Supporting self-supply of water

An innovative approach to reach SDG6.1 in rural Africa at $25/person and have impact on SDGs for poverty, food, gender and climate

Context

Some 300 million people in rural SSA, are "left behind". They often live in small communities and do not have "basic service"; an improved water source at <30 minutes return trip from home (WHO, 2022). An option to provide this group with at least a "basic service" is supporting self-supply with affordable technologies. A range of such technologies is called SMARTechs, (Simple, Market-based, Affordable, Repairable Technologies). Examples include improved hand dug wells or manually drilled tube wells, low-cost pedal, hand and solar pumps, rainwater harvesting and underground storage tanks and household water filters. With these options SDG6.1 in small rural often remote communities can be reached at a cost of $25/person. Reaching the same group with machine drilled boreholes and imported pumps would cost $50 - $150/person (Sutton, 2021). Low cost technologies help to reach SDG6.1, but also can lift families out of poverty and reach other water related SDGs. SMARTechs are part of the SMART approach that includes:

1. **Innovation**. Improved options for wells, pumps, ..that can be produced locally.
2. **Training**. Building capacity of the local private sector in technical & business skills
3. **Self-supply**. Stimulate rural (farm) families to invest in their own water supply for both domestic and productive purposes.

This approach is applied in 9 African countries via SMART Centres who train the local private sector and via projects provide basic service in rural areas with low cost technologies at a cost of $25/ person. An example is Zambia where some 460 wells ($1000 /well) were subsidized. A recent evaluation by IRC indicates that each well serves on average 40 people, so **family owned wells serve small communities**. The income from livestock or irrigation provides money for maintenance and 92% of the pumps are functioning. Another effect is that 130 families paid for their own wells and pumps. So supported farm wells create a market for full self-supply (IRC, 2022). See also Annex 3.

The objective of this paper is to share evidence from Tanzania, Malawi, Zambia and other countries on innovative options for rural water supply, either partially or fully self-supplied. Examples that prove the potential of the combination of **low-cost farm wells, rainwater harvesting and agricultural skills to reach SDGs for poverty, food, gender, water and sanitation, employment and climate resilience.** This evidence is based on the book "Self-supply" (Sutton, 2021), the evaluation of the SMART approach (IRC, 2022), and on decades of field experience with instructive failures but increasingly also considerable successes.

Groundwater

At the 2023 UN water conference in New York there was discussion about groundwater challenges such as pollution and depletion but also its huge potential for rural development. For instance, in Sub-Saharan Africa (SSA) only 5% of the area equipped for irrigation uses groundwater (UNESCO, 2022). Some 61% of SSA is covered by aquifers of the "local shallow" type, which can locally be overexploited but have no risk of depletion (World Bank, 2023). If farmers harvest all the rain that falls on their land with options like Deep Bed Farming, they become "catchment managers". Some 80% of all farmers in SSA are small holder farmers. With irrigation in the dry season, they could increase the food production, generate income and have water for drinking and domestic use. With existing or new technologies the cost of a well and pump can be $200 to $1000. Water can be made safe to drink with a $25 household water filter. There is potential and need for millions of small farm wells which is also the message from John Cherry, leader of The Groundwater Project and winner of the 2020 Stockholm Water Prize (Cherry, 2022).

Technological innovation
Of the many water technologies worldwide, SMART Centres are selecting cost-effective options, sometimes improve them and make them fit for local production. Options include:

1. Household Water Treatment; An intermediate solution for safe drinking water, promoted by the WHO is Household Water Treatment and Safe Storage (HWTS). Household water filters are particularly effective and good quality options for 1 family start at cost of around $25.
2. Wells; Existing dug wells can be improved with a well cover and a pump at a cost of $100-$200. EMAS drilled tube wells with a small diameter cost $10-$15/ meter so a 30 meter deep well cost $300 - $450 including a pump. Wells with larger diameter and drilled with other options in hard ground layers cost $500 - $1000 including a rope or solar pump. In areas with rocks, (small) mechanical drills are needed.
3. Pumps; Cost of EMAS, Rope, Treadle and solar pumps range from $50 to $300.
4. Rainwater harvesting and storage; To avoid depletion of groundwater "water balance" and Managed Aquifer Recharge (MAR) can be promoted. Examples of household level MAR include "the Tube recharge" that stores 100 - 200 cubic meters/year and costs $20. Other options to harvest rain are "half-moon bunds" or "Deep Bed Farming". Water can also be stored in underground tanks of 7000 litres that cost $150. Information in Annex 1 and 5.

