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WATER, SANITATION, ENVIRONMENT and DEVELOPMENT

Rainwater harvesting initiatives in Ekpoma, Nigeria

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Introduction

In 1989, I had an assignment as part-time consultant to the Federal Ministry of Health to monitor and evaluate primary health care activities in Bendel State in Nigeria (Bendel has since been split into Edo and Delta states). During the three-month period of the assignment, I noticed a widespread use of simple structures attached to houses to collect rainwater for domestic use in Ekpoma and other settlements around. My curiosity in this respect led to follow-up visits to this town making further observations and asking question from a cross-section of community members. The result of this simple exercise is presented in this short paper.

Background

Ekpoma is the administrative headquarters of Esan West Local Government Area in Edo State. With an estimated 1992 population of 63,467, the town is made up of twenty-two traditional wards (clans). It is located 80km north of Benin City which is the state capital. Ekpoma is located on the Ishan Plateau. Its characteristic physical features include a level topography, loose sandy soil and the paucity of surface drainage. There is a marked dry season the duration of which may extend to five months. The mean annual rainfall in the area is 1,556mm. The soils are porous with the result that the water table is very low. This explains the seasonal character of the streams which dry up during the dry months. The natural vegetation is deciduous forest which is very rich in timber resources.

One of the major socio-economic problems facing the area is shortage of water supply. As can be inferred from the foregoing description, the natural characteristics of the area are not favourable to abundant supply of water. Secondly, public sector intervention in the provision of water has been rather slow and largely ineffective. For instance, it is only very recently that a public bore-hole was installed within the settlement. At the time of writing this paper the bore-hole did not function as it was reported as having collapsed. The second borehole which was privately owned remained the only communal source of water. The cost of water from this private source was unaffordable to a majority of community members. The only readily available sources of water in Ekpoma therefore has constantly been the rainwater harvesting gadgets attached to dwelling units. This is an initiative that has been at work with regard to the satisfaction of the people's survival instinct.

The rainwater harvesting gadget

The idea of rainwater harvesting in Ekpoma and the surrounding settlements rests on the collection of rainwater that falls on the roofs of houses and channelling the water into an underground storage tank or reservoir. The main elements of the system are the roof-gutter, the pipe and storage tank (which community members refer to as 'wells'). With respect to a number of systems observed, there are additional fittings such as funnels with wire gauze.

The operation of the system consists of harnessing the rainwater that falls on house roofs. Most of the roofs in Ekpoma were made of corrugated iron sheets. The entire roof-edges or parts are fitted with gutters made of iron sheets. A pipe cast from iron sheets is fitted to the end of the roof-gutter and directed into a small opening leading into the storage tank. The tank is made of concrete blocks deep down the ground with part of it elevated above the ground level. Of course there is another opening of about 0.6m by 0.6m through which water is drawn using small buckets (steel or plastic) that is tied to a strong rope.

As important aspect of the gadget is the size of the storage tank; the bigger the tank, the more the volume of the water it can hold and the more the number of people the water will serve. There are variations not only in sizes of tanks but also in their shapes. Most of those observed were circular while others were rectangular or square. With regard to the circular tanks, the average size is 2.5m in diameter and 3.5m in depth. This works out to a capacity of 17,899 litres of water when the tank is full.

Apart from the shapes and sizes, there are also variations in the types of finishing. While quite a number of the water systems were covered with corrugated iron-sheets, a few were covered with concrete slabs; yet others were left open with poles or planks loosely stretched across the opening. Community observations and discussions with members indicated that variations in the finishing are a function of income. In fact a very minute proportion of households already fitted overhead tanks as part of the system; water is lifted from the underground concrete tank into the overhead steel tank by electric water-pump, and thus distributed into the house by gravity.

Cost of construction

The materials used in the rainwater harvesting systems are sand, gravel, cement, iron rods (as applicable) and planks (as applicable). The types of material vary directly with the types of storage tanks desired. A tank with a concrete slab for example, does not require iron sheets. By the same token, the quantity of materials is in direct proportion to the size of the tanks.

An average sized tank of about 18m3 will cost N13,709 ($US 343) going by 1993 prices. The same system cost only N1,169 ($US 29) five years ago. This reveals an astronomical rise in prices in the country during the period. Nigeria, it will be recalled, adopted the structural adjustment programme in 1986. The naira value has since fallen from $1,00 to N1.00 in 1985 to $1.00 to N40.00 in 1993. With this escalating rates in the prices of goods and services, lack of affordability has constituted one of the most formidable constraints facing construction of new and maintenance of the old systems.

