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The Water and Sanitation Index of Development Effectiveness (WIDE) in Sub-Saharan Africa: Overview of Country Performance[1]

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1   Introduction

Progress towards target 7C of the Millennium Development Goals of halving by 2015 the proportion of people without sustainable access to safe drinking water and improved sanitation facilities remains slow. The rate of access to improved water sources increased from 49% in 1990 to 60% in 2008, a marginal increase of less than 1% a year. Over the same period, growth in access to improved sanitation facilities was even more disappointing from 27% to 31%. Rural areas face the most serious problems in sanitation coverage. And yet it is not clear if the provision of sustainable access to safe drinking water and basic sanitation has been given the requisite financial and other support by the Sub-Saharan Africa (SSA) policy makers and donors. An even more important issue is understanding how the African governments have utilized the limited available resources especially development aid allocated to Water Supply and Sanitation (WSS) sector to guarantee the highest possible performance and deliverance of WSS services to the citizens.

The principal objectives of this brief are to compare countries' performance in the water and sanitation sector and analyze how effectively they used available resources, especially development aid received for the water and sanitation sector. In this context, we developed an innovative standardized measurement framework known as the Watsan Index of Development Effectiveness (WIDE), which compares drivers of progress with results achieved, and ranks African countries by the level of outcome obtained per unit of available input. In particular, it determines how effectively they used the development aid received for the water and sanitation sector. The further contents of the brief are as follows. Section 2 presents the structure of WIDE, detailing the models used for the analysis. Section 3 contains the empirical evidence and country performances. The caveat to the use of

the WIDE are presented in section 4, and section 5 concludes the brief.

2   Structure of the WIDE[2]

The WIDE is made up of two composite information layers, the Resources (measuring the input drivers), and the Progress or Outcomes. Each of these is calculated as a composite index, based on a number of pre-defined factors influencing progress in the water and sanitation sector.

We consider four types of inputs, all measured over the period 1995-2008:

1. Development aid to the water and sanitation sector, as measured by the average yearly per-capita ODA to the sector;
2. Domestic resources, as measured by the average per-capita GDP;
3. Water resources, measured by the quantity of per-capita renewable available water; and
4. Government capacity (a component of human resources), measured by the Ibrahim Index of African governance for rule of law, transparency and corruption.

Outcomes are measured across four dimensions:

1. Progress in the share of population with access to improved water sources, over the period 1995-2008;
2. Progress in the share of population with access to improved sanitation facilities, over the period 1995-2008;
3. Share of population with access to improved water sources in 2008; and

4. Share of population with access to improved sanitation facilities in 2008.

The analysis covers 45 out of 48 SSA countries. Data on water resources is missing for Djibouti and Seychelles, and GDP is unknown for Somalia. Furthermore, data on access to sanitation is not available for Seychelles in the Joint Monitoring Program (JMP) data set (most reliable internal source of all data on access to water and sanitation). It was therefore impossible to calculate the WIDE index for these three countries; hence they are not included in the ranking. For simplicity, resources and outcomes are aggregated by using an un-weighted average[3]. In the WIDE, all weights are implicitly assumed to be equal to 1.

There are a number of assumptions underlying the assessment presented here, which include the following:

• A country with a high level of either domestic resources or aid receipts should perform better than one with less financial resources;
• Natural factors such as availability of ground and surface water will impact on the effectiveness of aid flowing to the water and sanitation sector;
• Human capacity and good governance are a prerequisite for good water management; corruption is likely to lead to inefficiency; and
• A country which has adequate water resources and receives development aid should be able to exhibit measureable progress in water and sanitation provision, and this progress is facilitated by effective institutional arrangements.

Before the estimations, the data is first normalized and converted to an index value that ranges between 1 and 100, with high values indicating positive conditions. This is to ensure that the index is not dominated by a single variable having large absolute values. The normalized variables are then combined in simple un-weighted averages. Two indexes are then calculated, for inputs and outcomes. The two sub-indexes can be used to rank countries by intensity of inputs and results. A value of 0 indicates that the country has the same ranking for inputs and outcomes, e.g. the country with most resources achieved the best results. Positive values indicate that a country had an outcome ranking in excess of what could be expected given its resources. Large negative values, on the other hand, suggest poor performance.

WIDE Index: Empirical Evidence and Country Performance

As presented in Table 1, Gabon and Mauritius are the most endowed countries out of the 45 SSA countries covered in the analysis. Both countries received more than USD 10 per capita per year of ODA to the water and sanitation sector, and had a per capita GDP in excess of USD 5,000 over the period covered in the analysis. Gabon has also the highest endowment of water resources, with about 131,216 M^3 of renewable water per capita per year, which is about 58 times that of Mauritius. On the other hand, Mauritius exhibits the highest performance for the rule of law and absence of corruption in the region. At the other end of the spectrum, Zimbabwe and the DRC

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[2] For more detailed information on the methodological framework of WIDE index, please see Stampini and Sullivan (2011).
[3] In most cases of index development, additive formulae are used. It is however also possible to develop indices with multiplicative structure, but this is beyond the scope of this work. For more discussion of the use of Multiplicative indices for the HDI, see Herrero et al. (2007).

