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APPRAISAL OF WATER RESOURCE AS A KEY ASSET IN THE SOCIOECONOMIC AND HUMAN DEVELOPMENT INDEX IN SUB-SAHARA AFRICA.

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ABSTRACT

Water has no foe but a friend to all: in households, agriculture and industrial activities. Water is not only important to our health but to the development of the economy and ecosystems. In spite of these facts about water, this resource continues to be a scarce commodity in Africa and other developing countries. The paper aimed at comparing the schematic links between water and other components of poverty and/or development such as GDP, HDI, and life expectancy in selected African countries. In order to reach the objectives of this study, salient questions were applied. For instance,(i) Are there significant relationships between water, access to safe-drinking water and change in eco-socioeconomic indicators in 1985-2015? (ii) Has improvement in water sanity yielded corresponding improvement in the environment and people's livelihood? The result revealed that access to safe-drinking water has significant impact on the GDP, HDI, and life expectancy in all the countries studied. The study also revealed that sources of water withdrawal are as important as water utilizations. Current studies on the relationships between water and access to safe-drinking water and health need be investigated in the countries.

Key words: ***Water-resource, eco-socioeconomics, HDI, GDP, life-expectancy, Africa,***

INTRODUCTION

Water is said to be life because it plays a significant role in the existence of both living and non living things. This is because water is the most natural resources that sustain human life on this earth planet. Safe water for both domestic and industrial is not only a major problem for developing countries but also a global issue which needs

to be addressed. Rapid increase of urbanization has been attributed to failure to sustainable access of both domestic and industrial water. According to (Cairncross et al., 1990), poor services such as inadequate provision of safe water, drainage, and garbage collection are significant features of the world growing cities. The warming climate and human factors including urbanization, population growth, industrial activities, poor faming practices especially poor waste water management continue to impact negatively on our water resources (Dungamaro, 2009).

It is in record that in 2000, the General Assembly of the United Nations implemented the resolution A/RES/55/2 challenging nations to a new global partnership to ameliorate severe poverty. This resolution constituted series of time-bound targets termed the Millennium Development Goals (MDG). The N0. 7 included "promoting environmental sustainability" with the section 7c documentation on reducing the percentage of the population without sustainable access to safe-drinking water and basic sanitation by 2015". In Sub Saharan Africa, this MDG goal on water seems to be a mirage because the expected target as at 2012 was 77.5% yet, less than 65% of the population was covered (WHO and UNICEF, 2014).

In addition, water has direct and indirect impacts on man. For instance, sustainability of food production can be improved by the use of clean water to reduce poverty and hunger. The availability of clean water is not only essential for health reasons but for the socio-economic development of any country (WHO and UNICEF, 2006). Although the United Nation Millennium Development Goals was to take necessary action to improve the availability of clean water, success has become very challenging. It is a common saying that, `there is water everywhere, but no water to drink`. This fact was reiterated by Schafer et al, (2014) who noted that developing countries can have access to improved water source but such source may require further treatment for safe drinking. The WHO and United Nations Children Fund(UNICEF) joint Monitoring Programme(JMP) for water supply and sanitation confirm that: any new target set beyond 2015 will have to address water quality, which will be measured or estimated in a meaningful and cost effective manner. In such a case new water treatment method such as membrane technology can play a key role in the treatment processes. Water disaster, pollution, and ecosystem degradation have been major hindrances to achieving such a goal. Furthermore, current global trends such as increase in population, soil exploitation, climate change, and land degradation have contributed to water problem (Rossi, 2015). Decades ago statistics has revealed that 784 million people lack access to drinking water around the globe. (WHO, 2012). However, recent report confirms that about one- tenth of the world population do not have access to good drinking water (MDG, 2012). This supported the evidences of worsening safe-drinking water crises. Although many technological advancement have been made over the past years, the potential of safe drinking water delivery is still an obstacle in many countries (Lee and Schwab, 2005; Hunter et al., 2009; Rizak and Hrudey, 2008). Lack of clean water and poor sanitation are normally associated with high risk of water-related diseases including cholera, typhoid, malaria, diarrhea and others. Therefore apart from safe water, sanitation plays a key role so that water cannot be contaminated to avoid such diseases. In developing countries, more focus is related to the quantity of water rather than the quality for survival. The major cause has to do with lac of qualified technician to maintain the system and apply appropriate quantity of chemicals mostly chlorine to the water. Conclusively, educating people from African countries should be paramount as to eradicate cases of water contamination in the near future (Dugard, J., 2010). The main focus of this paper is to compare the schematic links between water and other components of poverty and/or development such as GDP, HDI, and life

expectancy in selected African countries. Are there significant relationships between water, access to safe-drinking water and change in eco-socioeconomic indicators in 1985-2015? Has improvement in water sanity yielded corresponding improvement in the environment and people's livelihood? The paper has answers to these questions.

