ROPE AND WASHER PUMP FOR LOW COST IRRIGATION FARMING.

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Malawi as a nation has been prevailingly affected by the inconsistent rainfall pattern which has resulted into droughts due to Water scarcity. Low food production due to shortage of water supply has also fruited into food insecurity in the country. Chikhwawa district has not been spared as well.

Therefore, Fountain of Hope organisation conducted a case study of Evelesi Bendesoni from Chimwaza Village, Traditional Authority Maseya, Chikwawa district. The study followed the experiences of a farmer in Chikhwawa district who was among the beneficiaries of Rope Pump through DAPP farmers' club women project. She has been in maize and vegetable production three years regardless of rainfall pattern since 2013.

The main objective of the survey was to assess the effectiveness of Rope and Washer Pump in supplying water for irrigation farming and the consistency in water supply, social and economic resource, rural livelihoods and sustainable development and if it could be the means of adaptation to climate change.

Interviews, Show me tell me method, Focus group Discussions were conducted with 2 groups of 5 each of women farmers' club representatives and 10 men.

The findings were that, the technology: 1. Increases household income. 2. Cheap materials and easily installed and maintained. 3. Consistently supply water for dual purposes. 4. Easily managed. 5. Increases food security. 6. Is environmentally friendly.

The technology has proved to be effective not only in supplying water for irrigation farming but also as a Source of social and economic resource, as a tool for Improving rural livelihoods and sustainable development, as an effective adaptation measure contribution to climate change impacts and as Source of food security.

Keywords: Irrigation, rainfall, Rope, tremendously, washer pump

Introduction

1.1 Background

Malawi is a land-locked and densely populated country located in sub-Saharan Africa. The country lies at the southern end of the Great East African Rift Valley system. It is bordered by Tanzania to the north, Zambia to the west and Mozambique to the east, south and south-west. The country's total area is 118,484 km^2, with an estimated population of 17 million, growing at a rate of 2.8% per annum.

The UNDP HDR of 2015 rated Malawi as one of the most vulnerable countries in sub-Saharan Africa to the deleterious impacts of climate change. Furthermore, the Malawi's NAPA of 2006 showed that sectors such as agriculture, energy, water, forestry, fisheries, gender, wildlife and human health are vulnerable to the impacts of climate change, climate variability and extreme climate events. Major climate related hazards that wreak havoc in the country are floods and droughts. For example, floods of 2015 affected 15 out of 28 districts in Malawi. About 1.1 million people were affected, 230,000 were displaced, 176 killed and 172 were reported missing. The total cost of flood loss and damage that the Government of Malawi incurred during these severe floods was estimated to be US$335 million, and that recovery and reconstruction costs stood at US$494 million. Malawi as a nation has been prevailingly affected by the inconsistent rainfall pattern which has resulted into droughts due to Water scarcity. Low food production due to shortage of water supply has also fruited into food insecurity in the country. The country is currently encountering a number of growing competing demands and challenges including high population growth resulting in increase for demand for water for domestic, agriculture or irrigation.

According to National Water policy by GoM 2005, Water and Sanitation Sector faces a number of challenges including the degradation of water resources, inadequate service coverage, inadequate financing, increasing water demand as a result of increasing population, HIV and

AIDS prevalence, insufficient capacity, lack of integrated approach to water resources management and development, climate change and climate variability, lack of mitigation measures for water related disasters and inadequate promotion of hygiene and sanitation. However, the sector has opportunities such as availability of relatively abundant water resources, political will, active women and youth, donor support, willingness of private and public sectors' participation, existence of regional and international initiatives
Chikhwawa district has not been spared as well and that is why it is among the poorest Districts in Malawi. From the social economic profile 55% of the households make less than 0.5 USD a day .The district has less and less rainfall year after year. The areas is generally dry through out the year. The district faces difficulties in harvesting rain fed crops as rain ceases to come before the crops mature. This poses a threat to food security and it is the only district which has been receiving food aid for many years.