Training in SMARTechs
Most SMARTechs can be produced locally. Examples are the EMAS pump in Bolivia and the rope pump in Nicaragua. Both started in 1990 and some 70,000 of each pump type were installed in these countries. In Africa, SMARTechs were introduced in around 2000. Although technologies like a rope pump are simple, the hard lesson learned is; "Simple is not easy". Good quality technologies and services require long term training and coaching in both technical and business skills. See also Annex 2.

Self-supply, farm wells
Self-supply is when households partly or completely fund their own water source.
Building supply chains of low cost technologies and stimulate farmers to invest in their own water source has huge potential to reach SDG6.1. Rural development in Europe and the USA started with self-supply. For instanced over 45 mln. hand pumps were sold in the USA. In Asia more people have their own supply than supply by utilities and 96% use an improved groundwater source (Foster, 2022). In Nigeria 90% of the water supply in and around Lagos is self-supply (Danert, 2015). Many examples are described in the book "*Self-supply" - Filling the gaps in public water supply provision"* (Sutton, 2021). See Annex 3
Millions of new wells may raise concerns such as water quality and depletion of ground water. These concerns can be effectively addressed. See Annex 1 and 4.

Reaching the left behind & funding
In general, all people in SSA who already have "safely managed" or "basic service" with piped systems or communal rural water points were subsidized for the CapEx by Governments or aid organizations with at least $25 / person. From the viewpoint of human rights and /or social justice the 300 million people in SSA who do not yet have "basic service" deserve the same subsidy. Funds should come from governments, NGO's or others interested in reaching water related SDGs. Funding sources can also be carbon credits and climate funds**.** With low cost technologies and subsidies for the yet unserved, the SDG6.1 target group in rural areas can be reached, **a group that now is "left behind".**

Effects of supporting self-supply / farm wells on other SDGs
Besides reaching SDG 6.1, other effects of this approach include contributions to;

- SDG 1. Poverty alleviation. Water for livestock and irrigation generate income
- SDG 2. Food security. Families with a well can also grow food in dry periods.
- SDG 5. Gender. A household well reduces the time currently used to fetch water.

- SDG 8. Employment. Drilling wells and producing pumps create jobs for drillers and metal workers. Access to water creates work in farming.
- SDG 13. Climate. Rainwater storage and low-cost wells build climate resilience.

Conclusions

1. Supporting self-supply/farm wells is a promising option to reach the SDG6.1 in rural Africa with additional positive impact of poverty, food, gender, and climate resilience
2. With an average grant of $25/ person this approach is **2 to 6** times more cost effective than other approaches in rural areas.
3. Reaching SDG 6.1 in rural SSA requires a transformation from:
    a. importing technologies - to also producing technologies locally
    b. water for domestic use only - to also water for productive use
    c. subsidizing communal water supply - to also subsidize household wells.
4. Upscaling can be achieved by collaborative and cascaded exchanges of knowledge.

Recommendations

1. Support existing or create new **rural development hubs** in each country. Hubs that have knowledge and can disseminate relevant, and most cost-effective technologies and approaches needed for rural development and building climate resilience.
2. Large scale capacity building of the local private sector to build commercial supply chains of affordable WASH and agriculture technologies.
3. The WASH and agriculture sector need to cooperate much more than now, in order to reach water related SDGs in rural areas in SSA.

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Annex 1. Innovation.

