31				87	86
Moldova	73	99	88	99	100	
Romania		94	99			97
Ukraine			72			
Average	58	85	86	92	95	91

Figure 10: Share of connected households that report for paying for water (top) and that report having a water meter (bottom) (Source: World Bank Group, 2018).

Average tariffs were similar across local operators, typically ranging between €0.40 and €0.50 per cubic meter. Tariff levels for urban and regional utilities are similar for Albania, Kosovo, Bosnia and Herzegovina, and Moldova, but significantly higher for Romania and Croatia. However, commercial and financial performance monitoring are weakly implemented by local rural water supply operators, especially community-managed operators; capacities are better for urban and regional utilities and private operators (World Bank Group, 2018).

Table 13 provides the recommendations derived in the World Bank Group (2018) to improve the enabling environment for rural water services at the national level for the five elements of the enabling environment for sustainable service delivery, i.e., institutional capacity, financing and affordability, asset management, water resources management, and monitoring and regulatory oversight

Table 13: Recommendations to improve the enabling environment for rural water services at the national level (Source: World Bank Group, 2018).

Institutional capacity	- Recognize rural services as part of a broader development agenda, balancing the tendency of urban-biased programs and policies. - Develop an overarching sector strategy, legislation, and planning framework that explicitly addresses urban/rural inequalities through phased targets. - Ensure that the portfolio of service delivery models is reflected in policies and programming measures. - Develop training programs and build capacity of service providers, including local ones, and local governments to implement their mandates; this may require programs or institutional solutions to overcome fragmentation. - Create decision-maker support for a supported self-supply model; implement and evaluate a pilot program.
Financing and affordability	- Develop dedicated funding windows or earmark national funds to ensure that a slice of national sector programs are directed to investments in rural areas. - Develop transparent guidelines for prioritization (e.g., based on safety risks, low access, willingness of co-investment from local level). - Introduce stronger incentives, conditionality, and accountability to finance rural expansion as part of investment funds for regional and urban utilities. - Develop and implement pro-poor measures to address connection barriers for the poor and vulnerable (e.g., minorities). - Ensure that tariffs remain affordable, when needed, through social tariffs, while optimizing cost recovery.
Asset management	- Clarify asset ownership for all management models and adapt legal framework to formalize all management models in line with realities and vision on service delivery; ensure that legal framework is widely understood. - Support at-scale asset inventories in rural areas to identify investment needs and support asset transfers under aggregation of service delivery models.
Water resources management	- Support local governments and all service providers in ensuring that water abstraction permits are secured and that local conflicts are addressed. - Carry out campaigns to ensure that misuse and unauthorized use of drinking water for agriculture is minimized.
Monitoring and regulatory oversight	- Develop simple licensing for all operators, link licensing to performance monitoring systems for all water service providers, including simplified indicators to measure performance of local water operators. - Develop oversight for adequate tariff setting by means of guidelines and external checks that are suitable for the conditions of local water operators. - Increase transparency on water quality information for rural water services through dedicated water safety programs. - Develop relevant instruments for regulating self-supply supported with behavioral, communication, and economic instruments.

Data on sanitation service provision in rural areas of the Danube countries are scarce. The study on seven countries in the Danube region (World Bank Group, 2018) revealed that

- Piped water in the home is an important driver for flush toilet access, but not the only one.
- Access to flush toilets is generally high, with Romania, Ukraine, and especially Moldova being a notable exception. Accessibility, convenience, and privacy are higher for flush toilets due to the in-door location (Figure 11, top).
- Most households using flush toilets are satisfied with their sanitation facilities and conditions, while most pit latrine using households are not.
- Affordability is a main barrier preventing households using pit latrines from upgrading to flush toilets; households' willingness to pay is fairly high, indicating a latent demand.
- Sewerage coverage is low, except in Kosovo, and most households have on-site fecal sludge containment facilities; households' willingness to pay is substantially lower for sewer connection than for flush toilets.

