Urbanization and the rural and urban provision of water and sanitation

Paper prepared for the

5th UAPS African Population Conference 2007

Arusha, Tanzania

Draft: 27 September 2007

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Abstract

In most developing countries there is a huge gap in the delivery of infrastructure services such as water and sanitation between rural and urban areas. This better access to services is one of the drivers of urbanization. But at the same time urbanization puts a heavy strain on service delivery in urban areas. In addition, technological changes and decentralization should favor rural water and sanitation. Traditionally urban areas were favored over rural ones. In the paper cross-country panel regressions are used to compare factors that determine access to water and sanitation in rural versus urban areas. Both rural and urban access to water and sanitation have a positive association with population density, whereas they have a mostly negative relationship with urbanization, whereas population growth does not seem to have much effect. The paper concludes with policy advice on how to improve access to water and sanitation and thus to make progress towards the MDGs.

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Introduction

"Safe drinking water, sanitation and good hygiene are fundamental to health, survival, growth and development. However, these basic necessities are still a luxury for many of the world's poor people." (WHO and UNICEF, 2006). Worldwide 1.1 billion people lack access to water and 2.6 billion to improved sanitation and are therefore deprived from a human right. In sub-Saharan Africa almost half of the population has still no access to an improved water source and two thirds have no access to sanitation, making it the region with the worst access rates. Whereas for water it is likely that the MDG 7 will be reached on a global level, for sanitation that is highly unlikely.[1] For rural areas this picture is even bleaker with for example 58 per cent of the rural population in Africa not having access to an improved water source in 2004. In general, people without access to water and sanitation are difficult to reach due to adverse circumstances like living in remote areas or urban slums or displaced families (Anand 2006; UNDP 2006).

Progress towards increasing access to water and sanitation in rural areas has been quite diverse not only across regions but also within regions. Whereas a number of countries like Afghanistan, Chad, Ecuador, Ghana, Namibia, Malawi, and India have made dramatic progress in access to water in rural areas in other countries like Algeria, Ethiopia, Morocco, Nigeria, and Togo the often low access has even declined. For sanitation no African countries are among the top performers, and even in South Africa rural access to sanitation declined. There is also no obvious pattern with respect to initial access as countries with a low initial rate like Afghanistan and a high initial rate like Thailand were among the top performers in sanitation (WSSINFO 2007).

There is widespread agreement that investment in water and sanitation services has been insufficient in the past, especially in Africa. The main effects of limited resources and institutional problems are the lack of maintenance and high leakages, both physical and financial. In many African cities more than 50 per cent of water supply is unaccounted for. This in turn leads to low revenue and prolonged financial problems of water providers, especially in urban areas (AfDB and OECD 2007).

[1] MDG Goal 7/Target 2: Halve the proportion of people without sustainable access to safe drinking water and basic sanitation.

Improved access to water and sanitation contributes significantly to better health outcomes, as for example clean water is important for disease treatment. Increased and easier access to water can increase poor people's productivity and reduce poverty. It frees up time for productive activities in the households while easing pressure particularly on girls and women, who otherwise have to fetch water from remote places. It also decreases interruptions of the production system in enterprises thus increasing productivity. Access to safe water and sanitation helps to attract better teachers and retain kids in school, contributing to better education. The absence of adequate sanitation and water in schools is a major reason that girls drop out. Improved sanitation reduces illness and medical expenditure. Effective water disposal also reduces malaria mosquito breeding. Furthermore, since many endemic illnesses in Africa are waterborne, better sanitation reduces overall risks of illness (UNDP 2006; OECD 2007a).

To analyze the factors that have an impact on the delivery of water and sanitation in rural versus urban areas both the demand and supply side have to be taken into account. After an overview of recent changes in the provision of water and sanitation the paper provides an analysis of the different factors that influence the provision of rural and urban water and sanitation, with a special emphasis on population variables. For the first time a comparison between rural and urban provision based on panel data analysis is provided. The conclusions focus on aid allocation, improving institutions and complementarities with other infrastructure.

Changing patterns in the delivery of water and sanitation

Sources of financing

The main sources of funding for the provision of water and sanitation are government tax revenues, aid, and user fees. In addition to the public sector services are also provided through private sector participation and community participation. Public spending for water and sanitation typically represents less than 0.5 per cent of GDP, and it is as low as 0.1 per cent in Pakistan and Zambia.[2] Sanitation investment averages only about 12–15 per cent of total water and sanitation expenditure in Sub-Saharan Africa (AfDB and OECD 2007; UNDP 2006).

