SUSTAINABLE DEVELOPMENT GOALS AND URBAN SANITATION IN SUB-SAHARAN AFRICA:
"Mathiness" in Measurement?

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Abstract

Most urban residents in sub-Saharan Africa lack access to improved sanitation. More importantly, according to the measurement made for the Millennium Development Goals, (MDGs), over the past 25 years average conditions have improved slightly from a very low level. This almost complete lack of improvement occurred during a period when regional real per capita income increased by almost forty percent. As a result, given this apparent absence of response to income growth, it is not surprising that access to urban sanitation in the region has been among the worst performing MDGs. This paper shows that the method of measuring the urban sanitation component of the MDG, and, more importantly, its proposed successor in the Sustainable Development Goals (SDGs), does not accurately reveal whether progress is being made. Even more problematically, the current measure frames the goal in ways that direct resources away from investments with high benefit-cost ratios to approaches which fail cost-benefit tests. The current SDG measure exhorts rather than measures. That is, it is posed in terms of the political motivation for the goal rather than the costs of achieving greater accuracy. Consequently, as Romer says of such approaches: it will continue to "create incentives for participants to exaggerate disagreements…" rather than seek "a broadly shared consensus."

Key words - Sustainable Development Goals, sanitation, sub-Saharan Africa, data.

Introduction

According to UN Secretary General Ban Ki-Moon, "When tackling progress towards the Millennium Development Goals, (MDGs) sanitation stands out as one of the critical areas where we are falling way, way behind."[1] Indeed, contrary to the achievements of the MDG on water, the sanitation goal was markedly unsuccessful.[2] The lack of improvement seems particularly critical in urban sub-Saharan Africa (hereafter SSA), where levels of coverage, at 40 percent, are significantly lower than those of other developing regions, see Joint Monitoring Program JMP (2015a,) p. 76. Further, the one percent increase in SSA city dwellers with access to improved sanitation over the 25-year period of the MDGs may seem to represent modest progress, but, in fact, it implies an actual increase of more than 200 million people without access to improved sanitation in those cities JMP, (2015a). Thus, as can be inferred from Go and Quijada (2012), access to sanitation in urban SSA was among the worst performing MDGs.

If the measure of lack of improvement is right, the costs of this situation in terms of health, productivity, and loss of basic dignity are extraordinary. As is well known, a massive disease burden is associated with deficient hygiene, sanitation, and water supply, see among others, Prüss-Üstün, Bos, Gore, and Bartram (2008) and Bartram and Cairncross (2010). Importantly, this burden is not distributed evenly among regions with diarrhea being the leading cause of death

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[1] Secretary-General's remarks at the preparatory meeting for the International Year of Sanitation, New York, 2007. Retrieved from http://www.un.org/sg/statements/index.asp?nid=2556. Accessed on the 12th of December 2015.

[2] The question of performance against the goals can take a number of forms. One useful metric of weak performance, as developed by Go and Quijada (2012), is how many countries fail to come close to achieving the goal. They show that access to improved sanitation was the target on which the largest number of countries missed by a significant amount. In SSA, rural sanitation improved but urban did not. Hence, by this standard, urban sanitation in SSA was the most poorly performing MDG.

among children under-five in sub-Saharan Africa, resulting in 19 percent of all deaths in this age group Black et al. (2010); the majority of these cases being attributed to inadequate sanitation.[3]

What appears to be even more worrisome is that the lack of improvement in urban SSA's sanitation occurs despite significant increases in per capita income. For instance, over the 1990 to 2015 period, average real GDP per capita in SSA increased by almost 40 percent.[4] During the same period, urban sanitation conditions deteriorated significantly even in places with significant increases in per capita income. Indeed, on one of the most basic measures of improvement, open defecation, the revised JMP estimates indicate that the number of urban residents relying on this method increased by 16 million between 1990 and 2015.[5]

What causes this seeming lack of improvement in SSA?[6] Was it the performance itself or the measurement of the performance that caused the poor performance? The new approach to measurement embodied in the Sustainable Development Goal (SDG) for urban sanitation makes a number of improvements. In particular, according to a recent report (JMP (2015b), the program convened a working group to consider revising its definition to consider some types of shared facilities.[7] However, the JMP (2015b) summary of that meeting indicates that the recommendation of the working group to consider as improved facilities shared by a limited number of users was rejected. Instead, JMP called for a continuation of the approach to measurement used in the MDG.