Table 1 Most and Least Endowed Countries: Input Drivers (in absolute figures)

	Country	AID (Average Yearly Per-Capita ODA to WSS)	GDP per capita	Water (in per capital renewable available resources)	Governance	Input (Normalized)
Most Endowed	Gabon	10.02	8,245	131,216	-0.52	72.1
	Mauritius	14.46	5,021	2,251	0.84	54.9
	Eq. Guinea	11.35	6,899	57,834	-1.24	48.4
	Botswana	3.79	5,348	1,337	0.63	43.0
Least Endowed	Sudan	0.17	891	842	-1.45	5.8
	Burundi	0.65	121	1,333	-1.31	5.3
	Zimbabwe	0.30	446	947	-1.56	3.5
	Congo, Dem. Rep.	0.25	164	15,999	-1.80	3.2

Source : Authors' calculations. Data are sourced from OECD CRS (aid); AfDB (GDP); FAO (water) and Governance (Mo Ibrahim databases).

Table 2 Lowest and Highest Progress Outcome (in absolute figures)

	Country	Progress in the share of pop. with access to improved water (1995-2008)	Progress in the share of pop. on with access to improved sanitation (1995-2008)	Access rate (%) in 2008, water	Access rate (%) in 2008, Sanitation	Outcome (Normalized)
Highest	Malawi	29	9	80	56	67.0
	Gambia	13	7	92	67	62.9
	Botswana	1	16	95	60	61.1
	South Africa	7	6	91	77	60.7
Lowest	Sudan	-6	1	57	34	20.8
	Tanzania	0	0	54	24	19.8
	Madagascar	7	2	41	11	16.8
	Sierra Leone	-8	3	49	13	11.4

Source : Authors' calculations.

have the lowest resource endowment, with extremely low values of per-capita aid to the water and sanitation sector and of the index of rule of law.

Progress outcomes are summarized in Table 2, in which countries are ranked by the outcome index. The best outcomes are reported for Malawi, Gambia, Botswana, and South Africa, in that order. Malawi made impressive progress in water provision (+29%). Access to sanitation, although still at 56%, also grew by 9 percentage points.

Gambia, Botswana and South Africa report slower progress outcome. However, this is due to the fact that all were in the right tail of the distribution of access rates for both water and sanitation in 1990. Next to the best performers are Angola, Mauritius, Namibia, Comoros, Cape Verde and Swaziland, all with scores of above 50 points. At the other end of the distribution, Sierra Leone and Madagascar recorded the worst results, both displaying slow progress and low access rates. For the former, regression in water access is

largely due to the protracted civil war during the period covered by the analysis. Madagascar, on the other hand, did not experience a full blown war but went through serious stress resulting from a turbulent power transition in 2002.

The WIDE index is presented in Annex 1, which ranks the countries according to the difference between output and input ranking. Values range between +25 to -35. The six best performers, all with WIDE values of 20 or above in-

clude Angola (the best performer with 25), Rwanda (23), Zimbabwe (23), Central African Republic (23), Malawi and Comoros (both with 20). Angola's performance is commendable. In spite of ranking 30th in resource availability, it achieved the 5th highest outcomes. This suggests that the scarce inputs were used relatively more effectively than in other SSA countries. Angola's exceptional performance can be explained by the government's implementation of aggressive capital investment program to expand and rehabilitate WSS infrastructure and institutional reforms after decades of persistent civil conflict.

The next sets of fairly good performers include Burundi, Gambia, Uganda, Côte d'Ivoire, Cameroon, Kenya and the DRC, with WIDE scores between 11 and 17. For some of these countries, good performance is due to several factors including sector reforms, in particular for Burundi and Uganda where water and sanitation issues have recently received significant attention. At the other hand of the distribution, we find Equatorial Guinea, which ranks 38th out of 45 countries for outcomes, despite being the third most endowed country (thanks to high levels of aid, GDP and water resources).