[2] It is difficult to capture real public spending on water and sanitation partly because of the fragmentation of financing across ministries, partly because of decentralization and partly because donor financing is often off-budget (UNDP 2006).

Between 1996 and 2002 the share of ODA for water and sanitation declined from 7.2 per cent to 3.3 per cent. Until 2005 aid to water and sanitation increased to 4.5 per cent of total ODA (OECD, 2007b). The water and sanitation sector is especially heavily dependent on project funding with multiple fragmented donor projects, which makes planning at the sector level very difficult (Slaymaker and Newborne 2004).

In most developing countries a large share of expenditure for water and sanitation comes from private sources, mainly user fees, which puts a heavy burden on the poor. In Uganda water payments account for 22 per cent of the average income of urban households in the poorest 20 per cent of the income distribution. In general the poor pay higher prices for water, as they are not connected to the network and thus have to rely on water vendors. In Nairobi and Accra the prices paid in low-income settlements with little access to the public provision are around 8 times higher than those paid by high-income residents.

However, high connection fees and the difficulties related to connecting people living in informal settlements restrict the expansion of piped water to poor households. The key factors limiting the amount of user payments are affordability and willingness to pay, which in turn depends on the quality of services. On the other hand recovery of at least operating costs through fees provides incentives for efficient usage and improves the sustainability of provision. Thus some form of subsidy for poor users is necessary in most cases. Especially rural water and sanitation will thus continue to rely on aid (AfDB and OECD 2007; UNDP 2006).

The water and sewerage sector only received limited private investment, partly due to a non-favorable business climate and unclear regulation. Water and sanitation projects require high initial investment, long payback periods and low rates of return. In the medium term the private sector is not expected to fill the financing gap in infrastructure in Africa (Thoenen 2007; AfDB and OECD 2007). Several studies of private sector involvement in utility provision have shown that private participation has to be complemented by adequate regulation and competition in order to increase efficiency (Estache et al. 2005; Zhang et al. 2004). Private sector participation is not a “light” version of full privatization or a way around capable institutions and sound regulation. In order to successfully involve the private sector, the public sector must have strong capacities within its institutions in order to negotiate a fair and satisfying deal (Thoenen, 2007).

In many African countries more than 50 per cent of households are served by small-scale private water suppliers. Their prices are usually similar to those of larger utilities. However, these small-scale providers face similar problems to other small and medium enterprises like limited access to finance and a restrictive regulatory environment (Kariuki and Schwarz 2005).

Outcomes in the water and sanitation sector

In the provision of water higher spending might not lead to a proportional increase in the quality of service delivery, as leakages are quite high (Briceno-Garmendia et al., 2004). Therefore, an increase in public expenditure is likely to increase outcomes only if institutions are in place that will ensure the efficient use of resources. A major challenge for the provision of water and sanitation are capacity constraints with respect to planning, management and implementation especially at the local level. Thus measures like restructuring of ministries, matching of resource allocations with policy commitments and establishing national monitoring and evaluation frameworks are needed to improve access to water and sanitation (AMCOW et al. 2006). In this respect better governance and lower corruptions have been found as statistically significant determinants of efficiency of water provision (Estache and Kouassi, 2002).

So far cross country regressions of the determinants of access to water and sanitation do not distinguish between urban and rural areas. However they provide some insights about the factors related to population and institutions that might be relevant for this analysis.

Wolf (2007) finds that aid to water seems not to be effective, using 2002 data for 110 countries. The effect of governance on access to water and sanitation is also limited. The coefficient for control over corruption is not significant, but the interaction term between corruption and aid to water and sanitation has a positive significant coefficient for water, meaning that control of corruption does not have a direct effect on access to water but that the efficacy of aid in improving access to water is positively related with control of corruption. The level of federalism at the provincial level has a negative association with access to water and sanitation. The fertility rate is negatively associated with both access to sanitation and water. In addition, population density has a positive association with water and sanitation, as it is more cost effective to provide network infrastructure if population density is high.