Operation and maintenance

The quantity of water an average sized tank will hold at full capacity is about 18,000 litres. When installed in a dwelling unit of two households (national average household size is 6.8), the storage tank water will last for 88.2 days or approximately three months at a minimum consumption rate of 15 litres per capita per day (a WHO survey indicated 15 litres as minimum average daily consumption for rural areas of Africa). However, it should be noted that water drawn out of the tank is replenished by subsequent raining during the rainy season – i.e. May to October. It is during the dry season that water consumed from the reservoir is not replenished. This in effect is the period of critical shortage when the harvested rainwater is most useful to community members.

As to the quality of rainwater harvested, it can be observed that the water is generally not potable even though it is used multipurposely (including drinking). No laboratory tests have been carried out; however, discussions with health workers around revealed that harvested rainwater was generally unsafe for drinking without some form of treatment. The reason, it was gathered, has to do with storage and use of the water. The first few rains in the year inevitably collect a lot of dust not only from the atmosphere but also from the roofs where dust might have collected in large quantity during the dry season. It was observed that while some households turn the collecting pipes away from the reservoir during the period to prevent impure water entering, others did not. Another factor contributing to the presence of impurities in the harvested rainwater is inadequate cleaning of the tank. Most tanks are washed invariably only once during the dry months when the water level falls almost to the tank floor as families will not devote sufficient quantity of scarce water resources for this purpose.

Table 1
Cost of construction of rainwater harvesting gadgets (1988 and 1993)

Material/Labour	Quantity	Rate (Per Unit) (₦)		Cost (₦)	
		1988	1993	1988	1993
Materials					
Sand	1.5t lorry loads	120	350	180	525
Gravel	1 lorry load	250	750	250	750
Blocks	384 No.(9"x9"x 18")	2.5	10	960	3,840
Cement	18 bags	40	168	720	3,024
Iron - Sheet	1 Bundle of 20 sheets	32	1,400	32	1,400
Planks	10 No (2"x3"x12")	1.5	25	15	250
Nails	8lb	1.5	10	12	80
Labour					
Digging	20 man-days	15	80	300	1,600
Bricklaying	20man-days	15	80	300	1,600
Carpentry	8 man-days	10	80	80	640
Total			-	1,169	13,709

Discussion

The origin of rainwater harvesting initiative in Ekpoma area has not been ascertained. Discussions with a cross-section of community members shown that the first such system was probably constructed by the early missionaries who worked in St. Peter and Paul Seminary in the town. Others claimed that the practice was as old as the community itself. However, the fact remains that it is a widespread practice with one in every four or five houses having a rainwater harvesting system. The practice has since become a survival strategy as they are about the only water sources available between November and March. When tank water is completely used up, community members have to travel up to six km to fetch impure stream water that is found in small ponds.

The initial efforts in the construction and installation of rainwater harvesting systems were crude; however, with time incremental refinements were added to the gadgets to increase their utility value. As mentioned earlier, some members of the community including those in the Seminary have added electric pumps and overhead tanks to the systems.

The problem facing potential rainwater harvesting system owners is the currently high prices of building materials (as prices in other sectors of the economy).

A second problem observed is technical incompetence in the design and construction of a number of the gadgets. Some concrete walls of the storage tanks were collapsing while some tank roofs were caving in and therefore constituting danger in the premises.

A third problem relates to factors that detract from the safety of water with regard to drinking. For example, it was observed that where storage tanks were covered with concrete slabs, these were used by household members in drying food stuff part of which sometimes escaped into the tank. It was also observed that roaming domestic animals (e.g. goats, sheep, dogs) used the slab tops as places of abode on which they defecate.

Recommendations

In view of the foregoing descriptions and discussions, the following recommendations are important in strengthening the people's initiative and therefore making rainwater harvesting system more affordable and effective:

- Public sector intervention should include encouraging people or compelling them to integrate rain water harvesting with the overall housing plans submitted to Town Planning Authorities for approval. The construction of the system thereby goes on simultaneously with the construction of the main building.
- The operators and users of rainwater harvesting systems need to be given required technical assistance in construction and installation. A relevant government agency should establish a technical assistance unit and identify communication channels between the unit and the public to make this possible.
- Community members through People's Bank and Community Banks should be made more easily accessible to soft loans specifically for construction rain harvesting gadgets.
- Relevant government agencies should embark on health education programmes that emphasize aspects of sanitation and personal hygiene with reference to the use of water from the rainwater harvesting systems.