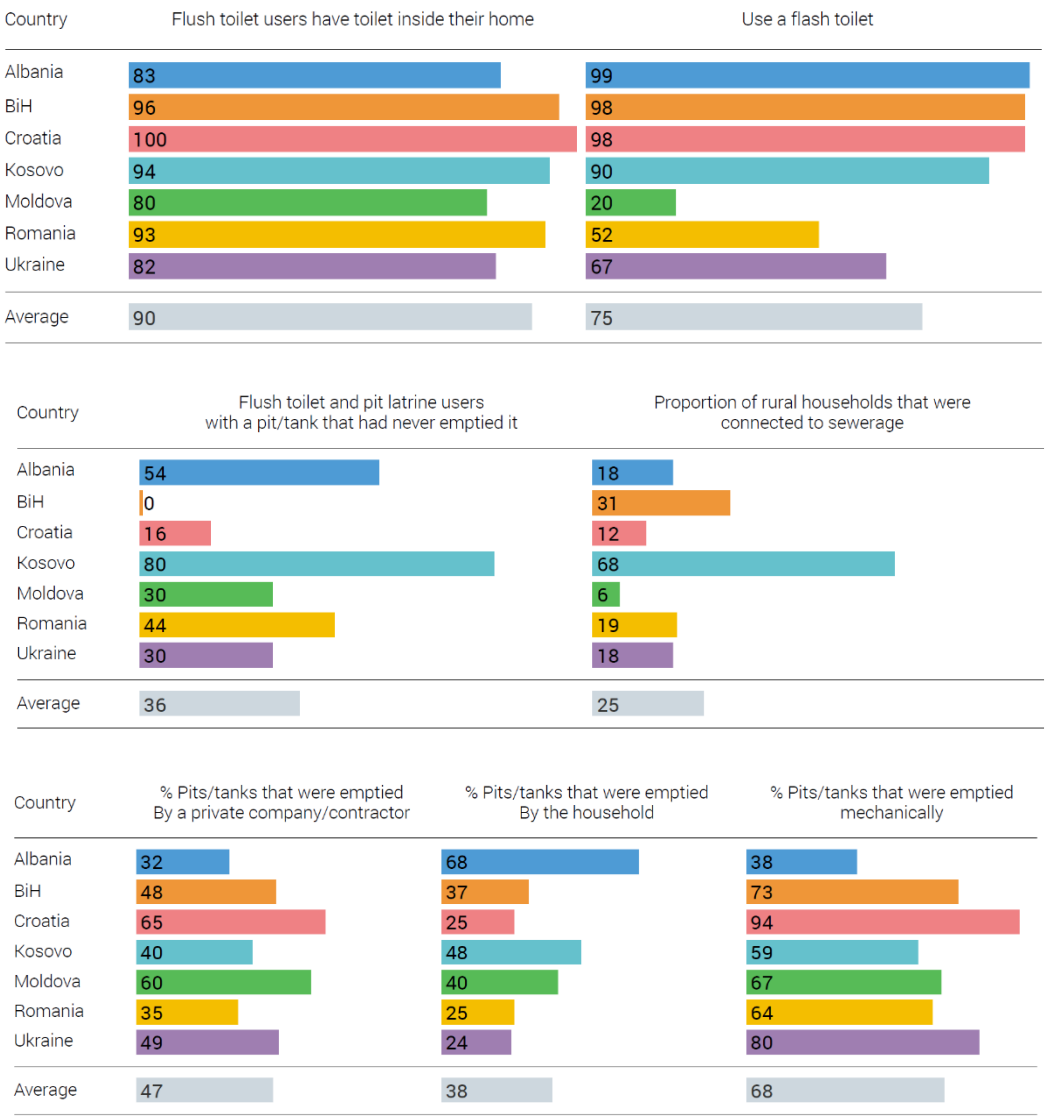


Figure 11: Level of sanitation services by country: Share of flush-toilet users with indoor toilet and share of households using a flush toilet (top); Emptying practices of households connected to sewer network (middle); and pit and tank emptying methods (bottom) (Source: World Bank Group, 2018).

Figure 11 (middle) shows that in Kosovo and Albania, most households have never emptied their tanks or pits, while the majority in Romania, Moldova, Ukraine, Croatia, and Bosnia and Herzegovina have. Most households that have emptied their pit or tank have done this mechanically, mostly using a local private service provider; except in Albania where most emptying is done manually (Figure 11, bottom). Local governments have little involvement in rural sanitation; nor do they actively promote and supervise flush toilet or septic tank construction; nor are they able to offer emptying services. Only in Ukraine do municipal utilities offer emptying (World Bank Group, 2018).