Estache et al. (2006) find a positive impact of privatization, lowering corruption and per capita GDP on access to improved water sources. However, the degree of urbanization does not have a significant coefficient in their regressions, based on data for 72 countries for 1990 to 2002. Anand (2006) using simple cross country data for 2000 does find strong association of per capita GDP with access to water and sanitation but does not find any significant coefficient for population growth.[3] In sum, both population and institutional variables do have different effects on water and sanitation outcomes and the results of previous studies are not conclusive with respect to their effects.

Urban versus rural provision

Traditionally urban areas were favored in the delivery of services as it is easier to deliver services in urban areas and the clientele in urban areas was favored by politicians. As the crisis in water and sanitation is primarily affecting the poor in general and woman in particular, who have limited bargaining power, political priority has been low. Likewise the attention of donors has been more on the health and education sector. The focus of government policies on meeting the MDGs has increased the attention for rural provision of services (UNDP 2006).

Recently, there are different factors that are changing the imbalance between urban and rural supply of water and sanitation:

- Cities are growing faster putting a strain on available services. Urbanization will put growing pressure on service delivery in the cities so just to maintain current service levels will require increased investment. Much of the growth will occur in already overcrowded slums and informal settlements with very low coverage. In some countries e.g. Mozambique, Nigeria and Uganda coverage rates in urban areas have already declined. But that does not mean an improvement in rural areas, as population growth there also remains high (UNDP 2006).
- Technological changes and privatization failures make the provision of small, decentralized water providers more cost effective. Especially in countries with low coverage levels and ineffective public utilities small-scale private water providers are prevalent both in urban slums and remote areas. The local private sector currently

[3] Anand (2006) uses different sample sizes for different specifications of his model.

accounts for more than 85 per cent of all private investment in the water sector, using small networks, water kiosks or mobile distributors (Kariuki and Schwartz 2005).

- In many countries decentralization has been promoted with a potential of shifting more resources to rural areas. In addition, local and municipal governments and service providers are mainly responsible for the provision of water and sanitation. Thus the capacity and accountability of these bodies and the strength of community water users associations influence coverage. Especially the willingness and capacities of communities to contribute labor and finance for maintenance determine success of water provision. Thus community involvement and the use of appropriate technologies are crucial factors (UNDP 2006).

Methodology and data

Cross-country regressions are used to compare factors that determine access to water and sanitation in rural versus urban areas. In the econometric analysis 4 different cross country panel data regressions will be carried out with rural/urban access to water/sanitation as dependent variables. These data are available for a sufficiently large number of countries for the years 1995, 2000 and 2004.

Following an approach used by Estache et al. (2006) panel regressions of access to water and sanitation were performed. For the dependent variables and most of the independent variables logs were used in the estimation. For the panel regressions fixed effects were used, as this is the appropriate specification according to the Hausman test. This absorbs the differences in the outcome variables due to intrinsic characteristics of each country.

The variables related to population that are included in the analysis are (see Table 1):

Urbanization. The quality of water and sanitation facilities is generally higher in urban areas and the costs to use them in terms of transport costs and opportunity costs such as travel time and the need for children to work is lower. Thus, it is expected that this variable is positively associated with access to water and sanitation.

Growth of urbanization. For cities with rapidly growing population it has been observed that the expansion of infrastructure networks could not take pace with the increase in demand (AfDB and

OECD 2007). The growth rate of urbanization is also a proxy for rural-urban migration, for which no data is directly available. Urban population growth is much higher than rural population growth, despite higher fertility in rural areas. This variable is expected to have a negative coefficient in urban areas and a positive coefficient in rural areas, as it shifts demand.

Growth of rural population. Likewise for access in the rural access high population growth might make it difficult to keep levels already achieved. High population growth means that there is also a high share of children in the population and a lower share of the population is working and thus contributing to productive activities. Thus it is expected that the coefficient is negative.

Population density. Population density is expected to reduce the costs of service provision on a per capita basis. In addition, the costs to use the facilities in terms of transport costs and opportunity costs such as travel time is lower. Hence population density should also be positively associated with access in rural areas.

The main other factors that are discussed in the literature as determining access to water and sanitation are the following:

Public expenditure. In principle higher government spending in the sector should increase the coverage at least after some time. However, for water and sanitation no cross-country figures of government expenditure are available, probably due to the highly fragmented nature of the sector. In addition, the water and sanitation sector is heavily dependent on project funding, whereas government expenditure only plays a minor role (Slaymaker and Newborne 2004).