Simple, Market-based, Affordable, Repairable Technologies

<u>Household water filters</u>;
Worldwide over 2 billion people do not have safe drinking water (WHO, 2022). A cost-effective solution is Household Water Treatment and Safe storage (HWTS) as promoted by the WHO. Of all HWTS options water filters are relatively effective in reducing water borne diseases due to the consistent use (Wolf, 2018). There is a wide range of household water filters. For instance, options with a ceramic of diatom filter elements produce 20 to 60 litres/day and cost $25 - $50. Membrane filters produce 100 - 200 litres/day and cost $30 - $100 or more. Gravity and inline water filters became a multimillion business and many (richer) families in both developed and developing countries buy them via commercial supply chains. The challenge is how do the 2 billion poorest also get access. Where faeces are the problem water filters can be used. Where chemicals like arsenic is a problem, rainwater can be collected and then treated with a filter. One way to reduce cost of filters is local assembly. An example is Ethiopia. High quality diatom filter elements are imported and containers are produced locally. The basic model cost $22 and over 350.000 have been sold. Interesting in Ethiopia is that an increasing number of utilities see that they cannot always guarantee safe water from the tap. As an additional service over 100 utilities now sell filters and that number is increasing fast (Foppen, 2019). In many countries in SSA water from (old) piped systems is not always safe to drink so Ethiopia could become an example for other countries.
A bold idea called “2 with 8” was launched at the 2022 Stockholm World Water Week stating that safe drinking water for 2 billion people would be possible with $8 billion(MetaMeta SMART Centre Group, 2023).

<u>Upgrading hand dug wells</u>
In SSA there are 5 to 9 million hand-dug wells from which water is lifted with a bucket. These wells could be upgraded with a well cover and a windlass or a locally produced hand pump and so become an improved water source (Sutton, 2021). Many hand-dug wells dry up in the dry season and by making them deeper can be difficult or even dangerous. To prevent wells drying up, they can be combined with a Tube recharge system installed nearby the well that collects water from the roof or ground run off. For information on Tube recharge systems, see websites of the SMART Centre in Zambia or the SMART Centre Group.

<u>Drilling new tube wells – EMAS and SHIPO method</u>
Most rural water points in SSA consist of a machine drilled borehole and an imported handpump and are designed to serve on average 250 people. The investment cost (CapEx) of these systems ranges from $2000 to $8000 so $8 - $32/person. If this water source is within 30 minutes return trip it is a “basic service”. However, population densities in many rural areas is less than 50 people /square km so people have to walk more than 30 minutes. This is where a large part of the target group of SDG6.1 lives. Providing a basic service for small communities with the conventional approach would cost $50 to $150 / person (Sutton, 2021). If made well, manually drilled wells can have similar pump capacity and water quality as machine drilled boreholes (Practica/UNICEF, 2010). For small communities of 50 people or less the depth and diameter of tube wells (boreholes) can be less than for large communities. An example of very low-cost tube well is EMAS. This concept that can drill 50 meter deep or more in soft laterite layers. With casing diameters of 5 cm and small pumps the cost of wells is $10 to $15 per metre so the cost of a 30 meter deep well is $300 - $450 including a pump. Wells for small communities with larger diameters and drilled with options like the SHIPO drill, and combined with a rope or small solar pump cost $500 - $1000. Information on manual drilling see websites of RWSN, Jacana and SMART Centres

Pumps

Imported hand pumps like the Indian Mark II and Afridev on wells to 40 m deep cost $ 600 - $1000/pump and are fit for 250 people. Locally produced pumps like EMAS or rope pumps that can pump from wells of 40 metres deep cost $50 - $120 and are fit for 10- 50 people.
New small solar pumps that can be assembled locally are now being tested. They have similar pump capacities as hand pumps and depending on size and depth cost $150 - $500. Locally produced EMAS, rope and solar pumps guarantee that skills and low-cost spare parts for repairs are affordable and available. This is key for maintenance. Water from farm wells, can also be used to produce food for own consumption. Surplus can be sold on local markets thereby generating income to pay for pump maintenance and replacement.
For information on hand pumps see websites of the World Bank (the Hand Pump Option) and RWSN. For information on EMAS and rope pump see site of the SMART Centre Group.