5.3. Financing

Figure 12 shows the proportion of sector financing from tariffs, taxes and transfers. New EU Member States and Candidate Countries receive higher financing from transfers compared to other countries. Share of overall expenditures going towards O&M and investments is shown in Figure 13. In 2017, several countries did not invest in wastewater infrastructure at all (Kosovo, Moldova, Montenegro

and Ukraine). Total expenditure in the water sector is generally below 1 % of GDP (except for Montenegro and Romania with > 1.5 %).

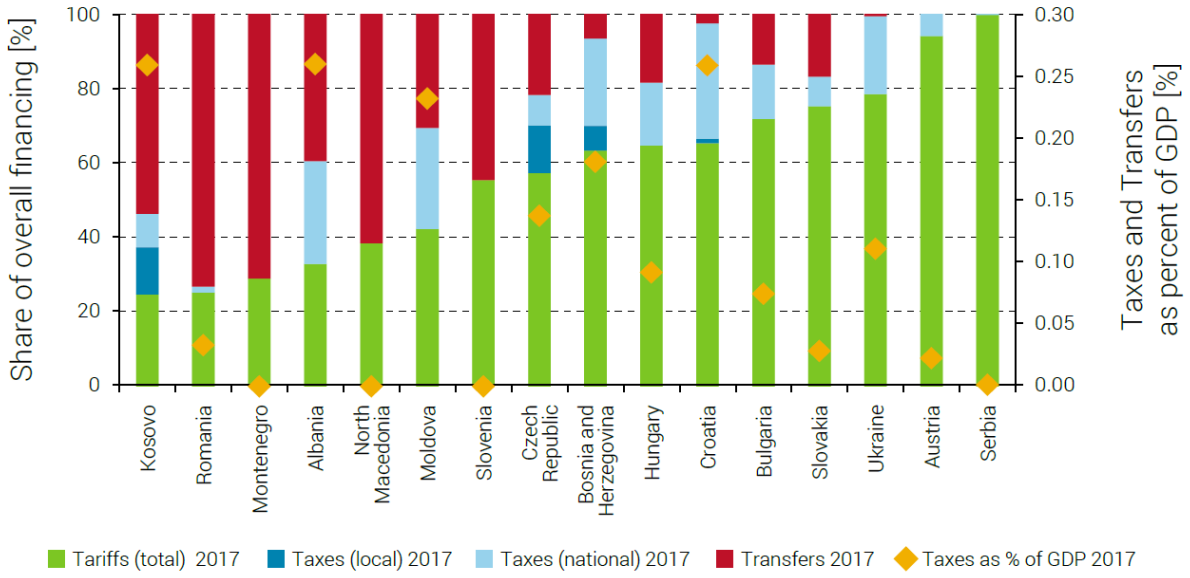


Figure 12: Proportion of sector financing from tariffs, taxes and transfers in the countries of the Danube region (Source: World Bank Group, 2019).

