METHODOLOGY NOTE ON

THE WATER UTILITY PERFORMANCE INDEX

CONTENT

1 Assessing performance of utilities

Assessing performance of utilities, based on a range of indicators, is an important mean to improve their performance by highlighting areas where service provision can be enhanced.

In the process of producing the "Country notes", the performance of water and wastewater utilities is to be assessed. In order to do so, a comprehensive performance index, called water utility performance index (WUPI), has been elaborated. It evaluates the performance of a single utility taking into account technical, financial and operational elements of the service provision. A set of 10 indicators, selected among the IB-Net[1] indicators, is used to calculate WUPI. Each indicator is weighted 10% in the overall index calculation. For water only companies, 7 water related indicators are taken account. For sanitation only companies, 6 wastewater related indicators are taken into account as shown in the table below.

N°	Indicators	Water indicators	Wastewater indicators
I1	Water coverage	X	
I2	Sewerage coverage		X
I3	WW treatment coverage		X
I4	Continuity of service	X	
I5	Metering	X	
I6	Sewerage blockages		X
I7	Non-revenue water	X	
I8	Staffing level	X	X
I9	Collection ratio	X	X
I10	Operating cost coverage	X	X

If indicator I1 and I2 are missing, no WUPI is assessed.

If indicator I3 is missing, it is replaced by the value 0, hence allowing to calculate the WUPI of the utility.

When "non-coverage" indicators are missing (i.e. I4 to I10), the average of all other non-coverage indicators is used to fill up the missing values. At most, three missing "non-coverage" indicators out of seven can be replaced by the average value of the other. If the utility has more than three "non-coverage" indicators missing, then the WUPI is not assessed. These calculation process and threshold have been elaborated based upon correlation tests which show that WUPI scores remain very robust when removing up to three indicators as correlation is above 80% to 90%.

[1] IB-Net is the international benchmarking network for water and sanitation utilities. It offers direct access to a database gathering water and sanitation utilities performance data.

Using the above mentioned calculation rules to assess WUPIs, the following number of utilities are available for WUPI calculation in the different countries of the Danube region.

Country	**WUPI**	**Wupi Water only**	**Wupi Wastewater only**	**Wupi All**
Albania	32	2	0	34
Bosnia & Herzegovina	25	0	1	26
Bulgaria	45	0	0	45
Croatia	15	0	0	15
Czech Republic	24	0	0	24
Hungary	27	1	2	30
Kosovo	7	0	0	7
Macedonia, FYR	27	0	0	27
Moldova	39	0	0	39
Montenegro	1	0	0	1
Romania	32	0	0	32
Serbia	29	0	0	29
Slovak Republic	7	0	0	7
Ukraine	78	0	2	80
Total	***388***	***3***	***5***	***396***

The 10 IB-Net indicators included in the WUPI are further described in the sections below.

1.1 Coverage Indicators

Service coverage indicators provide information on the share of population with access to the water and/or sewerage service. Hence they are key indicators to describe services development. However, access to sewerage does not necessarily mean that wastewater collected is fully treated before discharge back to the environment. Wastewater treatment coverage indicator provides an understanding of the proportion of effluent that is effectively treated with secondary treatment or better before being discharged.

Moreover, it should be noted that coverage indicators are impacted by whether the data on population is up to date and accurate.

Service coverage indicators definition

IB Net n°	Indicator	Definition	Unit
1.1	Water coverage	Population with access to water services (either with direct service connection or within reach of a public water point) as a percentage of the /total population under utility's nominal responsibility	%
1.2	Sewerage coverage	Population with sewerage services (direct service connection) as a percentage of the total population under utility's notional responsibility	%
[[(81d/2)+ 81e]/81a] *(70/30A)	Wastewater treatment coverage	[[(Wastewater treated w/primary treatment)/2 + Wastewater treated w/secondary treatment]/ Total Wastewater volume collected]* (Population under responsibility of the utility with sewerage services through house connections/ Total population under notional responsibility of the utility for sewerage, irrespective of whether they receive service)	%

A minimising coefficient is associated with primary treatment of wastewater to grant a higher performance value to sanitation utilities which have implemented a secondary treatment.

1.2 Non-coverage Indicators

The non-coverage indicators gather seven indicators as shown in the table below.