The Money maker pump

The organisation Kickstart sells Money maker pumps which are pedal pumps that can pump from water levels of max 8 meter deep so from rivers, lakes or wells. There are 3 pump models with cost of $80 to $190. Some 50% of these pumps are sold to NGOs who (partly) donate them to small farmers. The other 50% are sold to small farmers often with micro credits. Studies indicate that over 75% of these pumps are used for irrigation cash crops and on average generate $700 extra income / year. Some 380.000 Money maker pumps have been sold already in 17 countries in Africa and lifted 1.5 million people out of poverty

Rainwater harvesting and storage

Groundwater can supply water year-round but must be recharged. It is essential that the installation of farm wells is combined with awareness on “the water balance” so awareness that no more water can be pumped out than goes in somewhere. There is a range of Managed Aquifer Recharge (MAR) options. An option that is fit for family level is the Tube recharge that can store 50 to 200 cubic meters per year and cost $20 for materials. After training, these systems can be made by farmers themselves. Other options include half-moon bunds as promoted by the organisation Just Diggit and collecting water from roads (Green roads for water). Where wells are expensive, an option is to collect rainwater in storage tanks. For example, with yearly rainfall of >200 mm an area of 400 square meters can yield 8000 litres/year. This can be stored in EMAS underground tanks. A tank of 7000 litres cost around $150 including an EMAS pump. A $25 water filter can be used to make water safe to drink. More information on the website of the SMART Centre Group.

Deep Bed Farming (DBF) Malawi and Catchment Management

- A promising option for rainwater harvesting is Deep Bed Farming (DBF) as applied in Malawi. The rainfed farming makes families and especially women, highly vulnerable to climate change shocks such as drought, dry-spells, flooding and siltation. Inconsistent rainfall combined with (destructive) conventional farming is leading to severe top-soil erosion. Soil erosion during rains is exacerbated by farming methods that created a widespread human-made “hardpan”.
- Hardpan, “discovered” by the FAO in 1997, was found to be common in most areas of Malawi and other countries (FAO, 2019). The hardpan is a layer of 20 cm – 30 cm situated under the topsoil caused by damaging farming methods. It prevents the infiltration of rainwater, hindering root development and plant growth. It also prevents the recharging of shallow aquifers and encourages water spill and erosion of top soils. To address this challenge the UK and Malawi-based organization Tiyeni developed the DBF method which consists of a one-time tillage (to break the hardpan) combined with furrows and flat-topped beds along the contour which increase infiltration and prevent runoff. Crop stalks and leaves are used as a moisture trapping layer that retains water and deposits nutrients in the ground. DBF also incorporates crop rotation with legumes, interplanting of crops between the beds, and “green manure cover crops” to improve soil fertility and reduce evaporation.

- The combination of DBF with Conservation Agriculture principles, can increase yields from the current 2 tonnes/Ha to 4 tonnes or more in the first year of adoption (Mvula, 2021). DBF is currently practiced by 25,000 farmers and was adopted by the Malawi Government as part of its development strategy (Tiyeni, 2022). Whether using DBF or other water harvesting options, the challenge in all areas is to ensure that rain percolates in the soil as much as possible and downhill surface runoff is reduced. In this way it can be seen that smallholder farmers are not just farmers but are the first step in proper catchment management.
- By harnessing all the water that lands on the fields and ensuring that it percolates, farmers become the essential **Catchment Managers**. It is impossible to manage catchments without engaging all, or the majority of, farmers. With their engagement in this, groundwater is replenished in every episode of precipitation. As more farmers adopt, critical mass is achieved, with many benefits to the catchments.