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[3] The focus on diarrhea underestimates the disease burden caused by inadequate water and sanitation. The health impacts of inadequate sanitation extend far beyond diarrhea to include many other important diseases. See among others, Hunter, MacDonald, and Carter (2010).
[4] http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD; August 2016.
[5] The open defecation figures are computed from JMP (2015), Annex 3.
[6] We recognize at the outset that focusing on the performance of African cities is a contrivance in a region as diverse and complicated as Africa. Nevertheless, given the regional and sectorial breakdowns in the MDGs, and SDGs, we believe this aggregation may be useful.
[7] A key feature of the JMP definition of sanitation defined as "improved" depends upon whether it is used by only one household. A flush or pour flush toilet or latrine connected to a piped sewer system or septic system, a simple pit latrine with a slab, a ventilated improved pit latrine (VIP) or a composting toilet used by only one household is considered "improved." Any other flush or pour-flush latrine, open pit latrine, bucket latrine, hanging latrine or open defecation, or any type of latrine shared by more than one household is considered "unimproved."

That measure focused on the provision of individual units as a basis for access to improved sanitation.[8] As a result, shared facilities, such as those used by more than one-third of SSA's urban residents, continue to be considered as unimproved, see JMP (2015b).

In our view, this focus on the provision of individual family units in SSA is an example of misplaced concreteness: it uses more easily collected data which, unfortunately, have little to do conditions. Like Romer's (2015) criticism of some of the models used in growth theory, the measure is like the well-known aphorism which describes economics as "precise but irrelevant," see Davidson (1984). Indeed, we argue that the measure has the same basic characteristic that Romer (2015) ascribes to some economic model building.

> "The style that I am calling mathiness lets academic politics masquerade as science. Like mathematical theory, mathiness uses a mixture of words and symbols, but instead of making tight links, it leaves ample room for slippage between statements … between statements with theoretical as opposed to empirical content. p. 89

and he suggests that this approach could lead to:

> "Presenting a model [will be] like doing a card trick. Everybody knows that there will be some sleight of hand. There is no intent to deceive because no one takes it seriously. Perhaps our … norms will soon be like those in professional magic; it will be impolite, …, to reveal how someone's trick works." p.93.

That is, our main argument is that the WHO/UNICEF Joint Monitoring Program (JMP) approach to measurement and monitoring of urban sanitation conditions in SSA suffers from a similar form of mathiness. While a number of studies have criticized various aspects of the estimates made by the JMP, see the review by UN Habitat (2013), our criticism is more fundamental. It is that the exhortative rationale for their approach is like the "academic politics" that Romer argues may be behind the mathiness approach to growth theory. Once again like some growth theory, their rationale for the measure's construction results creates a slippage between the

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[8] There are numerous ways to "share" a toilet facility. To be clear, JMP rejected a policy that would have included sanitation as "improved" if the facility otherwise meets the definition of improved sanitation and is shared among no more than five families known to each other.

concept they are measuring and empirical content that is so large that the measures are not taken seriously. Indeed, as we will show, rather than providing possible insights into what works, the measure may well lead to investments in more expensive technologies that fail cost-benefit studies, instead of those that can afford significant benefits.

In short, while as JMP's argument (2012) for not changing their approach during the MDG period may have been understandable in the context of a looming end to MDG measurement period, this is no longer the case. The SDGs are designed to measure progress over the next 15 years. We are concerned that the continued reliance on the current methodology will continue to provide little guidance as to the actual sanitation conditions, and that reliance on the current SDG for urban sanitation will continue to frame the issue in unproductive ways.

The paper is structured as follows: the first section illustrates how some of the difficulties involved in measuring access to improved sanitation in cities. A second section demonstrates both the kinds of inaccuracies that arise with the current approach and the apparent lack of concern with what appear to be obvious errors. It then examines the levels of improved urban sanitation in SSA countries and discusses the problems posed by both the exhortative and risk-averse rationales JMP gives for its definition. Section two concludes by showing how the JMP measure encourages investments that fail cost-benefit tests. A final section concludes. It recognizes that a measurement approach that seeks consensus in a disinterested, scientific way will almost certainly require additional resources. But without such a shift in orientation, the SDG sanitation goal will detract from rather than contribute to the objective of achieving the goal of sustainable development.