Non-coverage indicators definition

IB Net n°	Indicator	Definition	Unit
7.1	Metering level	Total number of connections with operating meter/ total number of connections	%
15.1	Continuity of service	Average hours of service per day for water supply	hrs/day
6.2	Non-revenue water	Volume of water “lost” per km of water network per day	m^3/km/day
12.4	Staffing level	Total number of staff expressed as per thousand people served	#/'000 W&WW pop served
23.2	Collection ratio	Cash income / Billed revenue	%
24.1	Operating cost coverage	Total annual operational revenues/Total annual operating costs	%
10.1	Sewerage blockage	Total number of blockages per year expressed per km of sewers	#//km

1.2.1 Metering level

Metering of customers is considered good practice. It gives customers the opportunity to influence their water bills and it provides utilities with tools and information to better manage their systems.

1.2.2 Continuity of service

The continuity of service describes the number of hours per day during which users are effectively provided with water supply. The closer it gets to 24 hours a day, the better it is.

1.2.3 Non-revenue water

Non revenue water represents water that has been produced and is “lost” before it reaches the customer (either through leakage, through theft, or through legal usage for which no payment is made). Part of these water losses can be retrieved by appropriate technical and managerial actions. It can then be used to meet currently unsatisfied demand (and hence increase revenues to the utility), or to defer future capital expenditures to provide additional supply (and hence reduce costs to the utility). The International Water Association (IWA) distinguishes between non revenue water (%) and unaccounted for water, with the latter not including legal usage that is not paid for.

There are a large number of indicators which measure non-revenue water. The most common one is calculated as the difference between water produced and water sold, and measured as a percentage of water produced. Other indicators measure non-revenue water as the difference between water produced and water sold per kilometre of network, or per connection. There is a debate as to the most appropriate measure of non revenue water. A percentage approach can make utilities with high levels of consumption, or compact networks, look to be better performing than those with low levels of consumption or extensive networks. Moreover, the percentage indicator of non-revenue water can prove to be highly volatile. As a result, the non-revenue water indicator chosen for the calculation of our performance utility index is the one expressed in volume per km per day.

1.2.4 Staffing level

Staff costs are traditionally a major component of operating costs. Understanding staffing levels can often give a quick guide to the extent of any over-manning in a utility. While it is preferable to be able to allocate staff time to either water or wastewater services, this information is sometimes not available. Comparisons are best made between utilities which offer the same scope of service both in terms of total size, and mix of water and sewer service.

Staff productivity is measured as the number of staff per 1,000 people served, where higher productivity is reflected fewer staff per 1,000 people served. The variance in staff productivity is partially linked to differences in connection practices. In many places in the world as in the Danube region, water connections are shared among multiple households. Such an environment is often correlated with lower staff productivity.

1.2.5 Collection ratio

Billing customers and getting paid are two different things. The effectiveness of the invoice collection process is measured by the total amount collected as a percentage of the billed amount. The collection ratio is useful to assess the economic sustainability of the service, ie its capacity to effectively collect revenues which will be used to finance the service.

1.2.6 Operating cost coverage

The operating cost coverage ratio shows to what extent the revenues of the service exceed its operating costs. In order to improve economic sustainability of the service, this rate should be higher than one, meaning that revenues fully cover operating costs and can also partly fund investments.

1.2.7 Sewerage blockage

Sewer blockages are a measure of the ability of the sewer network to provide a service to customers. Blockages can reflect a number of issues including the effectiveness of routine operations and maintenance activities, the hydraulic performance of the network, and the general condition of the pipes. Sewer blockages include all blockages or collapses that occur in sewers or drains that are the utility's responsibility, whatever action is needed to clear them. The indicator used is expressed “per km of network” to allow comparison between utilities of different sizes.

2 Making cross-utility performance comparison

The purpose of building up a performance index is to help identify best practices in the Danube region and to compare water and sanitation utility performance against those best practices.

A benchmark is built using Danube region best practices as reference for each WUPI indicator. These best practices are credited the maximum WUPI indicator value. Performance of each water and wastewater utility is then assessed and ranked against these regional best practices. Using the available data gathered in IB-Net database, the following values have been picked for best practices.