MATERIALS AND METHODS

Study site(s)

The study was programmed to cover four out of the five regions of Africa. These included, West Africa (Ghana and Nigeria), Central Africa (Cameroon), South Africa (Malawi), and East Africa (Sudan)(Figure 1). These countries were selected based on (i) the strong MDGs in operation (ii) intensive and extensive agricultural, industrial and urbanization (iii) availability of data most relevant for the study.

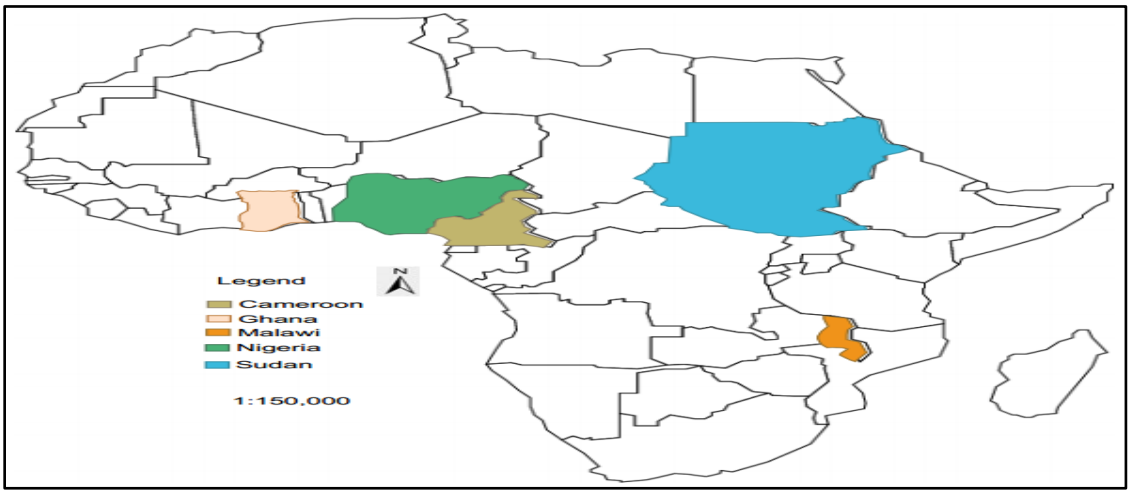

Figure 1: Africa showing the countries of study.

The countries, their landmasses and demography were Ghana (238533km^2, 250009153persons); Nigeria (923768km^2, 182202000 persons) and Cameroon (475442km2, 22534532 persons). (Nwaogu etal., in press; FAO stat, 2012; UN, 2014). Sudan used to be the largest country in Africa and the Middle East (area wise), before the country split in two in July 2011 (Sudan and South Sudan). In addition, it ranked as the 10th largest country in the world. It covers an area of 728,215 square miles and has an estimated population of 30,894,000. The country's name derives from the Arabic bilad al-sudan, which means "land of the blacks." (Diab, 2013). About one-third of the total area Sudan is suitable for agricultural development like other studied countries (World mark Encyclopedia of Nations, 2007). Malawi has a total area of 118,480 sq km with a Population of 16,777,547 (2013 est.). (Bureau of African Affairs. U.S. Department of State, 2011; Cutter, 2006; Kayser et al., 2015).

Data collection and analysis

Relevant data for the study were acquired from literatures and the database of related international, regional and national organisations including:

- International organisations: International monetary fund, World Bank, World Health Organisation, United Nations Children's Fund, United Nations Development Programmes, Food and Agricultural Organization, and other Joint Monitoring Programmes (JMP).
- Regional organisations: African Development bank, Global Growth Generator-BRIC and City group; African Ministers' Council on Water (AMCOW).
- National organisations: National Beaureau of Statistics of Nigeria, Millennium Development Goals Report on water and other socioeconomic indicators for Nigeria, Ghana, Malawi and Cameroon respectively.