I.   The MDG Measurement Problem.

JMP's *Technical Task Force Report* (2010) and subsequent Working Group Report (2015b) both argue they do not consider any shared facilities as improved because of the

complications and the costs of data gathering for shared and public facilities, and the inconsistencies they have found in estimates of the amount of shared facilities. In the end, their proposed approach focuses on data known to be more easily measurable – those of individual units. But, this focus on individual family excludes the 34 to 40 percent of the urban SSA units that are now shared.[9]

Perhaps the main problem with the current measure is that it sets the quality bar too high. For example, while the shared facilities do not offer the same quality of service as individual family units, many of them are indeed sanitary but do not count as improved. For example, Gunther et al. (2012) found that 80 percent of facilities in Kampala's slums which were shared by four or fewer families were thought to be sanitary. Similarly, the South African General Household Survey (2015) indicates that 75 percent of users of shared facilities found them to be sanitary, while in Tanzania, according to Jenkins et al. (2014), shared facilities were often more sanitary than individual units. It is clear, then, as demonstrated by Heijnen et al. (2014b) and Fuller et al. (2015), that there is considerable heterogeneity across places. As a result, there is no simple way to use the JMP estimated indicator of "improved + shared facilities" to solve this shortcoming, even if appears that a significant share of shared facilities, particularly in smaller groups, provide access to improved sanitation.

At the end of the day, however, heterogeneity across service levels does not imply that the quality of service offered by shared facilities is likely to be as high as it is with individual units. For example, Heijnen et al.'s (2014a) meta-analysis of the effects of shared facilities on the health outcomes of users suggests that the likelihood of illnesses, particularly diarrhea, is greater for users

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[9] According to the Africa Infrastructure Country Diagnostic, the share of urban dwellers who relied on shared sanitation facilities in the region was 40 percent rather than the 34 percent figure reported by JMP. It is also worth noting that shared facilities account for an increasing portion of services.

of shared units, and Gunther et al. (2012) show that physical cleanliness of the facilities declines sharply with the number of users beyond a certain level.[10] These results are what would be expected: the likelihood of less maintenance and congestion problems with individual units is in general likely to be lower. Nevertheless, as we will show, the fact that the two types of facilities cannot be simply aggregated does not mean shared units should not be counted.

At the same time that JMP sets the measurement bar too high its approach also sets it too low. For sanitation services to achieve broader health effects what matters is behavior at the community level not the household level.[11] For instance, according to estimates by Bateman and Smith (1991), and Esrey (1996), among others, if service provision falls below 75 percent of community members, investments in sanitation do not result in an environment free from sanitation-related negative externalities. So, according to these studies, when less than 75 percent of a community has access to sanitation, even those families with access to individual household facilities remain at risk due to the untreated wastes of their neighbors. Unless the provision of individual units exceeds the threshold for general improvement – clearly an uncertain level, but also one that is almost certainly well above the average of 40 percent reached by SSA's cities –

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[10] Heijnen et al (2014b) found nine studies which investigated whether diarrheal disease was affected by whether a latrine was shared or not. In all but two, sharing a latrine was found to be associated with an increased risk of disease They also pooled the studies reporting an effect on diarrhea in a meta-analysis using a random effects model. This yielded a pooled odds ratio of 1.44 (95%CI: 1.18–1.76), suggesting a measure of the increased risk associated with shared sanitation. However, when adjustment is made for household wealth and feces visible in the facility, shared sanitation was statistically significant risk factor in only two countries, and had the opposite effect in one country. As the authors say, these results are subject to more than the usual caveats as to robustness, particularly due to simultaneity bias and other problems. On the difficulties in drawing inferences about the effects of various sanitation related policies see Zwane and Kremer (2007).

[11] This is particularly true for densely populated informal settlements, where the crowded conditions heighten the health risks associated with poor sanitation and their negative externalities see McGranahan, (2014).

the measured improvements do not result in improved conditions.[12] In this light much of the individual country level improvements in urban sanitation noted by JMP are illusory.

Against this more stringent requirement, cities in very few SSA countries have experienced any improvement in urban sanitation provision. The result is that, on net, and given the extraordinary growth in urban population that is projected across SSA – an almost tripling of urban population to over a billion million people by 2050[13] – the absolute number of city dwellers without access to sanitation will continue to increase regardless of what the measure indicates.