Aid to water and sanitation, as percentage of GNI. Aid that is specifically targeted to the sector is expected to improve access to the services. Unfortunately no data disaggregated by water and sanitation is available. However, in a previous analysis of access to water and sanitation (without a distinction between urban and rural areas) no major effect of aid to the sector was found (Wolf 2007).

Amount of investment of private participants in water and sanitation. As private participation is supposed to improve the quality of management and/or the availability of finance, this variable is expected to have a positive coefficient, but only in the urban areas as most private participation happens there (World Bank, 2006).

Decentralization. Decentralization is one approach to better match service delivery with the preferences of people. However, especially in developing countries there are many obstacles to decentralization, because the tax base in rural areas is weak and vertical imbalances in technical and administrative capacities are large (Bardhan, 2002). The only variable capturing decentralization, which is available for a large number of countries is federalism at the state/province level.[4]

Control over Corruption. Corruption can affect the provision of public services through three channels, namely increase of prices and decrease of government output, reduced investment in human capital and thus shortage of inputs and reduction of government revenue. Corruption reduces spending on operations and maintenance. The variable is highly correlated with voice and accountability, which captures the extent to which citizens of a country are able to participate in the selection of governments.

Fixed line and mobile phone subscribers (per 1,000 people). There is some evidence that asymmetric information plays an important role in public service delivery in various respects. Therefore countries with better media and ICT coverage should have more efficient public service provision.

Infrastructure/road density. Better quality of infrastructure, especially roads makes it cheaper to build water and sanitation facilities in rural areas and to maintain them. Thus a positive coefficient is expected for rural access.

GDP per capita. It is assumed that as incomes begin to increase, people's preferences for water and sanitation will also raise and thus access will increase through political pressure. However, better access to water and sanitation is also a factor that influences productivity, so the causality is not clear. Anand (2006) finds a strong positive correlation between GDP p.c. and access but that is declining over time. However, GDP p.c. is also highly correlated with other variables of interest such as access to ICT and voice and accountability so it will not be included in the regression analysis to reduce problems of multicollinearity.

The socio-economic control variables that are standard in the public service delivery literature include the following (Gupta et al., 1999; Rajkumar and Swaroop, 2002):

[4] The variable used for decentralization is from the updated World Bank Database of Political Institutions (Beck et al. 2001). The indicator used is: Are the state/ province governments locally elected? It takes the values 0 - no decentralization, 1 - some decentralization and 2 - decentralization.

Rural versus urban poverty. As poverty in the respective area has an impact on the ability of local governments to collect taxes or fees for the building and operation of the utilities a negative coefficient is expected, especially for rural access. However, poverty data over time are generally scarce.

Adult literacy rates. Educated people are more likely to value access to water and especially sanitation and might be better able to voice their concerns. Therefore a positive relationship is expected especially for sanitation.

Table 1: Summary statistics of main variables

Variable	1990	1991-1995	1996-2000	2001-2004
Access to water (% of households), urban	91	90	91	92
Access to water (% of households), rural	71	72	73	75
Access to sanitation (% of households), urban	77	76	78	79
Access to sanitation (% of households), rural	53	54	56	57
Poverty headcount ratio at rural poverty line (% of rural population)		40	51	44
Poverty headcount ratio at urban poverty line (% of urban population)		25	30	30
Federalism at the state/provincial level	0.81	0.85	0.85	0.85
PPI projects in water and sewerage total investment	4	155	424	307
Control over corruption		0.004	-0.071	-0.018
Rural population growth (annual %)	-0.08	0.09	0.45	0.35
Urban population growth (annual %)	2.87	2.29	2.37	2.25
Urban population (% of total)	52	53	54	56
Population density (people per sq. km)	144	142	154	168
Fixed line and mobile phone subscribers (per 1,000 people)	131	153	265	481
Roads, paved (% of total roads)	47	48	50	55
Literacy rate, adult total (% of people ages 15 and above)	71	73	76	80
ODA for Water and Sanitation (% of GDP)	0.60	0.77	0.80	0.78

Sources: World Bank, 2006 and 2007, Kaufmann et al., 2005; OECD, 2007b; WSSINFO, 2007.

For the panel data analysis data were grouped into three periods, according to the availability of data for the dependent variables 1995, 2000 and 2004. Thus for the independent variables averages over the periods 1991-1995, 1996-2000 and 2001 to 2004 were used to capture some of the lagged effects.