These data covered the periods between 1985-2015. They included percentage populations (total, rural and urban) access to safe-drinking water; Water withdrawal sources (in volume and %); Drinking water coverage (in %); GDP (in PPP and %); HDI; Life Expectance at birth (in year). Both the quantitative and descriptive statistics were employed for the data analysis. For instance, the ANOVA was used to measure the significant relationships the variables (Access to safe drinking water and GDP, HDI and Life Expectancy at Birth) while, the student t-tset was used to test the differences in access to safe drinking water between the two date intervals 1985-2000 and 2001-2015 across the five countries. On the other hand, the qualitative analysis involved the application of percentages, volumes and figures in ascertaining the rates of increase or decrease in water withdrawal and sources.

RESULTS AND DISCUSSION

The result showing the access to safe drinking water between 1985-2015 was presented in table 1. Population increase annually in Africa (Figure 2) and in almost all the developing countries of the world. This increment and the associated impacts are primarily found in the urban areas where the people tend to cluster because of better livelihood. Our result revealed that total population increased with increasing demand for water which is one of the basic amenities. For instance, Ghana has 8% increase in safe drinking water for the total population while, Sudan 5% increase for the urban population, Malawi 3% rise for the rural population, Cameron and Nigeria 2% increase each for the urban and rural population respectively (Table 1).

Table 1: Access to safe drinking water(%) 1985-2015

Variables(% of total)	Cameroon	Ghana	Malawi	Nigeria	Sudan
	1985-2000				
Total population	73.9	82.4	88.8	60.1	53.7
Rural Population	49.9	79	86.3	46.8	48.6
Urban Population	92.8	89.9	93.4	79.4	62.8
	2001-2015				
Total population	75.6	88.7	90.2	66.5	55.5
Rural Population	52.7	84	89.1	55.4	50.2
Urban Population	94.8	92.6	95.7	80.5	66

(Modified after WHO/UNICEF-JMP, 2015)

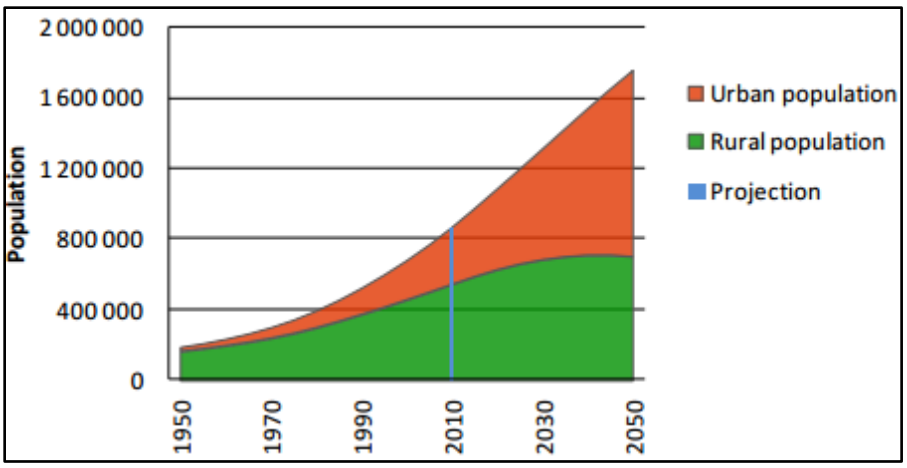

Figure 2: African Sub-Sahara population 1950-2050(Adapted from Mats, 2013)

Studies have revealed that the challenges of achieving the MDG targets in water accessibility and sanity were driven by urban populations, where the water supply coverage through household connections declined while the access through other improved sources(trucked water, public taps, hand pumps, protected wells)(Figure 3) rarely compensated for that (Banerjee & Morella, 2011; Herrera, V., 2014).