II. JMP's Implementation Problem: Framing or Costs?

JMP recognizes that most shared sanitation facilities used by five or fewer households are usually shared by extended families. If we also assume that within families, service quality is usually higher than that of facilities that are shared by a number of families, (JMP, 2010, p. 2), an assumption that receives empirical support from Gunther et al. (2012), then it follows that the inclusion of shared sanitation facilities used by five or less households would provide a more accurate estimate of sanitation improvements. However, collecting this information would require

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[12] The 75 percent threshold is difficult if not impossible to substantiate. We also examined what happens to the estimates with a less severe threshold of 60 percent. On an individual country basis, the results show that only 16 out of 42 countries are above the 60 percent threshold. Further, if we use the data on the share of unsanitary individual units found by Gunther et al. then in only 3 of those countries would the increase in sanitary individual units more than be sufficient to increase in the number of improved units to a point where more than 60 percent had improved access. Cumulatively, this kind of simple simulation suggests that unless the threshold is much lower, using a lower threshold is not likely to have a significant effect on the number of sanitation units which improve local health conditions.

[13] UN (2014), p. 20.

distinguishing this type of shared facility from those shared by larger numbers of families. Such a step would undoubtedly increase the costs of collecting the information.[14]

Developing and maintaining a comprehensive world-wide data set on difficult, often previously un-synthesized information is an expensive exercise that requires trade-offs and compromises. As a result, due to cost considerations it is understandable that the measures developed are less than perfect. But, costs appear to be only one of JMP's motivations for this approach. Moreover, costs do not appear to be the primary reason for JMP's rejection of counting some shared facilities. Rather, a rationale given for not including shared units is that such a change in definition would send the wrong message. It would, in JMP's words, "put the monitoring at risk of being accused of manipulating the numbers to improve appearances to meet the looming 2015 MDG deadline" (2010, p. 3). One of their main concerns, in other words, was related to how the target was framed as a policy for the MDGs, rather than the costs of collecting the data. Perhaps that argument had validity when the MDG deadline was imminent, but JMP has continued this approach with its SDG measure as well.

In our view, both the cost and exhortative argument fail for the reasons given by Romer. The former argument fails because the current measure is so weak that "no one takes it seriously." That is, as we will show, the inaccuracies appear to be taken for granted with the result that the current measure cannot serve as the basis for developing a consensus about how to achieve sustainable development. Similarly, the latter motivation fails, most fundamentally, because

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[14] Measuring access to improved urban sanitation will almost certainly require new data collection and hence could be costly. Existing surveys, such as the Demographic and Household Survey, the World Bank's Living Standards Measurement Surveys (LSMS) and the World Health Organization's Health Surveys (WHS) are, as JMP says, not sufficient. Some of these surveys are collected in a limited number of countries; others are too small to provide regional breakdowns; and few provide information on shared sanitation. In sum, none of the existing surveys are able to be used even in concert to provide the information. See Jerven (2016) for a review of these surveys.

political rationales for the links between concept and measurement will not lead to consensus building.

Inaccurate Data: Some Examples

There are numerous examples of the measure's inaccuracy but two are particularly instructive: Ghana and Angola.[15]

In Ghana, over 70 percent of urban sanitation facilities are shared, and are thus excluded from measurement. As a result, Ghana's 7 percent improvement in the share of households with improved access, one of the largest improvements in SSA, actually measures a much smaller improvement, one that may or may not have been offset by changes in conditions in shared facilities. In addition, while the measured improvement was large, it was from such a low level that it is unlikely that any health benefits accrued. As Heijnen et al. (2014b) show, if improved shared facilities were counted in Ghana, the share of urban households with access to improved sanitation would double to 40 percent. That is still a low level but very different from the extremely weak performance level implied by the current measure. In sum, the current results provide almost no useful information about sanitation conditions in urban Ghana.

Similarly, according to JMP estimates, Angola experienced the largest improvement in the provision of access to improved urban sanitation in SSA, experiencing a 24 percent improvement to one of the highest levels in SSA, 89 percent in 2015. Given this measure it is not surprising that

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[15] There are numerous problems with the accuracy of the data. For instance, JMP adjusts for shared sanitation in its final estimates by subtracting the mean overall available survey estimates for shared sanitation used by each country. However, in 34 low- and middle income countries no data on shared sanitation use are available, so there is no subtraction. Consequently, although they present country by country estimates, these figures, as they say, are not comparable across countries. See Wolf et al. (2013).

an African Ministers' Council on Water AMCOW (2011) analysis of conditions in Angola suggests that while "the data used for the JMP calculations are limited, … consensus exists around the coverage figure," so that "progress [in Angola] is admirable." p. 26.