Econometric results

Estimation results are shown in tables 2 and 3. They confirm the hypothesis that the factors that are associated with access to water and sanitation differ by location. Population density mainly has a positive association with service delivery in rural areas as expected. For access to water also in urban areas population density seems to play a positive role. The degree of urbanization has a negative association with access to water in both urban and rural areas, although for rural areas it is only significant at the 10 per cent level. Urbanization also has a negative association with rural access to sanitation. By contrast the growth rate of the urban population is not significant for urban access to water. In sum, high urbanization seems to create some problems for access to water. For rural access to water the coefficient for rural population growth is negative and significant indicating that in countries with high population growth it is difficult to mobilize enough resources to expand water supply sufficiently. For access to sanitation higher urbanization is associated lower rural access, indicating a concentration of resources in urban areas.

Control over corruption does not seem to have much impact on the provision of water and sanitation. Only for rural access to water there is a positive coefficient, which is only significant at the 15 per cent level. However, the share of telephone subscribers has a positive association with access to both water and sanitation. However, for urban sanitation it is not significant. The coefficients for road quality are not significant for any outcome. Education as measured by the adult literacy rate does not seem to have a positive association with access, except for rural sanitation. Likewise aid for water and sanitation seems to have limited effects. The coefficient is only positive and significant for urban sanitation. This result might be partly driven by the absence of available data on government and private sector spending in the sector. In sum these results confirm most of the above hypothesis.

Table 2: Econometric results for access to rural and urban water and sanitation, without federalism

	Access to water, urban		Access to water, rural		Access to sanitation, urban		Access to sanitation, rural	
Ln Population Density	0.069	+	0.406	**	0.083		0.843	**
	[1.80]		[4.06]		[1.06]		[3.84]	
Share of Urban Population	-0.003	*	-0.006	+	0.002		-0.026	**
	[-2.26]		[-1.73]		[0.80]		[-3.03]	
Growth rate of urban population (annual %)	0.003				0.008			
	[1.13]				[1.22]			
Growth rate of rural population (annual %)			-0.023	*			-0.015	
			[-2.46]				[-0.74]	
Control of Corruption	-0.003		0.028	~	-0.012		-0.023	
	[-0.51]		[1.56]		[-0.91]		[-0.60]	
Ln Fixed line and mobile phone subscribers (per 1,000 people)	0.010	*	0.026	*	0.006		0.059	*
	[2.32]		[2.15]		[0.62]		[2.20]	
Ln Roads paved (% of total roads)	0.006		0.002		-0.008		0.026	
	[0.69]		[0.10]		[-0.49]		[0.55]	
Ln Adult Literacy rate	0.036		0.043		0.072		0.347	*
	[1.25]		[0.57]		[1.21]		[2.12]	
Aid for water and sanitation (ODA) (% of GDP)	0.0002		-0.008		0.018	*	-0.0001	
	[0.04]		[-0.71]		[2.10]		[-0.00]	
Constant	4.183	**	2.716	**	3.516	**	0.0338	
	[23.66]		[6.47]		[9.72]		[0.04]	
Number of observations	194		188		193		177	
Number of countries	89		87		89		84	
R square within	0.2307		0.5333		0.2355		0.4693	

Source: Author's calculations

Note: For all regressions t-statistics are shown in parenthesis. ** indicates significance at the 1 per cent level; * significance at the 5 per cent level, + significance at the 10 per cent level and ~ significance at the 15 per cent level.

The inclusion of other potential influential variables like decentralization, PPI or rural and urban poverty reduces the number of observations drastically but does not change the above results much. We only report the results of including the decentralization variable here (Table 3). The inclusion of the other variables reduces the number of observations even further and leads to similar results. The inclusion of these additional variables. None of the three variables were significant. The absence of a significant coefficient for federalism implies that decentralization is not a panacea for pro-poor development and provision of water and sanitation, especially as its implementation is often sketchy. If economies of scale and network externalities exist central planning might lead to better outcomes.