Figure 3: Improved sources drinking water in Africa

Tables 2:Estimated trends of drinking water coverage

	Drinking water coverage estimates					
	Urban (%)		Rural (%)		Total (%)	
Cameroon	**1990**	**2015**	**1990**	**2015**	**1990**	**2015**
Piped onto premises	25	28 (12%)↑	2	4 (100%)↑	11	17
Other improved source	53	67(26%)↑	32	49(53%)↑	40	59
Other unimproved	20	4(80%)↓	44	31(30%)↓	35	16
Surface water	2	1(50%)↓	22	16(27%)↓	14	8
Ghana						
Piped onto premises	32	41(28%)↑	2	3(50%)↑	16	19
Other improved source	43	61(42%)↑	37	81(119%)↑	40	70
Other unimproved	8	7(12.5%)↓	11	8(27%)↓	9	7
Surface water	8	0(>100%)↓	50	8(84%)↓	35	4
Malawi						
Piped onto premises	33	37(12%)↑	2	3(50%)↑	6	8
Other improved source	54	63(17%)↑	34	86(60%)↑	36	82
Other unimproved	6	4(33.3%	45	10(78%)	41	9
Surface water	3	0(>100%)↓	19	1(95%)↓	17	1
Nigeria						
Piped onto premises	3	32(>900%)↑	1	3(200%)	12	2
Other improved source	44	78(44%)	22	56(>100%)	28	67
Other unimproved	18	16(11%)	25	27(8%)	23	21
Surface water	6	3(50%)	50	16(68%)	37	10
Sudan						
Piped onto premises	46	78(70%)	13	16(23%)	32	23
Other improved source	8	20(>100%)	45	37(18%)↓	35	32
Other unimproved	12	31(75%)	29	36(24%)	25	35
Surface water	2	3(50%)	10	14(40%)	8	10

↑=increase (indicating improvement percentage in drinking water trend)
↓=decrease percentages (indicating decline in the use of unsafe water)
(Author‘s computation and analysis with data modified from WHO/UNICEF-JMP, 2015).

Estimated trends of drinking water coverage (Table 2) revealed that Nigeria has increased rate of piped onto premises and other improved sources in 2015 for rural and urban inhabitants. Drinking from surface water declined by more than 100% in Malawi and Ghana. Generally, the result showed that improvement was achieved in drinking water coverage’s for the countries (Table 2). The MDG has helped in decreasing the percentage of

surface water patronage in Africa (WHO/UNICEF, 2010) by establishing more improved sources (Bouabid, 2015; Ntouda, 2013).

Table 3: Water withdrawal sources (in million m^3 & % of total) 1985-2015

Variables	Cameroon	Ghana	Malawi	Nigeria	Sudan
	1985-2000				
Agriculture (million m^3)	728	652	810	5567	987
-% of total	74	66	80	69	2.5
Industrial(million m^3)	79	235	148	1689	3609
-% of total	8	24	15	20	97
Municipal(million m^3)	178	95	47	810	258
-% of total	18	10	5	11	0.5
Total	985	982	985	8004	3734
m3/inhabitant	65	50	65	70	1187
	2001-2015				
Agriculture (million m^3)	1014	1201	1118	7245	6813
-% of total	76.5	68	81	65	96.3
Industrial(million m^3)	82	372	356	2014	1215
-% of total	4.5	21	13	22	2.9
Municipal(million m^3)	318	256	54	1130	414
-% of total	19	11	6	13	0.8
Total	1494	1829	1528	10,389	8442
m3/inhabitant	67	53	90	77	1521

(Adapted from GGG, 2011; IMF, 2015)

The proportion of water withdrawal sources across the countries were shown in table 3. The source variables included agriculture, industrial and municipal. Agriculture has been one of the major anthropophagic activities demanding for intensive and extensive water supply globally. In the past two decades, Africa like other developing countries has been falling short of water provision for agriculture. However, the recent rapid improvement has been recorded. For example, between 1985-200 the average sum (volume) of 728million m^3 (74%), 652million m^3 (66%), 810million m^3(80%), 5,567million m^3(69%), and 3,609 million m^3 (97%) of water was withdrawn for agricultural purposes in Cameroon, Ghana, Malawi, Nigeria and Sudan respectively. On the contrary, all the countries recorded 100% increase in the average volume of water withdrawn for agriculture from 2001-2015 (Table3). The study revealed that agricultural water use dominated the others because arable farming accounted for the highest socioeconomic activities in all the countries studied (World-mark Encyclopedia of Nations, 2007; Cutter, 2006).The significant need of water resources for agriculture in Africa has been documented by several studies (Bouabid, 2015; Ntouda et al., 2013; Barrett, 2010; Mats, 2000). According to Mats (2000), water use for cultivation of food crops, feed crops and fodder is relatively associated with nutrition. Availability and accessibility of water for agricultural use are thus also directly connected to food security, which in the statements of World Food Summit 1996 means "a condition in place when everyone, at all times, have physical and socioeconomic access to adequate, safe and nutritious food that satisfies their dietary requirements