For illustrative purposes, the relationship between input drivers and outcomes is also presented graphically for a sub-sample of countries in Figure 1. The left hand panel shows that South Africa is well endowed in domestic financial resources, as proxied by per-capita GDP, and governance, while it is relatively poor in terms of water resources and does not receive much development aid for its water and sanitation sector. On the other hand, Malawi receives more aid, but it shows extremely low values of domestic financial resources and water availability. Gabon is the most endowed country in the sub-sample for GDP, aid and water resources, but it has the lowest level of governance. Yet, as illustrated on the right hand side graph, Gabon has the worst results in the sub-sample, performing well only in the provision of improved water. South Africa has the highest access rates, while Malawi displays the highest improvements in access to water and sanitation, and relatively high values for (end of period) access to both. This suggests that Malawi used the available resources effectively.

Figure 1 **Input drivers and Outcomes in Malawi, Gabon and South Africa**
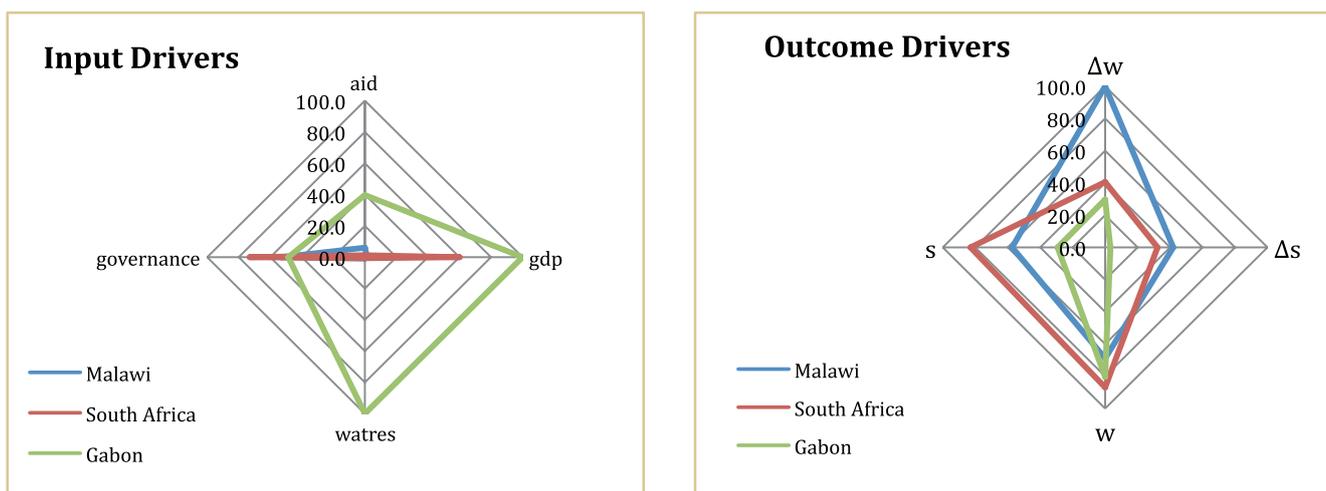
Source: Authors' calculations.

3   Caveats to the use of the WIDE

Every index attempts to summarize complex phenomena in one single figure, and results are inevitably affected by the structure chosen for measurement and aggregation of the different components. To avoid value judgments on the relative importance of each input and outcome, we used unweighted averages, implicitly accepting a weight of 1 for each of them. Nonetheless, some variables may have close to uniform distributions that increase the relative weight in the input or outcome sub-index[4]. For example, the distribution of per-capita aid to the water and sanitation sector is positively skewed, meaning that most countries receive less than USD 1 per capita per year, while small island states report high values (e.g. USD 25 per capita per year for Sao Tome and Principe).

On the other hand, the Mo Ibrahim index of governance has a more uniform distribution and a higher mean after normalization. We looked into the possibility of transforming some variables (e.g. by taking their logarithm) to reduce distribution skewness. We found that this changed the ranking of some countries by a few positions, but did not alter the overall picture. As a way of overcoming any implicit weighting of component values influencing overall scores, we recommend that comparisons of inputs and outcomes be made on the basis of the ranking in the group, rather than on the raw score. The structure of the WIDE was chosen accordingly (as a difference of rankings, rather than e.g. as

a ratio between outcome and input indexes).

Finally, it is important to notice that the structure of the outcome drivers partly penalizes countries that had already achieved high percentages of access to water and sanitation in the baseline year. For example, a country that had reached universal access in 1995, and maintained it in 2008, will have two positive outcome drivers (for end of the period access to water and sanitation). Another country that had no access in 1995, and recorded progress to reach universal access in 2008 will have four positive outcome drivers (two for progress, two for access at the end of the period). The latter will record a higher outcome score. A country like Mauritius, which records high rates of access for both water and sanitation in both 1995 and 2008, and has considerable financial resources and good governance, is ranked 30th out of 45 countries by the WIDE.