Best practice and lower bound definition for WUPI in the Danube region

Indicators	Danube region Best Practices	Danube region Lower Bound	Unit
Water coverage	100%	-	%
Sewerage coverage	100%	-	%
WW treatment coverage	100%	-	%
Metering level	100%	-	%
Continuity of service	24 hours	-	hrs/days
Non-revenue water	3	80	m^3/km/day
Staffing level	1	5	#/'000 W&WW pop served
Collection ratio	100%	-	%
Operating cost coverage	180%	50%	%
Sewerage blockages	0.1	20	#/km

For the coverage indicators as well as for the metering level and the collection ratio, best practices are set at 100%. For the continuity of service, the best practice is set at 24 hours per day. Starting from those optimal values, utilities are granted scores according to a decreasing linear relationship, the worst possible practice being 0% for coverage indicators, metering level and collection ratio, and 0 hour per day for the continuity of service.

For other indicators, utilities get the maximum score when their practice matches the best practice values. They get no point at all when their practice is below the lower bound value of the indicator. In between best practice and lower bound values, utilities are granted scores according to a linear relationship.

3 Results of WUPI calculation

Following the methodology described above, WUPIs have been calculated for utilities in each country of the Danube region. The table below shows the WUPI scores (rated on 100 points) per country (average, decile, quartile).

WUPI with 10 indicators

country	mean	p10	p25	p50	p75	p90
Albania	48.1	33.2	38.3	48.3	56.4	62.1
Bosnia and Herze	56.1	41.3	46.7	53.7	66.8	74.4
Bulgaria	68.0	61.0	64.6	68.0	71.8	75.6
Croatia	68.2	56.0	60.8	65.4	77.0	81.7
Czech Republic	91.8	86.2	89.8	92.2	94.9	97.4
Hungary	85.9	78.8	82.7	86.4	89.3	91.9
Kosovo	66.8	55.3	63.2	68.5	72.6	74.5
Macedonia, FYR	68.3	58.4	63.8	69.0	73.2	77.0
Moldova	48.0	25.2	36.7	48.7	60.6	67.3
Montenegro	63.9	63.9	63.9	63.9	63.9	63.9
Romania	73.0	64.8	68.1	72.6	76.9	82.1
Serbia	70.4	58.2	64.6	70.9	76.6	80.5
Slovak Republic	86.6	81.9	83.5	84.9	92.6	94.1
Ukraine	57.4	44.5	50.1	57.3	65.5	70.9
Total	63.8	39.0	52.1	65.3	75.6	88.7

Source: benchmarkingfile.dta

WUPI water only with 7 indicators

Country	**mean**	**P10**	**P25**	**P50**	**P75**	**P90**
Albania	61.5	36.1	47.9	67.4	75.1	75.2
Hungary	93.2	91.9	92.3	93.3	94.1	94.2
Total	***77.3***	***36.1***	***67.4***	***83.***	***93.3***	***94.2***