and food preferences for an active and healthy life." The concept based on the three dimensions: availability, access, and utilization. While food availability refers to the regional or global level of "supply", including food production, stock levels and net trade, access refers to reaching "growing demands", i.e. inter- and intra-household food distribution. Effective utilization defines the nutritional state of individuals and signifies whether individuals and households judiciously utilized the food they have accessed to. For instance, can the food be prepared under sanitary environment and if the health condition is such that both the essential macro and micro nutrients can be metabolized and absorbed (Barrett, 2010). Industrial engagements accounted for another area where water was largely withdrawn in the last 15 years. In Cameroon, Ghana, Malawi, Nigeria and Sudan the average volume (in millions m3) of 82, 372, 356, 214 and 1215 were withdrawn. The quantities by far exceeded those in 1985-2000 (Table 3). The rapid growth in urbanization pushed for a high need for water by the inhabitants. The quantity for Nigeria rose from 810 million m^3 to 1,130million m^3. Cameroon (178-318 million m^3) and Sudan (258-414million m^3). It was also revealed that a total of 1829 million m^3 at 53 m^3 .inhabitant was recorded in Ghana in 2015. Others were Malawi (1528million m^3 at 90 m^3.inhabitant), Cameroon (1494 million m^3 at 67m^3/inhabitant) Sudan (8442 million m^3 at 1521 m^3/inhabitant) and Nigeria (10,389 million m^3 @ 77m^3/inhabitant) (Table 3).

Table 4: Access to safe drinking water and GDP, HDI and Life Expectancy at Birth

ANOVA

VARIABLES	*SS*	*df*	*MS*	*F*	*P value*	*F crit*
GDP(PPP)	2212.8	4	442.5	9.47	<0.001**	2.710
HDI	4955.6	4	1238.9	26.52	<0.001**	2.866
Life Expectancy at Birth	934.2	4	46.7	11.34	0.027*	2.638

* Significant at 0.05 probability level

**significant at 0.01 and 0.05 probability level

The relationships between Water/safe drinking water accessibility, GDP, HDI and life expectancy have been examined (Table 4). The result revealed that the relationship between them were significant during the study periods. Both GDP and HDI were highly significant with the provision of safe drinking water (P<0.001). Similarly, life expectancy showed significant (p=0.027) with access to safe drinking water in the countries (Table 4).

Role of water in economic development and peoples life expectancy have been reported by several studied (Ntouda, et al., 2013; Bouabid Ali, Louis G.E., 2015; Bouabid, A., 2013). GDP and HDI are vital indicators for measuring water and safe drinking accessibility. GDP has previously been used as a significant variable of socioeconomic environment to study water utility operation in selected African countries (Buafua, 2015). It is of no doubt to conclude that the risk of occurrence of diarrhea and other water-related diseases are highly related to

the lack of access to drinking water (Bouabid, 2015), the living standards of households (Ntouda, et al., 2013) and the place of residence (Rossi, 2015; WHO/UNICEF, 2010).