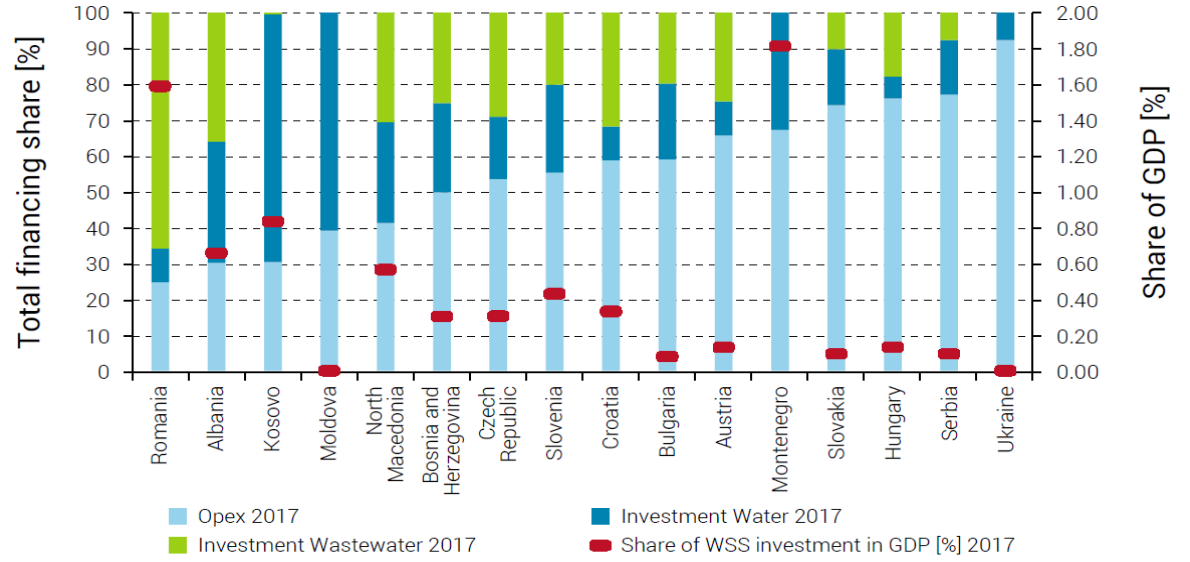


Figure 13: Share of overall expenditures going towards O&M and investments (Source: World Bank Group, 2019).

Smets (2004) derived three key facts to close the urban-rural gap:

1. Developing the enabling environment, policies, legislative framework, financing and support measures for all delivery models.
2. Achievement of SDGs requires multiple service delivery models for rural areas operating in parallel:
   - Regional/urban service providers expanding to rural areas;
   - Supporting local operator models, through professionalization; and
   - Improving self-supply for dispersed populations.

3. Sanitation solutions for rural areas need to go beyond sewerage, anchored in local reality and require local government engagement.

5.4. Experiences from various countries

Maringer (2024) presented the experience in rural water service provision of Upper Austria. In Upper Austria there are about 4,000 villages with less than 20 buildings. Water cooperatives are governed by public law and have been specifically developed to serve rural areas. Members of a water cooperative are the users and the water/wastewater system is common property if the members. In Austria about 3,400 cooperatives exist. They predominantly serve communities, small villages and settlements in rural areas. In Upper Austria, there are more than 1,150 drinking water cooperatives (with about 500 drinking water cooperatives having less than 10 members) and about 260 wastewater cooperatives (with about 150 wastewater cooperatives having less than 10 members). The largest drinking water cooperatives have more than 1,000 members whereas the largest wastewater cooperatives have less than 250 members. In the Federal Stat of Upper Austria an umbrella organisation guides and supports the activities of the water cooperatives. *OÖ Wasser* was founded in 1946 by a unanimous resolution of the Upper Austrian Parliament as a one stop shop of consulting, supporting and representing to water cooperatives. The objectives of the umbrella organisation include help in procuring spare parts and equipment, organise and maintain training courses (various topics for members of cooperatives) and facilities for instruction, as well as act as an advocate representing the interests of members. *OÖ Wasser* also provides group insurances for all water cooperatives and supports claims processing in required. The umbrella organisation *OÖ Wasser* thus supports small cooperatives in keeping their water treatment state-of-the-art, self-determinate, cost effective, local- based, independent and crises proofed. Long-time experience shows wate cooperatives with a support organisation is a sustainable model fit for the future.

Vouk and Gabrić. (2024) presented the situation in Croatia with more than 6,300 settlements with less than 2,000. The situation of rural wastewater treatment in Croatia is still poor, up to now there is no Croatian legislation for small agglomerations. Joining EU increases financial resources available for water and sanitation. Various examples of implemented systems smaller scale have been shown, including the vacuum sewer system of Galdovo for 7,000 persons (one of the biggest vacuum sewer systems sin the world). For small-scale wastewater treatment technologies exaplmes have been shown for conventional activated sludge, rotating biological contractor, and treatment wetlands (e.g., Kaštelir-Labinci for 2,000 PE).