Consider the credibility of this estimate and corresponding evaluation. Angola was one of the world's most rapidly urbanizing countries during this period. It also had one of the least egalitarian income distributions in the world, and an urban population which resides mostly, 55 percent, in slums, UN Habitat (2015) p.84. In such a context, it is not surprising that cholera has been endemic in Angola with over 80,000 cases and 1,000 deaths in 2006, and a serious recurrence in 2013, WHO (2014). Certainly Angola has had such a disrupted historical context that describing improvements of the scale noted as just admirable would be a significant understatement.

But, did the improvements really occur? For such improvements to have actually taken place, the scale of the government's effort would have had to have been enormous. For one thing, the increase in the share of the urban population with access to improved sanitation would have had to be very close to the very large increase in urban population over the period.[16] But, more than this, it would have had to have provided individual services to over 80 percent of the current slum population, including almost 1 million urban residents who were openly defecating in 1990.[17]

To consider the credibility of these estimates compare the Angolan results with those of South Africa. The latter did not have as large increase in the share of urban population as did Angola, and it also implemented one of the most ambitious housing subsidy program in the world, providing 100 percent per unit subsidies for more than 3 million units, see Tomlinson (2014).

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[16] According to JMP, between 1990 and 2015 Angola's urban population increased by 7.3 million and the access to improved sanitation increased by 7.2 million. JMP (2015), Annex 3. Perhaps part of the problem is that JMP's estimates do not take into account the 25 underestimate of the country's population, See Jerven (2016), p.355.

[17] JMP (2015), Annex 3. Open defecation in Angola's cities declined from 34 of urban population to 1 percent and the urban population of Angola was 2,6 million.

However, against a backdrop of slower urbanization, higher income, and an expansive subsidy program, South Africa could achieve only one-fourth of the amount of the improved access measured in Angola. Nor did it have to address the concerns of an urban population where in 1990 more than one-third of the population was without any facilities.

Certainly Angola's 1990 base year provides measurement difficulties, given its long term civil war, but, the 2015 estimates are, nevertheless, unbelievable. In effect, the AMCOW Report (2011) is similar in spirit to the identified errors that Romer reports remained uncorrected in published journal articles after pre-publication criticisms of math errors were demonstrated: no changes were made because the inaccuracy simply was thought not to matter.

Concerns with the Health Standards of Shared Facilities

Nor does JMP's concern with the encouragement of weaker standards justify excluding shared facilities as suggested by Heijnen et al. (2014a, p.9) who say:

> "policymakers and public health professionals should exercise caution in taking steps that may encourage the promotion of shared sanitation."

This conclusion stems from their finding that the odds of experiencing diarrhea are 44 percent higher with shared units than they are with individual facilities. However, the shared facilities they considered are not the kind of shared facilities recommended by the JMP working group – i.e., sharing among 5 or less households known to each other. When applied to the smaller groups, this conclusion does not justify using more caution with regards to broadening the definition for a number of reasons. First, even if we overlook the difficulties in drawing inferences about sanitation policies raised by Zwane and Kremer (2007), and focus on their results, we find that in only two of the nine studies they examined were facilities shared by fewer than five families considered, and of these one found no discernible effect of sharing. In addition, the comparison between shared

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and individual units is often not the relevant one. As Heijnen et al (2015) say, "In many countries, particularly in crowded urban areas, shared sanitation is the only technically and economically viable option for those wishing to avoid open defecation." In such contexts, the comparisons should be between the two viable options – shared units and open defecation -- and not as though individual and shared options are the options available. In sum, Heijnen et al.'s analysis does not provide a rationale to reject the JMP working group proposal to include facilities shared by five or fewer families.

The Policy Approach Implied by the SDG Measurement.

The SDGs do not discriminate between services which are bought by individuals without government assistance and those whose services are subsidized. This is a curious formulation because of both the dire consequences of the negative externalities associated with unimproved sanitation, and the millions of people affected by the externality. In such a context, an important question would be how does the encouragement of individual units via subsidy compare with the encouragement of shared units?

For this comparison consider the numbers of people involved and their income levels. At present, about 130 million African urban residents rely on shared toilet facilities, having increased by almost 100 million over the past twenty years, while the number without any facilities, i.e., relying on open defecation, about 30 million, JMP (2015), increased by about 16 million. For both of these categories to have increased during a period of rising incomes suggests that supply did not respond to increasing demand. However, as suggested by Figure 1 it is not only the increases in income that matter, the level of income also makes a difference. The figure presents the performance on urban sanitation provision, based on the JMP measure of improved sanitation in 2015, and the per capita income levels for 42 SSA countries.