Table 3: Econometric results for access to rural and urban water and sanitation, with federalism

	Access to water, urban		Access to water, rural		Access to sanitation, urban		Access to sanitation, rural	
Ln Population Density	0.075	~	0.337	**	0.217	*	1.136	**
	[1.55]		[2.86]		[2.45]		[3.89]	
Share of Urban Population	-0.004	**	-0.010	*	-0.002		-0.031	*
	[-2.65]		[-2.14]		[-0.53]		[-2.58]	
Growth rate of urban population (annual %)	0.004				0.012	+		
	[1.07]				[1.71]			
Growth rate of rural population (annual %)			-0.004				-0.014	
			[-0.32]				[-0.49]	
Control of Corruption	-0.004		0.026		-0.020		-0.064	
	[-0.50]		[1.14]		[-1.32]		[-1.10]	
Ln Fixed line and mobile phone subscribers (per 1,000 people)	0.012	*	0.036	*	0.010		0.059	~
	[2.39]		[2.55]		[1.11]		[1.63]	
Ln Roads paved (% of total roads)	-0.002		-0.009		0.010		0.042	
	[-0.19]		[-0.34]		[0.54]		[0.65]	
Ln Adult Literacy rate	0.012		0.050		0.031		0.364	+
	[0.39]		[0.61]		[0.56]		[1.88]	
Aid for water and sanitation (ODA) (% of GDP)	0.004		0.005		0.021	*	0.034	
	[0.77]		[0.41]		[2.38]		[1.17]	
Federalism	-0.009		0.016		-0.018		0.004	
	[-1.16]		[0.72]		[-1.31]		[0.07]	
Constant	4.353	**	3.086	**	3.268	**	-1.008	
	[18.58]		[5.96]		[7.60]		[-0.80]	
Number of observations	138		132		138		123	
Number of countries	67		65		67		62	
R square within	0.2157		0.5023		0.3645		0.5384	

Source: Author's calculations

Note: For all regressions t-statistics are shown in parenthesis. ** indicates significance at the 1 per cent level; * significance at the 5 per cent level, + significance at the 10 per cent level and ~ significance at the 15 per cent level.

Mainly due to the limitations of available data the results of the study have to be treated with care. For some variables such as rural and urban poverty levels and government financing data are not available for a large enough number of countries to be included in the regression analysis. This might lead to omitted variable problems. Other variables are closely correlated, like GDP per capita, voice and accountability and control over corruption, so only one of them could be included in the regressions. Furthermore aid figures are only available for water and sanitation in general. Thus it is difficult to distinguish between the effects of these variables. In addition, there might be some endogeneity problems despite the lags of the independent variables. For example

more aid might go to countries with less access to water and sanitation and as access only changes slowly there might be some reverse causality.

Conclusions and policy recommendations

The results of this paper make it clear that although there are some similarities between the different sectors and regions there are also important differences with respect to the effects of urbanization, population growth, adult literacy and aid in the provision of water and sanitation.

Population density has a much stronger effect for rural access as compared to urban access. Urbanization seems to reduce access mainly for rural sanitation and urban water, whereas population growth mainly seems to have an effect on rural water. However, population growth will increase both population density and urbanization. As the urban population in Africa is likely to double by 2030 it is necessary to adjust the allocation of resources to these new challenges, balancing the growing needs of the urban population with lower current access for the rural population. In this respect especially the urban poor, who often live in informal settlements need to be targeted.

For both funding - in the form of aid - and institutions - in the form of control over corruption, decentralization and private participation - the empirical results suggest limited effects. This might to some extent be due to more long-term effects that could not be captured here. As aid seems to be mainly improving urban sanitation, this provides an additional argument for shifting more resources towards sanitation in addition to its relative underfunding and very low access rates.

The fact that no significant effect for decentralization could be found might indicate that there is a considerable lack of capacity at the local level, which needs to be addressed first before the potential positive effects of decentralization like better targeting and accountability can materialize.

With respect to other infrastructure only the share of telephone subscribers is associated with better outcomes for water and sanitation. This might be due to the fact that telephones are closely associated with higher levels of development. But it also provides an argument for the

coordination of the development of different infrastructure sectors, which not only might lead to cost savings but also to improved efficiency.

To overcome the limitations of the analysis presented above there is a need for better data that capture outcomes more precisely. Better data is also needed for variables with a potential impact on these outcomes, like the different types of finance for water and sanitation, which is virtually non-existent at the moment. Even if the MDGs will be reached, which is rather unlikely for many African countries a lot will remain to be done. More research is needed to be able to set priorities based on the efficiency of different measures.

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