WUPI wastewater only with 6 indicators

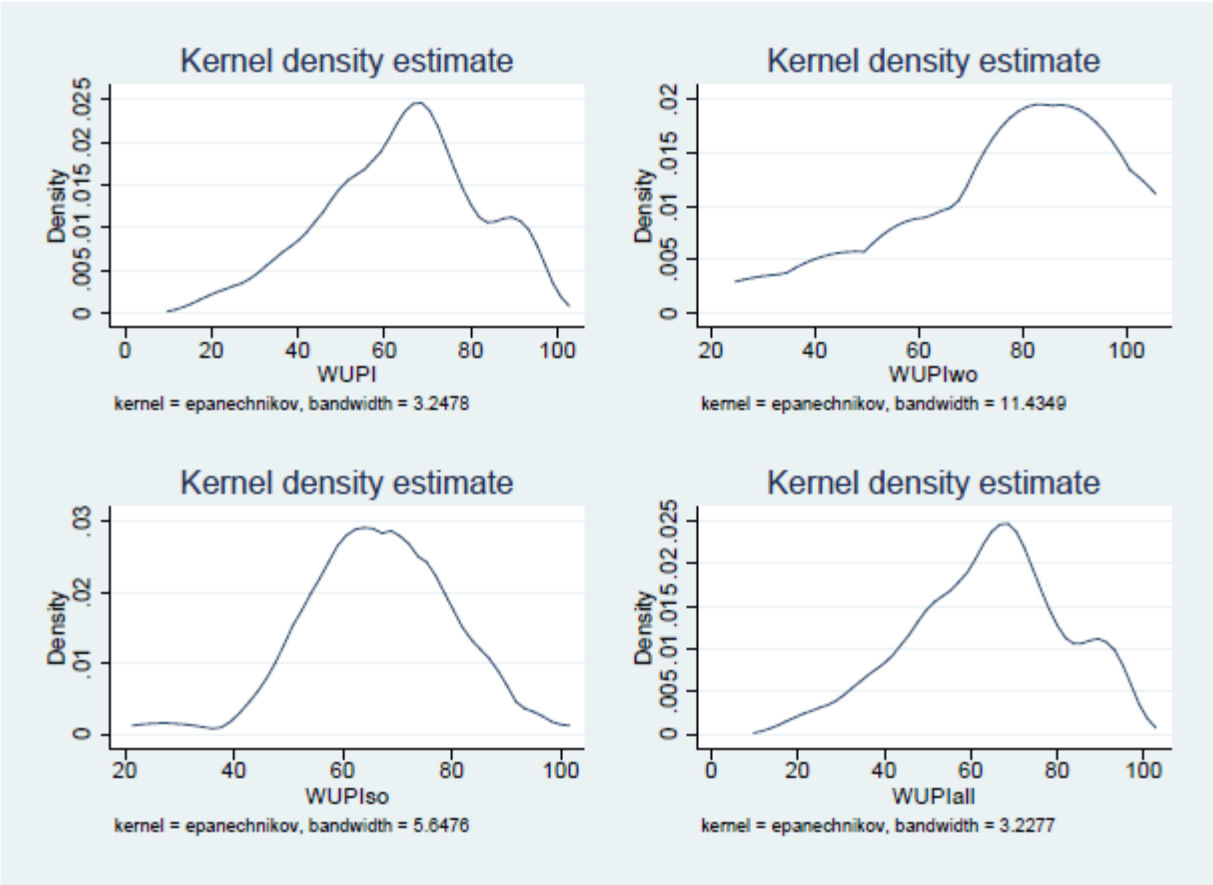
Country	**mean**	**P10**	**P25**	**P50**	**P75**	**P90**
Bosnia Herzegovina	56.1	54.3	54.3	54.8	59.2	59.2
Czeck Republic	76.6	57.3	57.3	85.8	86.6	86.6
Hungary	73.1	66.1	68.2	70.1	76.8	79.4
Macedonia, FYR	75.7	67.6	70.0	79.0	79.9	80.1
Moldova	27.0	27.0	27.0	27.0	27.0	27.0
Romania	65.5	65.5	65.5	65.5	65.6	65.6
Ukraine	56	49.2	50.3	57.9	61.0	61.2
Total	***65.5***	***50.3***	***58.2***	***66.8***	***76.8***	***80.1***

WUPI combined

country	mean	p10	p25	p50	p75	p90
Albania	48.4	33.2	38.3	48.5	56.7	62.7
Bosnia and Herze	56.1	41.5	46.9	54.3	66.0	74.2
Bulgaria	68.0	61.0	64.6	68.0	71.8	75.6
Croatia	68.2	56.0	60.8	65.4	77.0	81.7
Czech Republic	91.6	86.0	89.7	92.2	94.9	97.4
Hungary	85.4	78.0	81.6	86.0	89.4	92.4
Kosovo	66.8	55.3	63.2	68.5	72.6	74.5
Macedonia, FYR	68.8	58.4	64.0	69.5	73.9	78.7
Moldova	48.0	25.2	36.4	48.7	60.6	67.3
Montenegro	63.9	63.9	63.9	63.9	63.9	63.9
Romania	72.9	64.8	68.1	72.6	76.9	82.1
Serbia	70.4	58.2	64.6	70.9	76.6	80.5
Slovak Republic	86.6	81.9	83.5	84.9	92.6	94.1
Ukraine	57.4	44.7	50.1	57.4	65.5	70.8
Total	63.9	39.1	52.2	65.4	75.6	88.7

Source: benchmarkingfile.dta

Moreover, the following graphs show the distribution of WUPI scores among utilities.