This is due to the comparison of the 2nd input ranking with the 6th ranking for outcomes, the latter being affected (as previously explained) by the initial high access rates (translating in a WIDE of -4). This does not mean that the country did not manage its aid effectively. It rather indicates that, when the analysis focuses on how to effectively manage limited resources to achieve progress starting from low levels of access to water and sanitation, other countries represent a preferable model to look at. A country like Tanzania, with little resources, may learn more by analyzing the policies put in place by Ma-

lawi, which achieved much faster progress while relying on the same levels of inputs.

4   Conclusions

This brief summarized the performances of 45 SSA countries with regards to development effectiveness in WSS using WIDE index. The index has been designed specifically to capture linkages between the various factors including ODA which will give rise to a better performance in the WSS sectors. What we have presented here is a first step which must be built upon to create a robust and reliable tool to evaluate development in the water and sanitation sectors. There now remains only four years before the 2015 deadline for the achievement of the MDGs. Though it is clear that there will be a shortfall in many areas, better monitoring of progress, and better understanding of the causal linkages of aid effectiveness, will make an important contribution to their overall achievement.

Discussions in the preceding sections showed clearly that the sanitation sector is often neglected or given less priority in the general government budget allocation. This is reflected in the current low level of progress in the subsector. Thus, increased investment in sanitation facilities, particularly in rural areas, is highly recommended. Greater attention should, however, be given to adequate public awareness and sensitisation, including hygiene education for the correct use of latrines and cleaning of hand after defecation.

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[4] For a discussion on the issue of scale relating to the use of indices in water management, see Sullivan and Meigh, 2007.

annex 1   **Watsan Index of Development Effectiveness (WIDE)**

Abb.	Country	Inputs	Inputs rank	Outcomes	Outcomes rank	WIDE
AGO	Angola	12,5	30	59,4	5	25
RWA	Rwanda	11,2	34	49,8	11	23
ZWE	Zimbabwe	3,5	44	40,2	21	23
CAF	Central African Rep.	10,5	36	48,2	14	22
MWI	Malawi	15,3	21	67,0	1	20
COM	Comoros	12,6	28	54,9	8	20
BDI	Burundi	5,3	43	35,3	26	17
GMB	Gambia	18,4	17	62,9	2	15
UGA	Uganda	13,7	26	48,7	13	13
CIV	Côte d'Ivoire	7,6	40	33,8	28	12
CMR	Cameroon	12,6	29	45,7	18	11
KEN	Kenya	10,0	38	34,6	27	11
COD	Congo, Dem. Rep.	3,2	45	26,4	34	11
NGA	Nigeria	6,6	41	26,0	35	6
GNB	Guinea-Bissau	10,1	37	30,7	32	5
ZAF	South Africa	33,7	7	60,7	4	3
SWZ	Swaziland	19,8	13	51,8	10	3
BFA	Burkina Faso	18,2	19	46,3	16	3
GIN	Guinea	14,7	24	39,6	22	2
ERI	Eritrea	12,3	32	32,9	30	2
BWA	Botswana	43,0	4	61,1	3	1
NAM	Namibia	32,8	8	55,8	7	1
SDN	Sudan	5,8	42	20,8	42	0
TCD	Chad	9,1	39	21,4	41	-2
CPV	Cape Verde	36,9	6	53,8	9	-3
LSO	Lesotho	20,4	12	46,6	15	-3
ETH	Ethiopia	11,3	33	26,0	36	-3
MUS	Mauritius	54,9	2	58,6	6	-4
MLI	Mali	18,4	16	43,4	20	-4
BEN	Benin	17,3	20	37,4	24	-4
TGO	Togo	10,7	35	23,2	39	-4
STP	São Tomé e Principe	42,1	5	49,0	12	-7
SEN	Senegal	26,3	9	46,3	17	-8
GHA	Ghana	20,5	11	44,8	19	-8
ZMB	Zambia	18,8	15	37,5	23	-8
LBR	Liberia	14,7	23	31,3	31	-8
NER	Niger	12,4	31	22,0	40	-9
MRT	Mauritania	18,2	18	33,6	29	-11
MOZ	Mozambique	14,0	25	24,9	37	-12
SLE	Sierra Leone	13,0	27	11,4	45	-18
TZA	Tanzania, United Rep.	14,9	22	19,8	43	-21
COG	Congo, Rep.	22,9	10	29,2	33	-23
GAB	Gabon	72,1	1	35,6	25	-24
MDG	Madagascar	19,7	14	16,8	44	-30
GNQ	Equatorial Guinea	48,4	3	23,5	38	-35
DJI	Djibouti	.	.	.	.	.
SYC	Seychelles	.	.	.	.	.
SOM	Somalia	.	.	.	.	.

Source : Authors' calculations.
Data not available for the three countries (Djibouti,Seychelles and Somalia) with dots cells.

annex 2 References

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