The situation in Czechia was presented by Gremlica (2024) Czechia has more than 4,700 villages with less than 1,000 population (below 200: ca. 1,350; 200-500; ca. 2,000; 500-1,000: ca. 1,400). This is a high number of municipalities compared to neighbouring states. In Czechia, the number and share of inhabitants living in small municipalities up to 2,000 population increased between 2010 and 2020, this is quite contrary compared to a lot of other countries in which the population in rural areas decreases. About 1,200 municipalities, mostly small ones, do not have water supply for public use, and the inhabitants are thus dependent on individual sources or municipal wells. In 2022, the share of population supplied with water from water supply systems in Chechia was 95.6 % and the share of population permanently living in houses connected to sewerage 87.3 %. The number of wastewater treatment plants in operation was 2,915. To date, wastewater treated in 70% of agglomerations between 1,000 and 2,000 PE

Finally, Baskovich (2024) presented the situation of rural water service delivery in three Latin American countries:

- Costa Rica has about 5 million inhabitants of which 27 % live in rural areas follows a community empowerment approach. 32% rural people served by about 1,500 ASADAs. An ASADA is a communal organization that builds, administrates, maintains, and operates the rural water supply and sanitation (RWSS) systems. A national entity serves as umbrella

organisation and is the technical governing body, offers centralized technical assistance, supervision and evaluation to ASADAs.

- Brazil has about 190 million inhabitants of which 16 % live in rural areas. 33% rural people served by 8 SISARs. A SISAR is an alliance of communal organizations in the same watershed that maintains and gets in charge of supplies for operation of RWSS systems, including social and environment training. The SISAR also makes commercial processes and water quality assurance.
- Colombia has about 46 million inhabitants of which 23 % live in rural areas has a territorial approach. 27% rural people served by 2,455 providers. Differential schemes have ad-hoc regulations and policies to offer progressive WSS services improvements. This territorial approach includes a M&E system, intersectoral coordination, subsidies, water quality control, ad-hoc technologies.

Baskovich (2024) concluded that a renew rural agenda for water service delivery in Latin America requires:

- Recognize there is a new rural identity, that demands better service standards.
- Accelerate government efforts to count with reliable in country information systems that can estimate the real financial and management effort that must be made to meet the SDG 6 targets by 2030 It is not more about access, it is about safely managed that requires accessibility, availability, and no pollution.
- We do not leave anyone behind, especially the last rural mile, where poorest, vulnerable and mostly indigenous population used to live.
- For that, a transformational holistic approach is needed. An approach that calls for building resilience and sustainability of the subsector, the recognition of the new rural identity, and calls for collaboration and inclusion.
- Focus on results, scale, resilience and sustainability.

5.5. Field visit

To share the Austrian experience regarding the organisation of rural water service delivery, if the workshop, small-scale water supply and wastewater systems in Lower Austria have been visited during the field trip on the second day. The visited systems comprised the following

1. Wastewater treatment systems in Oberndorf/Melk:
   - Plant 1 – SBR designed for 80 PE, 25 houses (wastewater cooperative Lingheim, Figure 14).
   - Plant 2 – SBR designed for 20 PE + sludge drying bed, 3 houses + milk washing wastewater (Figure 15, left).
   - Plant 3 – VF wetland designed for 9 PE, 1 single house (Figure 15, right).
2. Small drinking water cooperative Scheibbsbach (Figure 16)
   - Distributes drinking water to 34 houses, cooperative has no own water source but takes care of water distribution in the hilly areas North-East of the district capital Scheibbs.

Figure 14: Plant 1: SBR designed for 80 PE. Mr. Stamminger, chair of the wastewater cooperative Lingheim explains the treatment plant (left), and water quality measurements inside the operating building (right).

Figure 15: Planted sludge drying bed for SBR designed for 20 PE (plant 2, left) and Vertical Flow wetlands designed for 9 PE (plant 3, right).

Figure 16: Drinking water cooperative Scheibbsbach: pumping station (left) and view from inside the water reservoir (right).

Figure 17: Participants of the filed visit on 18 April 2024 near the water reservoir of the drinking water cooperative Scheibbsbach.