Rainwater harvesting with DBF on 0.5Ha
Many areas in sub-Saharan countries have average yearly rainfall of 500 mm or more. With (say) yearly rainfalls of 500 mm, each 0.5Ha (5000 square metres) receives 2500 cubic metres per year if there is no run-off. Assuming that 1500-2000 cubic metre is used up by crops and evaporation, then there is still 500 - 1000 cubic metres that can infiltrate into the ground.
In theory then, at least 500 : 365 = 1.2 cubic meters/day (1200 litres) would be available to pump out. This is enough for domestic use and some productive use. If all farmers in a certain area applied DBF, shallow aquifers would be continually replenished. With hand or small solar pumps, the risks of depleting the groundwater would be minimal.
Each farm well could provide water for cooking, drinking, washing for an average of 40 people and water for irrigation and / or livestock for 1 family so extending the cropping season and probably widening the nutrient balance in food. The condition is that **farmers become water managers** of their own plot and groups of farmers become managers of whole catchments. The net effect of this addresses the core requirements and target groups of SDG1.
More information on DBF see website of Tiyeni

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Annex 2. Training

In his key note speech at the Stockholm Water Week in 2017, mr. Bergkamp, former Executive Director of the International Water Association (IWA) mentioned that “to reach SDG 6, over 3 million practitioners would be needed. Training all these people, men and women, would require a “Marshall plan”-type of capacity building”. In short:

- There is a lack of engineers who can design new water systems, control the quality of newly drilled boreholes or repair pumps.
- Thousands of well diggers who now dig wells by hand could be trained in new manual drilling technologies that make work safer and would reduce the cost of wells.
- There is a lack of metal workers who know how to produce well drilling tools and handpumps and technicians who know how to select and install solar pumps.
- Trainings could be realised in WASH training centres with training capacity and demonstration of all technologies that are relevant.
- Centres where staff from Government, NGOs, and companies and farmers can see working examples and get advice on the most cost-effective options for the local context.
- Examples of such training centres are the **EMAS centre**s in Bolivia and Sierra Leone and **SMART Centres** in Africa.
- Other organizations working in this field include the Practica foundation which, with the support of UNICEF, has developed the manual well drilling sector in Chad and other countries.
- Practica also developed “drillability maps”. An example is a map for Zambia that indicates which areas are suitable for manual drilling.
- The EMAS group trained many well drillers in Latin America, Sierra Leone, and Senegal. In Zambia, Malawi and Kenya they trained in technologies fit for self-supply in cooperation with the SMART Centres there.
- The MetaMeta SMART Centre Group works with SMART Centres in nine countries in Africa and one in Nicaragua.
- Via training an estimated 10 million rural people in SSA got access to water with manual drilled tube wells and/or locally produced handpumps.

Worldwide, some 130,000 rope pumps are installed on subsidized wells for small communities and for self-supply (Haanen, 2017). “Simple is not easy”. It takes 2 to 3 years of coaching of local pump producers to make sure they produce good quality pumps. The same is true for well drillers. Besides the training of drillers and pump producers in technical aspects, it is also essential to train them in business skills to ensure financial sustainability. For information on EMAS and SMART Centres see websites.

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Annex 3. Self-supply.

Farm wells are key to rural development. Some examples:
USA. In the past over 45 million hand pumps were sold to farmers. Wells were dug by hand or made with manual drilling tools. Farmers climbed "the water ladder" and replaced the handpump with an electric pump or solar pumps. Many are now connected to piped systems but still 18 million farmers have self-supply due to the high cost of piped systems in some rural areas.
Asia. Over 500 million people in this region have self-supply, so more families have their own supply than supply by utilities, and 96% use an improved groundwater source (Foster, 2022).
Latin America. Over 70% of the EMAS wells in Bolivia were paid by families. In Nicaragua some rope pumps were subsidized for communal wells but the large part of the 70.000 pumps were paid for by farmers (full self-supply). Some NGOs donated a pump to families who dug their own well (supported self-supply). Besides improving water sources there was also a large economic impact. An extensive study indicated that replacing the rope and bucket by a pump increased family incomes by on average $225/year. So, the aggregated increased family incomes over 20 years were over $100 million. This is a result of $2 million of aid funding for training and promotion (RWSN, 2022).
Africa. In Zimbabwe, Water Aid supported families to upgrade their wells with a cover and windlass. Government also supported and now there are more than 200,000 improved wells. In Nigeria some 90% of the water supply in Lagos is self-supply so families pay a well driller to drill a tube well (Danert, 2015). In Madagascar over 150,000 Pitcher pumps were installed. In Sierra Leone there are 3000 EMAS wells and this technology has started in other African countries. Between 50% and 80% of all pumps mentioned above were paid for by families.
These and many other examples are described in the book "*Self-supply" - Filling the gaps in public water supply provision"* (Sutton, 2021).