Therefore, there is need to promote climate change adaptation and mitigation for sustainable livelihoods through measures that increase levels of knowledge and understanding and improve human well-being and social equity from which low cost water supply technology of Rope and washer pump can be one of such measures as discussed in this paper.

1.2 Problem Statement & Justification

In 2008, over 2.6 billion people were living without access to improved sanitation facilities, and nearly 900 million people were not receiving their drinking-water from improved water sources as stated by the UN-water global annual assessment of sanitation and drinking-water (GLAAS) 2010 report.

Worldwide there are some 700 million small-scale farmers with average areas of 0.1 to 2 hectare.

In Africa 80% of the poor are small-scale farmers who depend on unreliable rain to grow their crops. Many of these farmers could increase food production and their incomes if, besides agricultural inputs and access to markets, they would have access to affordable irrigation.

Besides the named challenges above, there is also a challenge in multi-sectoral adaptation contribution among different players in community development as narrated in the Climate Change Country profile Malawi*:*
The biggest adaptation challenge is Malawi's heavy reliance on rain-fed agriculture. The majority of smallholder farmers cannot afford irrigation technologies although the country is endowed with abundant water resources. Climate change also requires farmers to adapt to new agronomic practices such as conservation agriculture, growing of drought tolerant crops, and agro-forestry amongst others in order to improve productivity. The Greenbelt Initiative by the Government to increase the level of irrigation farming is a key national adaptation measure to

address this challenge in the agriculture sector. However, more adaptation measures have to be identified in order to compliment the initiative.

Potential adaptation measures in the water sector reflect the need to enhance and harmonise policies and strategies for catchment area protection, water conservation and sustainable utilization. The adaptation actions that Malawi is implementing in this sector like promotion of irrigated agriculture and water supply development for domestic and livestock use need to be up scaled by both internal and external support

Various studies have shown that under climate change scenario, human health is greatly affected through the spread of climate-sensitive diseases such as malaria and diarrhoea, and food production declines resulting in malnutrition. Years of below-normal rainfall (e.g., 1991/92) have correspondingly led to higher incidents of malnutrition.(*National Adaptation Programmes of Action* -NAPA)

On gender issues, vulnerable and disadvantaged groups carry the burden of the impacts of climate change. Women and girls are particularly impacted, as they have to walk further in search of basic commodities for the family such as firewood and water. Yet, women may not have the authority to decide on alternative and climate-resilient solutions for the household. The adaptation interventions should therefore mean to enhance gender inclusiveness in the adaptation programmes and projects.

This UN-Water which is a mechanism to strengthen coordination and coherence among all United Nations (UN) bodies dealing with a variety of water related issues, such as health, farming, environment, energy, food, climate, sanitation and disasters has a firm belief that still more can be done to strengthen the system to work more effectively on water and sanitation issues, which are among the most urgent challenges of the time.
This study therefore, aims at finding out the role of Rope and washer pump in supplying water for irrigation farming.

1.3 Objectives

1.3.1 Main objective

The main objective of the survey was to assess the effectiveness of Rope and Washer Pump in supplying water for irrigation farming. relation to consistent water supply, social and economic resource, rural livelihoods and sustainable development.

1.3.2 Specific objectives

The specific objectives were:

- To find out if the technology can be the source of food security in Malawi.
- To find out if it contributes to social and economic resource.
- To find out if the technology is an effective adaptation measure contribution to climate change impacts.

1.3.3 Research questions

The research had the following questions:

1. How accessible is the technology?
2. What are the advantages and disadvantages of the technology?
3. What contribution does the technology have towards climate change fight?
4. What is the uniqueness of the technology from other sources of water?
5. What role does rope and washer play in human development?
6. Are materials found in Malawi?