6. Summary

EU water legislation

- All countries in the Danube River basin are either Member States of the EU, Candidate Countries or Potential Candidates the EU legislation is applicable to the whole Danube River basin
- The new EU Drinking Water Directive (DWD, 2020) should have been already implemented in the Member States and is the basis for delegated acts from the EU Commission (e.g., up to now on monitoring of two endocrine disrupting compounds, minimum hygiene standards for materials and products that come into contact with drinking water, and on a methodology to measure microplastics in water intended for human consumption. Several requirements of the DWD such as more frequent monitoring and additional parameters to be analysed are a financial burden especially for small suppliers. A risk assessment is required for all suppliers independent of their size.
- The revised EU Urban Wastewater Treatment Directive (UWWTD, 2024) has more impact to rural areas as its applicability is now for all agglomerations above 1,000 population (instead of 2,000 before). In the Danube River basin, this effects about 10 million population living in about 15,000 agglomerations between 1,000 and 2,000 population. Besides more clear requirements have been set for individual systems, i.e., small wastewater treatment plants smaller than 1,000 PE.
- The EU Water Reuse Ordinance (EU, 2020) lays down minimum requirements for water quality and monitoring for the safe use of reclaimed water in the context of integrated water management mainly for agricultural irrigation. Treated wastewater has thus now been legally defined as source for irrigation water.

Updated WHO guidelines

- The WHO recently published two documents to support small water suppliers, i.e., "*Guidelines for drinking-water quality: small water supplies*" (WHO, 2024a) and "*Sanitary inspection packages – a supporting tool for the Guidelines for drinking water quality: small water supplies*" (WHO, 2024b).

Water service delivery models

- It is required to develop the enabling environment, policies, legislative framework, financing and support measures for all rural water service delivery models
- For achieving universal access in rural areas, multi-service models are required that operate in parallel, by i.e., regional/urban service providers expanding to rural areas, supporting local operator models; and improving self-supply for dispersed populations
- The share in financing of rural water services from tariffs should become higher. Subsidies for implementation of rural water services will be required to ensure full access
- It has to be recognized that rural small-scale solutions often require in higher expenses per person compared to decentralized solutions. This results in the fact that rural areas that are often poorer regions have to pay more. Subsidies thus have to take areas with different incomes into considerations.

- Support needs to be provided to rural water service providers not only during implementation but also during running the systems. Umbrella organisations that serve and support small service provider have shown to be a sustainable way to allow small service providers to guarantee excellent service over a long period.
- Examples from Latin America show that similar service provision models for rural areas are in place when compared to the

Situation in the Danube River Basin

- There is need for large improvement of wastewater infrastructure in the Danube River basin. 20 million people in the Danube River basin only have access to basic infrastructure. As experience from new EU Member States and Candidate Countries shows, accession to the EU makes available financial means for water and wastewater infrastructure.
- It is estimated that for 50% of the population living in agglomerations of 2,000 – 5,000 population in the Danube River basin (mainly in new EU Member States and Candidate Countries) no collection (ant treatment) of wastewater exists. This are an estimated 10 million people living without any collection.
- Very little information on small water supply and wastewater systems available in most countries in the Danube River basin. There are about 10 million population living in about 15,000 agglomerations between 1,000 and 2,000 population that are directly affected by the changes caused by the revised EU Urban Wastewater Treatment Directive (UWWTD, 2024) that lowers the applicability to agglomerations above 1,000 population (instead of 2,000 before). These additional 10 million population in 15,000 agglomerations require adequate wastewater treatment.
- The revised EU UWWTD gives more clear requirements also for individual systems, i.e., small wastewater treatment plants smaller than 1,000 PE. In the Danube River basin, about 11.2 million population lives in about 56,000 agglomerations below 1,000 persons. This huge number of small agglomerations also requires sustainable water and sanitation services.
- Financing is a huge challenge. Due to the lower population density in rural areas, investment costs for infrastructure per person connected are higher compared to larger settlements with higher population density. Often, rural areas are poorer compared to more densely populated areas. This results in the fact that poorer people have to pay more for water and sanitation services. Subsidies that consider this inequality and that are higher for rural areas should be naturally.
- Up-stream countries have been (partly) over fulfilling the UWWTD requirements, e.g., small WWTPs also have been obliged to biological treatment a long time ago. Support systems (e.g., subsidies and umbrella organizations from small providers) have been in place and are stable since decades. Models for these support systems from up-stream countries as well as experiences running them are a valuable input when developing and implementing support systems in other countries in the Danube River basin.