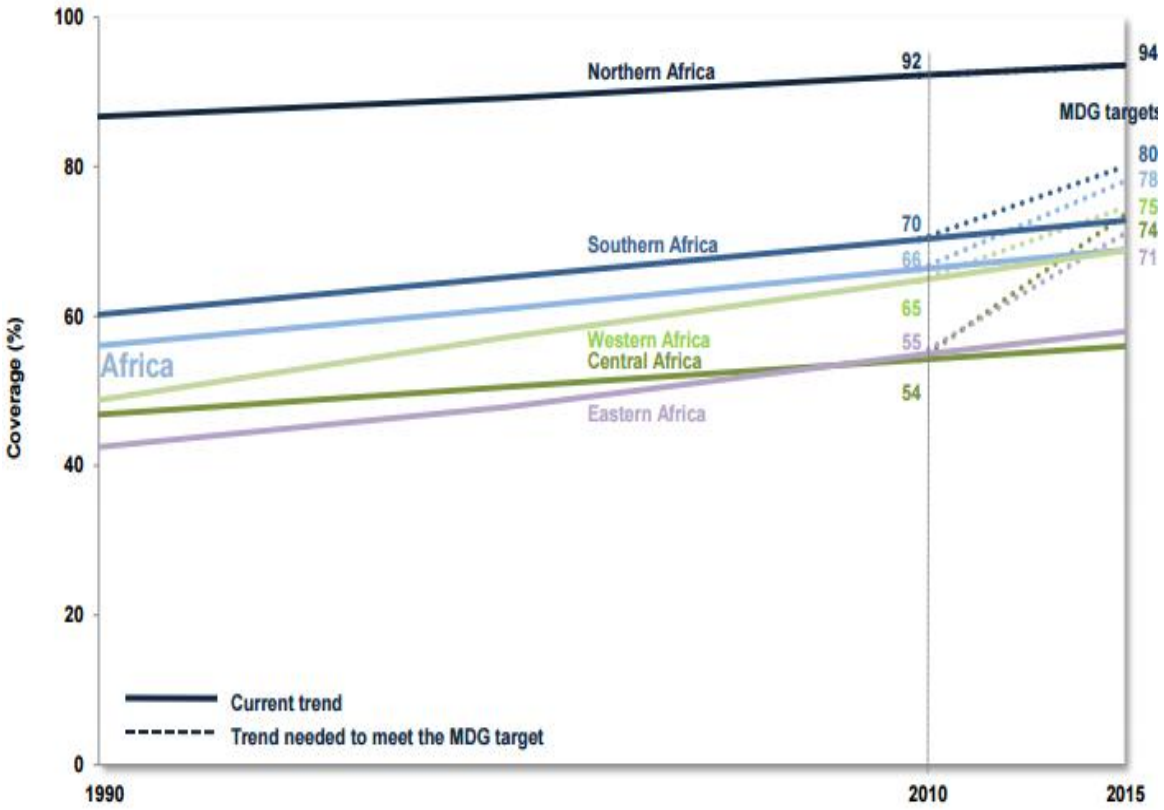

Figure 4: MDG drinking water targets for Africa Sub-Sahara Region 1990-2015 (Adapted AMCOW 2012)

Table 5: Test of the differences on Access to safe drinking water between the two date intervals 1985-2000 and 2001-2015

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	497.7812	772.8981	0.644045	0.01226
Cameroon	0.245366	0.040534	6.05329	< 0.001**
Ghana	-0.1866	0.149016	-1.25225	< 0.001**
Malawi	-0.01488	0.035038	-0.42468	0.028*
Nigeria	0.0225	0.020243	1.111448	< 0.001**
Sudan	-0.09388	0.036347	-2.58277	0.034*

*Difference is significant at 0.05

**Difference is significant at 0.01 and 0.05

The test of the significant difference on access to safe drinking water between 1985-2000 and 2001-2015 across the countries revealed that the values were significant for all the countries studied (Table 5). At P<0.001, Camerron, Ghana and Nigeria were highly significant while, Malawi (P=0.028) and Sudan (P=0.034) were significant at the 95% level of confidence (Table 5). These indicated that large differences existed between safe drinking water accessibility in the countries during the given time frame. This result was in line with previous reports in Africa and other developing countries (WHO/UNICEF, 2010; Banerjee, 2011); though the targets of MDG are yet to be met in some African regions. Although, North African countries favourably reached the MDG targets for the region; South Africa was 10% below, while West, central and East Africa regions were still far below the targets (figure 4) (AMCOW 2012).

CONCLUSION

Though the targets of MDGs on water was not fully realized in all the Sub-Sahara African regions yet, significant improvement has been achieved in water availability and safe drinking access from 1985-2015. This development boosted the agricultural sector and food supply in the region. The growth in GDP, HDI and life expectancy were obvious impacts of the trajedictory in water resources and accessibility in the region. However, there are still more opportunities for the international, regional and local organisations responsible for water resources management to save people and their livelihoods in Africa and other developing countries.

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