Figure 1: Share of Urban Population with Access to Improved Sanitation and GDP Per Capita in sub-Saharan African Countries
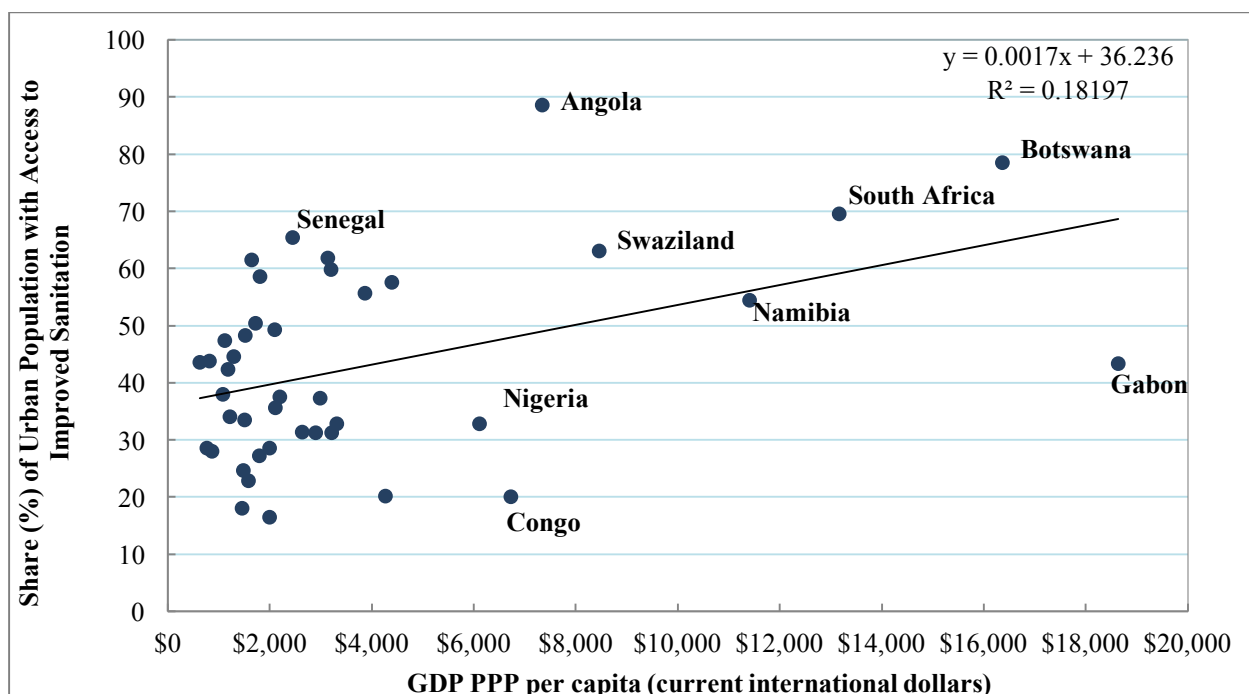
Source: Joint Monitoring Program (JMP), WHO/UNICEF(2015) International Monetary Fund (IMF) World Economic Outlook (WEO) (2015).[18]

The figure shows a bunching of observations at low levels of access for countries with low per capita income. To put it another way, with the exception of Senegal, all countries defined by the World Bank as having either a low income level, i.e., less than $1045, or lower middle-income level, up to $4,125, provide improved urban sanitation services for less than two-thirds of the population, and in many cases less than one-third. That is, with one exception, countries with low and lower middle per capita income have limited access to improved sanitation as measured by

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[18] Our sample of Sub-Saharan African countries does not include the four island countries and Equatorial Guinea and Somalia. The decision to omit these countries from the analysis was based on data availability, but in many respects, they represent extreme cases relative to the other observations. For instance, the largest cities in the island countries tend to be considerably smaller than in other SSA countries and thus have significantly less pronounced urban sanitation issues. Similarly, the IMF does not use Equatorial Guinea in its country measures because its small size and high income make it such a significant outlier.

the JMP. In contrast, for countries in the upper middle-income and high-income brackets, four of the eight countries have high levels of access to improved urban sanitation.