7. Conclusions and recommendations

General

- Rural water service delivery is a **challenge in all countries of the Danube River basin**.
- Untreated or inappropriate treated wastewater from rural developments is the most important contributor of surface water contamination via point sources, the importance of rural wastewater management is still widely neglected. Small WWTPs play an important role for the overall treatment of wastewater and to improve water quality specifically of small receiving waters and groundwater in rural areas.
- As all countries in the Danube River basin are either Member States of the EU, Candidate Countries or Potential Candidates the EU legislation is applicable to the whole Danube River basin.
- The EU DWD provides the framework for drinking water supply. Recently published WHO documents (WHO, 2024a, 2024b) support the implementation especially for small water suppliers.
- A clear **policy framework** for enabling and supporting rural wastewater management was lacking especially for wastewater treatment. The **recast of the UWWTD** should provide more clarity as the scope is now for all agglomerations of 1,000 PE and above. Additionally, more guidance is provided for smaller individual systems, however, requirements will become stricter.
- Water **availability** might be a challenge for small water suppliers due to **climate change**. Thus, **alternative water sources** (such as treated wastewater) **for non-potable uses** have to be explored. The EU Water Reuse Ordinance provides a legal framework for

Technologies

- Local communities should be able to operate the systems, i.e., technologies that are **simple and robust** and that have **low operation and maintenance requirements** and costs are required.
- However, **every technology requires operation, monitoring and maintenance**. If a technology is not operated and maintained well, even the simplest technology will fail. Only if operation, monitoring and maintenance is ensured, wastewater treatment systems will function over a long time.
- Experience shows that **treatment wetlands** - if properly designed, constructed & operated - can achieve the same (if not a better) treatment level as technical solutions. Treatment wetland have lower operation and maintenance requirements compared to technological solutions.
- **Design** of treatment systems should be made with **having use of treated wastewater** as target. Experience shows, that treatment wetlands can produce effluent quality suitable for different quality levels according to the EU Water Reuse Ordinance.

Implementation

- Financing rural wastewater management poses a significant challenge for Danube region countries. Thus, **clear financing strategies and financial support** for the countries would facilitate the development and implementation of national action plans to improve access to wastewater treatment and sanitation services of the rural population.

- Regional differences regarding affordability and social aspects need to be considered when developing action plans. For rural communities, financial support is required. Besides investment costs which are often supported in the form of subsidies, also coverage of costs for operation, monitoring and maintenance needs to be considered.

Operation, monitoring and maintenance & capacity building

- Operation, monitoring and maintenance (**OM&M**) of the implemented system **has to be planned from the start of a project**. This includes the definition of responsibilities for supervision at regional and/or country level.
- There are a number of rural water service delivery models that have been successfully applied. Experience from other countries can help to develop suitable models for OM&M for the Danube region, e.g., **water and wastewater cooperatives with regional umbrella organisations** and/or larger utilities that take over the operation and monitoring of small systems. However, fining persons for **voluntary work** is getting more challenging.
- For OM&M, **training of owners/operators is key** because the likelihood that the plant is safely managed increases if owners/operators are trained and thus understand why operation, monitoring and maintenance is important. National or regional training facilities allowing hands-on training of operators should be established. Special tailor-made trainings should also be offered to decision-makers such as community leaders and authorities.
- Usually, subsidies are only available for the implementation of the system. **OM&M is never subsidised**. A policy framework for enabling and supporting the development of new service models for rural wastewater management, to be supplemented by financing solutions for both investments and operation of systems should be established.

Future efforts required at international and national level

Based on the recommendations given above, the following efforts to support sustainable rural water and sanitation service delivery are required from the World Bank and ICPDR at international level, and the countries in the Danube Region at national level, respectively:

- On international level, funding for new infrastructure and for upgrading of existing infrastructure should by made available not only to large agglomerations. Also, the high number of small agglomerations need access to international funds. Subsidies for rural areas that are higher than in more densely populated centres have to support infrastructure development.
- Besides funds for infrastructure, international organization should make sure, that financial means for setting up and running support systems such as training of operators and umbrella organizations for small service providers are available.
- On national level, more focus on implementing water supply and sanitation infrastructure in rural areas should be made. Subsidy systems that are suitable for the local conditions and that take into account the needs of rural areas should be developed and implemented.
- Additionally, countries should develop and implement tailor-made support systems (e.g., schemes for training of operators and umbrella organizations for small service providers). Only when support systems are in place, a sustainable, long-term functioning of water services in rural areas can be ensured.

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