Concerns about self-supply

The idea of drilling millions of new farm wells may raise concerns like:

1. **Depletion of water layers**
   What will happen if all farmers in SSA will have their own well? Will groundwater layers (aquifers) be depleted?
2. **Water quality.**
   Is water from farm wells safe to drink?
3. **High cost**
   Is the investment cost/person (CapEx) of a tube well for 50 people not more expensive than a borehole for 250 people?

Question 1. Pedal or hand pumps and small solar pumps only pump up 1 to 5 cubic meters per day. Still, it is essential that no more water is pumped out than is replaced. So, wells should be combined with rainwater harvesting. Full "water awareness" training must be included in farmer training with Deep Bed Farming, focussed on replenishing ground water.
Question 2. Water from good quality tube wells of 15 to 30 m deep in general is safe to drink. If in doubt, the 2-5 litres/person/ day for drinking can be made safe with Chlorine, boiling or a household water filter. In case of chemicals like arsenic or fluoride, an option is to store for instance 1000 litres of rainwater and treat it.
Question 3. Small diameter tube wells and locally produced pumps are typically **TWO to SIX** times cheaper than larger boreholes and imported pumps. Cost of tube wells and pumps in wells of 15m - 30m deep made with innovative technologies range from $150 - $1200.

Communal wells with import technology versus household wells with local technology

The conventional approach for rural water supply in SSA is a machine drilled borehole with an imported hand pump used by an average of 250 people, costing $2000 to $8000. The CapEx (investment cost of borehole and pump) is $8-$32/ person.

To have basic service there needs to be an improved water source at less than 30 minutes return trip. However, in much of rural SSA the number of people per square kilometre is 50 or less. Reaching these communities with a machine drilled borehole and an imported pump (conventional technologies) would cost $50-$150/ person (Sutton, 2021).
This high cost per person is a reason why governments or NGOs hardly invest in rural water supply systems for small groups of people.

Solutions for small communities
A well for a few families does not need a high yielding aquifer and can even function with an "intermittent yield". For instance, a casing with a diameter of 6 cm has a storage capacity of 30 litres per meter so with 5 meters of water level, the storage is 150 litres. Pumping 6 times per day yields 900 litres which is enough for domestic use of 40 people. Between each pumping out, groundwater can slowly flow into the borehole casing.
Compared to communal wells, the advantages of household wells are:

1. High functionality of pumps.
   Experience is that >92% of family-owned pumps (with Family Based Management) are functioning. This is explained by the clear ownership, the convenience, food production and so the extra income funds repairs (IRC, 2022). Wells with a Community Based Management have pump functionalities of 60% to 75% (RWSN, 2022).
2. Time saving and safety for women and girls.
   A well at premises saves time and increases safety for women and girls who currently collect water from distant communal wells or other sources often at unsociable hours.
3. Food security, health and income.
   Having water at home all year round stimulates the production of food and sales of surplus to local markets. There are clear health and hygiene benefits.

Besides the impact on SDGs on poverty alleviation, food security, access to water and gender equality, farm wells create employment for well drillers and metal workers and irrigation gives work for farm families. Wells combined with rainwater harvesting, build resilience to climate change.