2.0 Materials and methods

Interview was conducted to the woman farmer by the name of Evelesi Bendesoni on how she was managing the irrigation facilities as well as production. From her narration, it was learnt that a well was dug 10 metres deep (although with this technology it could go up to 35 meters depth) and lined up with bricks to strengthen the walls. A concrete slab of 1 meter in diameter was mounted on the hole of the well before simple materials comprising rope with washers, guide block, 40 mm plastic pipe, a handle connected to a ringed used tire were installed. It irrigated effectively up to a Lima (0.25 hectare). She further explained about how she managed her crop production as a serious business. She had plans and crop budget on paper just as what she learnt from DAPP farmers' club project.

Show me tell me method was carried out where the farmer would explain and show on the ground what she was talking about. For instance, she had built a house, house assets, farm implements, enough food in her house, crop budget, plan of the season which were all shown as evidence of her explanation. This was an evidenced qualitative data approach.

Focus group Discussions (FGDs) were also conducted with 2 groups of 5 each of women farmers' club representatives. FGDs for 10 men were also conducted because men mostly influence decisions of women at community level as such their information was very relevant. FGDs were conducted in order to get group consensus on the situation on the ground in regard to the technology.

3.0 FINDINGS/RESULTS AND DISCUSSION

The following elements were realised from the study:

3.1 Source of reliable water supply for irrigation farming.

The farmer had enough water supply for irrigation farming purposes since 2013, as such she had been able to carry out her farming activities through out the year.

3.2 Source of social and economic resource

The technology has contributed to the country's social and economic resources as evidenced in the interviews with the farmer, 10 fellow women farmers and a group of ten men in the area. For instance, the farmer in this study had built a house, bought house assets and farm implements, had enough food in her house and was able to provide school materials for her children. These benefits had also been experienced in other places of the project implementation areas in the District where women farmers were able to sell the produce from their irrigation farming production in order to boost their economic status at household levels.

Therefore, the technology Promotes sustained, inclusive and sustainable economic growth.

3.3 Tool for Improving rural livelihoods and sustainable development

From the Focus group discussions, it was found that majority of the farmers who had access to rope and washer pumps had benefited in their economic life. Sales from the production, enabled the women farmers to support their families in meeting basic needs like school fees, food and clothes The activities were sustainable in nature because women farmers had acquired enough knowledge to manage the rope and washer pump technology where intensive trainings were conducted in wells identification, materials installation, casting of slabs, maintenance and production of some parts of the rope and washer pumps like fixing washers on the rope including where to get the materials.

3.4 The technology is an effective adaptation measure contribution to climate change impacts.

.The system is an adaptive measure to climate change impacts because irrigation farming activities were being carried out all year round regardless of dry spell or floods. Hence it compliments the Greenbelt Initiative by the Government to increase the level of irrigation

farming which is a key national adaptation measure to address this climate change impact challenge in the agriculture sector**.**

3.5 Source of food security

This farmer acquired the knowledge and expertise of this technology through DAPP farmers' club project which trained her and installed the technology for her crop production right in her field. It was not only, her but other farmers as well were benefiting from this technology in Traditional Authorities katunga, Maseya and Sub TA Ndakwera. These women farmers were excited since they had been in maize and vegetable production through out the year regardless of rainfall pattern for three years. This means that if more rope and washer pumps were supplied to the small scale farmers in Malawi, there would be increase in crop production through out the year, thereby increasing food security status in the country.

1.6 Accessibility of technology.

People always need water to survive. Water is not only necessary for drinking but also for irrigation and hygiene. Water is been taken from taps, boreholes, springs, rivers but also from hand dug wells. People make hand dug wells since history. They dig until they find water. A hand dug well has normally a diameter of 0.8 up to 1.5 metre and varies in depth, depending on how deep water is found. When using a ventilator for fresh air during digging, it becomes even possible to dig up to 30 meter or more. A hand dug well can be made in hard soils as well as in soft soils. The soil structure and water level determines how to support the walls. The quality of the water taken from hand dug wells varies. One thing is sure: the quality of a hand dug well improves immediately if it is properly lined inside and has a cover on top. These simple improvements of an open well prevents waste water from flowing back directly into the well, collapsing of the shaft, pollution by debris, animals and even from people from falling in. Therefore, the technology is accessible to everyone because does require only machine for digging .