This pattern of observations suggests that an income threshold serves as a determinant of whether access to improved urban sanitation occurs would perform correctly about ninety percent of the time (37/42), 33 out of 34 times for lower income countries, and 4 out of 8 times for cities in higher-middle income and high-income economies. It also suggests why Heijnen et al. (2014) find that African households who share facilities are not less educated, as they are in other regions, and why in Africa, again unlike other regions, more of the middle class, rather than the poor, consume services in this way. The reason is twofold: first, most families – not just the lowest income families -- in lower income countries are unable to afford the sort of facilities JMP defines as improved; and second, SSA contains most of the lower income countries.

But, not only can they not afford a JMP measured unit they will not be able to do so for a long time. For instance, as Figure 1 shows in 35 countries improved access is below the level at which broader welfare gains are realized -- say, for instance, at least 65 percent of the households in a neighborhood. If the income levels of most of these countries is compared with the per capita income levels at which the neighborhood health effects are generally achieved, i.e., about $7,000, we find that, again ignoring the case of Senegal, it will take a considerable amount of time to reach that income level. Indeed, using JMP's measure, unless exceptional efforts are undertaken, it is unlikely that progress will be made on this SDG for a generation or more, well beyond the SDG measurement period of 15 years.[19]

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[19] The pattern of observations in Figure 1 suggests that for many of the countries to reach the threshold where widespread access is likely will require a doubling of per capita income. At a per capita income growth rate of 2.5 percent that will take nearly 30 years.

Thus, as currently measured, the SDG for urban sanitation will be unreachable for those with the most need. Does such a standard of measurement make sense as a social goal? It sets a goal that almost certainly dictates failure. But, not only does it set an unachievable goal, it also encourages types of sanitation investments that fail cost-benefit analysis. For example, a recent benefit-cost analysis of sanitation investments, by Hutton (2015), presents benefit-cost ratios for investment in sanitation for the different regions and locations – i.e., urban and rural. He finds a solid benefit-cost ratio for urban facilities in SSA of 1.2, Table 13, p. 20. However, his estimate assumes 2.5 families share each facility, p.5. If instead of sharing these costs across 2.5 families the costs were incurred by a single household, so that the units would be considered improved as dictated by JMP's definition, costs would increase by 150 percent per family. (Sharing the cost of a unit costing 100 for one family between 2.5 families reduces individual household costs from 100 to 40). With these higher costs, the corresponding benefit-cost ratio for individual units falls to well below 1. That is, the type of investments that fulfill the JMP goal would fail traditional benefit-cost calculations.

III.   Conclusion.

As we come to the beginning of the SDG period and consider conditions in SSA where urban population growth is the most rapid in the world and urban sanitation is already an acute problem, an obvious question arises: Is the SDG measure the result of poor performance? Or is there something about the way the goal is defined that creates measurement problems? Our analysis suggests that the answer to both questions is affirmative. We have neither a good measure of performance, nor do we know whether performance has improved although we have good reason to believe that in many places it has not. Much more research is of course necessary, for

example, on the neighborhood effects of unimproved sanitation, and the effects that sharing by different sized groups might have on health. But, again, lack of research does not mean that JMP's caution in broadening the definition of access to improved urban sanitation is warranted, particularly in SSA where shared facilities are so common.

It is perhaps worth pointing out that the SDG measurement issue is not like the situation with outdated national income accounts that famously understated GDP in a number of SSA countries. Devarajan (2013) called the GDP mismeasurement an African statistical tragedy. In those cases, the adjustments had to do with rebasing the benchmarks used to devise income measures. The result of those changes, as he put it, was that "the development community was happily publishing GDP statistics and growth figures …, pointing out how well [Ghana] had been doing. Now we have to revise those figures. So in fact we did not know how well Ghana was doing." p. S11. Like the understated GDP, the current SDG urban sanitation measure is similarly uninformative. However, unlike those measures, this one will also have pernicious effects: it will encourage high cost investments, waste resources, and make the goal unreachable for many countries.

Ultimately, the current approach has not, in Romer's (2015) p. 90, words, "flushed mathiness out into the open." Nor has it achieved, as Satterthwaite (2016, p. 116) put it, more "honesty about the limitations of the statistics." Both the multi-donor Water and Sanitation Program (2013) and UN Habitat (2011) have recommended a different, more flexible standard than the JMP allows, as has JMP's working group. WHO and UNICEF should reconsider their analysis, and follow their international counterparts.

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