Examples of supported self-supply:
Zambia. Drillers trained by the Jacana SMART Centre in Chipata drilled over 460 tube wells with the SHIPO drill in East Zambia. The well ($1000 excl. overhead) was 90% subsidized. A condition for a family to get the subsidy is that they have a plan to generate income with the water. Initially the idea was that part of the families would start selling water. However this is not the case. Families with a well, **share** water with an average of 40 other people, so these family-owned wells are serving small communities (IRC, 2022). Also, over 90% of the family-owned pumps continue functioning which is much higher than communal pumps. The reasons for this high functionality include; clear ownership, convenience, extra income and affordable and locally produced spare parts. Another effect of the subsidized wells was the creation of a market for full self-supply. Already over 130 families have paid the full cost of wells and pumps. For more information see website SMART Centre Zambia

Tanzania
Around 2005, the SMART Centre in Tanzania installed some 700 rope pumps on manual drilled wells in small communities and schools with a 90% subsidy. These examples created a market for 100% self-supply and by 2022 there were more than 15,000 rope pumps installed of which an estimated 70% is self-supply so paid for by families. Many of the 100 well drillers and pump producers trained by SHIPO became independent small well drilling or pump producing companies resulting in a sustainable supply chain of affordable WASH technologies (IRC, 2022).

Nicaragua
The rope pump was introduced in 1990. Local companies were trained to produce this pump and by 2010 over 70.000 pumps were installed. With the increase of rural electricity many families replaced the rope pump with an electric pump (climbing the water ladder). Most of these pumps are paid for by families/ farmers themselves.
An extensive study indicated that families who replaced the rope and bucket on their wells by a rope pump increased family income by an average of $225 /year (Alberts, 2003). The total increased incomes of all farmers with a rope pump over 20 years was over $100 million. This development started with the investment of $2 million development aid for training and coaching of pump producers (RWSN, 2022; Briemberg, 2022).

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Websites

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- SMART Centre Nicaragua. www.smartcentrenicaragua.com

Annex 4. Reaching SDG 6.1 in rural SSA by supporting self-supply; subsidizing farm wells and storage tanks

"The State of the World's Drinking Water" report indicates that the investment needed to reach SDG 6.1 by 2030 and providing 50% of the yet unserved worldwide with a safely managed water source at premises (so a well-functioning piped water system) and 50% with "basic service" is over $600 billion (WHO,2022). Over 400 million of this target group live in SSA of which >75% are rural, often in areas with less than 50 people per square km.

A basic service with conventional technologies like a machine drilled borehole and an imported pump in these areas would cost $50 - $150/person (Sutton, 2021).

With the SMART approach the cost for the same target group would be $25/ person. This is based on improved hand dug wells or new manual drilled wells of 20 to 40 metres deep and locally produced pumps. Cost of such wells is on average $1000 and serve 40 people so the per capita cost (CapEx) is $25. Where manual drilling is not possible, underground tanks like the EMAS tank can be made with more or less the same cost per capita. Regarding funding.

In general, people who have already been provided with a "safely managed" or "basic service" received a government or NGO subsidy of $25 or more. So, people who do not yet have a basic service (some 300 million in rural areas), should have the right to receive the same subsidy. The cost of reaching the 300 million unserved in SSA with the SMART approach would be $7-8 billion. That would then leave no one behind.

Recommendations

Actions to scale farm wells and rainwater harvesting include;

1. Wide scale awareness-creation and training

Raise awareness, train and develop capacity for manufacturing and disseminating information about existing and new low-cost technologies for rainwater harvesting, wells, pumps and awareness of recharging aquifers in sustainable agriculture. This could be done via "Rural development hubs" in each country that also could include knowledge on other topics that are needed for rural development like conservation farming, rodent control etc. Examples of training centres are WET Centres of CAWST, EMAS centres and MetaMeta SMART Centres.

2. Build supply chains of affordable technologies

Build up commercial supply chains of effective, attractive and affordable water, sanitation and agriculture products. Outlets in each town should sell a range of options so people can choose. Large scale programs are needed to train the local private sector (SMEs) in technical and business skills.

3. Innovate payment systems

Payments options for those who cannot pay in one time like Micro credit, Pay-as-you-go, etc.