4 Trade-off between WUPI and tariffs

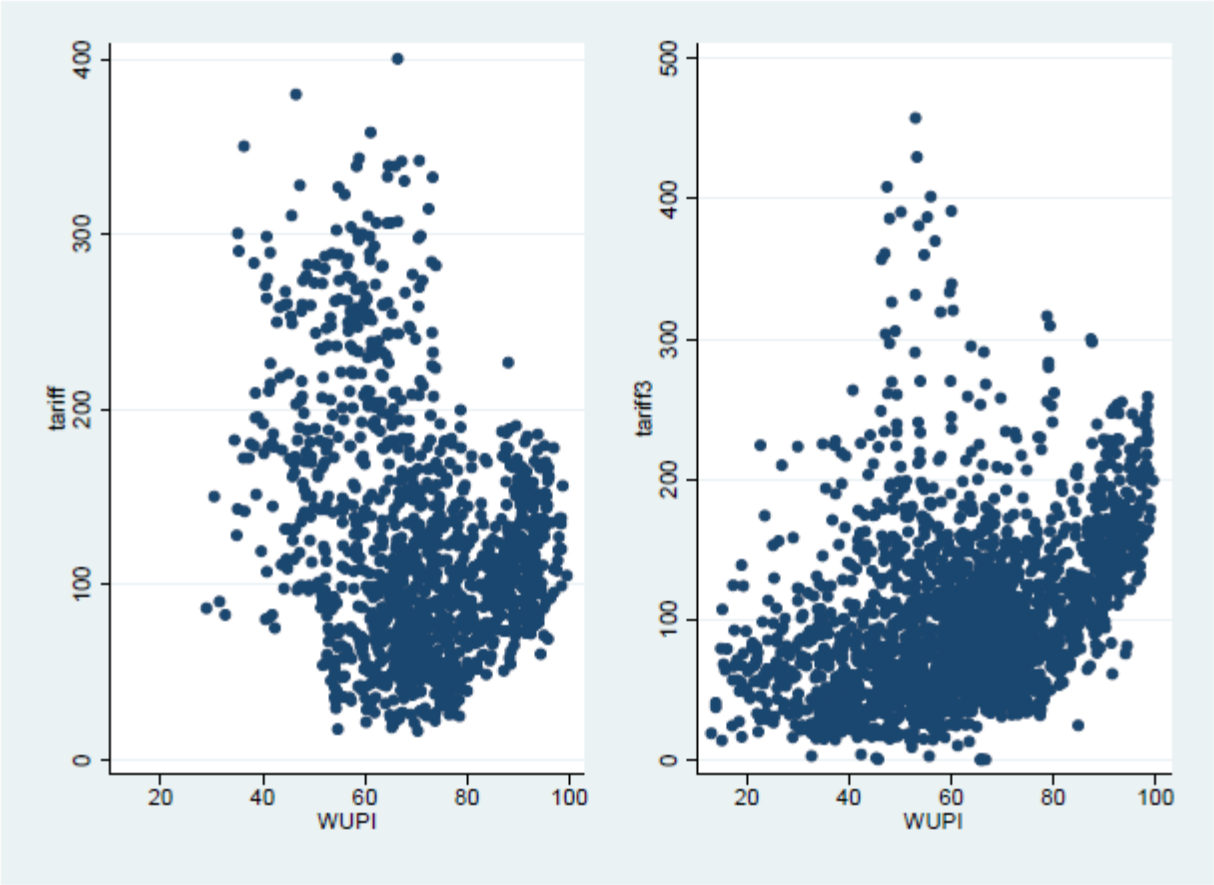
The relationship between the level of performance of a utility and its water and sanitation tariffs has been analysed using a slack based Data Envelopment Analysis (DEA) model. This methodology is widely used by regulators in Europe. DEA allows to study various utilities and to assess their relative efficiency by identifying efficient utilities which can be used as reference for inefficient ones. Each utility is then evaluated to determine its effectiveness, its degree of inefficiency and to identify the effective utility most comparable to it which can be used as benchmark reference. This method is particularly suitable for small samples and analyzes that include more than one performance criteria.

Two economic indicators have been used to test correlation with WUPI: annual average bill and utility revenues (see table below).

IB Net n°	Indicator	Definition	Unit
19.2	Annual average bill	Annual average bill for a household consuming 6m^3 per month, PPP adjusted	USD PPP/year
(90c/30) + (90d/30a)	Utility revenue	Utility revenues per served person, PPP adjusted	USD PPP/pers. served

Average tariffs need to be put in the perspective of affordability. Household income data, however, is not easy to obtain. As a result, the indicator selected in our performance utility index is the annual average bill for a household consuming 6m^3 per month expressing in USD purchasing power parity to allow more meaningful comparisons.

Despite an important dispersion, the data reveal a rather clear efficiency frontier. This suggests a trade-off between WUPI and tariffs: high WUPIs can be achieved only with higher tariffs. In other words, performance is costly.



WUPI and Annual water bill

WUPI and utility revenue