4. Subsidies for the target group of SDG 6.1

In general, people who have already been provided with a "safely managed" or "basic service" received a government or NGO subsidy of $25 or more. The 300 million people in rural SSA should have the right to receive the same subsidy. By scaling the example of Zambia the cost of reaching the 300 million unserved in SSA would be $7-8 billion. That is much less than what it would cost with the conventional approach and would leave no one behind.

References:

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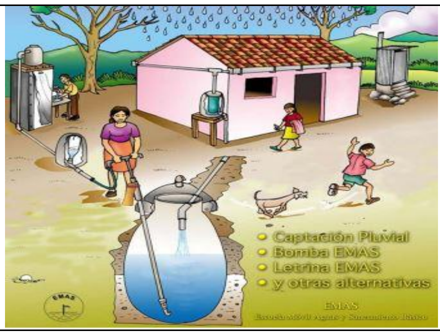
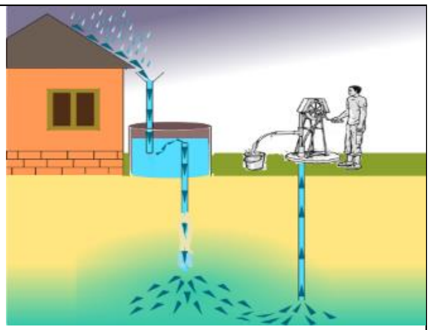
Websites

- SMART Centre Zambia. Jacana www.smartcenterzambia.com
- SMART Centre Tanzania. SHIPO www.smartcentretanzania.or.tz

Annex 5. Pictures of technologies fit for self-supply

		
Wire brick cement tanks Material: wire, bricks, cement. Volumes 1 to 50 Cubic metre Cost material: $20-$40/ c.metre	**EMAS underground tank** Egg shape hole of 7000 litres plastered with cement. Cost material: $100 - $200	**Tube recharge** Prevents dry wells. Can recharge 100-200 cubic meters /yr. Cost material: $10 - $50
		
Water from open wells Can be improved with a well cover and hand pump.	**Well cover & hand pump** Cost material: $100 - $200	**Tube bailer** Technology to deepen existing wells. Cost material: $20 -$100
		
Mzuzu manual drilling Ground layers; Medium hard Casings: 1.5 - 4 inch. Depth: 5- 25 meter Cost/well: $300 - $600	**EMAS manual drilling** Ground layers: Soft, medium hard Casings: 1.5 - 3 Inch Depth: 10- 60 meter Cost: $10- $15/ meter Cost well 30m: $300 incl. pump	**SHIPO manual drilling** Ground layers. Hard, no rocks Casings: 1.5- 4 inch Depth: 0-50 m. Cost/well: $400 - $1000

		
EMAS pump Pump depth: max 40 m. Can pump up to 30m high. Cost/pump: $ 40 - $80	**Rope pump 4 models** Models for hand dug and hand drilled wells. Cost/pump: $60 - $120	**Solar pumps 24 - 35 VDC** Pump head 1 pump: 3 - 14m Pump head 3 pumps: 40 m Pump volume 1 p.: 5 - 30 l/min Cost 1 pump set: $150 – $250
		 
Treadle pumps Options: Moneymaker, others.. Cost: $80 - $190	**Table top filter. Diatom elem.** Options: Nazava, Tulip. Cost: $20 - $40	**Membrane filters** Options: Sawyer, Aqua Clara,.. Cost: $25 - $50
		
Latrines Corbelled latrines. SaTo pan latrines several models Cost plastic part; $10 - $40	**Irrigation of cash crops.** Here 1000 m2, irrigated by 1 family with a Rope pump. Yearly extra income: $ 100 – $1000	**Simple is not easy**. SMART Centres training the local private sector and building supply chains.
Info on other options for affordable water and sanitation see EMAS websites or the SMARTech catalogue; www.smartcentregroup.com. Examples of scaling self-supply see www.smartcentrezambia.com		