1.7 The advantages and disadvantages of the technology.

Advantages found in this article include: I) Increases household income. 2.) Has Cheap materials and easily installed and maintained. 3.) Consistently supply water for dual purposes. 4.) Easily managed. 5). Increases food security. 6) Is environmentally friendly. 7) Is easiliy accessible

On the **disadvantage** part, **Simple but not easy.** One lesson learned is that, to make technologies sustainable, the most importance condition is **repairability**. Whatever

technology is installed, the users should be able to manage the maintenance. (Repairable, Affordable, Available). A problem with options like rope pumps is that they are "too simple". Many think they can make it. Although they are indeed simple, some construction and installation criteria are essential. For instance a small error in a bushing can cause the handle to break within two months. If made well it lasts for 20 years. In technology "the devil is in the detail".

1.8 The uniqueness of the technology from other sources of water.

a)Is simple to operate since even children are able to draw water from the rope and washer pump. b) It is for dual purposes of irrigation and drinking. c) Materials are locally available d) It takes water to as deep as 35 to 60 meters depending on tool for digging the well compared to other means of irrigation like treadle pump. e) If properly produced and installed it is used up to 20 years. f) It is easy to learn about the technology.

1.9 The of role rope and washer in human development

The impact of water in terms of basic needs like food or conversely undernourishment is proportionally highest for the smallest categories of farms with the lowest incomes. Also, for families living in absolute poverty this may mean a change of status, though they'll still be poor, and for the poor an opportunity to rise above the poverty line. It has therefore, increased access to water for irrigation and drinking to human beings. Low cost irrigation has increased food production and incomes of part of the 70% of the world poor who are small-scale farmers.

3.11 Availability of rope and washer pump materials in Malawi

Rope and washer pumps materials are available in Malawi. Production of a wheel tire with spokes, handle, rope with washers is done by DAPP at Mikolongwe Vocational School while other materials like pipes, ropes, guide blocks, cement are found in plastic products industries and hard ware shops . As for sand, bricks and quarry are locally sourced in the communities.

3.12 Description of the technology

The pumping elements of the ropepump are the pistons and the endless rope, which pull the water to the surface through the pumping pipe made of PVC or plastic. The rotation of the wheel, moved by the handle, pulls the rope and the pistons. The pistons, made of polypropylene or polyethylene injected into moulds, are of high precision to prevent hydraulic losses. The structure is basically made out of angle iron, piping and concrete steel. The pulley wheel consists of two internal rings cut out of lorry tires, joined by staples and spokes. A guide box at the bottom of the well leads the rope into the pumping pipe. The guide box is made out of concrete with an internal glazed ceramic piece to prevent any wear. It is a high efficiency and low cost technology, but includes some pieces of high precision and high quality. Rope pumps are

installed on handdug wells and on drilled wells or boreholes. There is no need for the pumping pipe to be installed vertically, which means that rope pumps can be installed as well near riverbanks or dams for irrigation.

The type of rope pump differs according to its application but in general, the rope pump used at community level requires the highest technical standard. The least expensive and simplest model will do for domestic use or irrigation at the household level. However, all can be fitted with the same spare parts. Maintenance costs are minimal in the range of 0 to 5 US$ per annum for the family well pump and up to around 10 US$ for the very intensive used community pump.

On Field performance, the maximum standard depth reached by the rope pump is 40 m. This can be increased to 60 m with adjustments and a double crank.

The minimum water depth in a well required for a rope pump is only 10 m. The guide box is positioned on the bottom of the well, as sand does not affect the functioning of the rope pump, which normally happens with other brand pumps. During the dry season, when the water table goes down, the rope pump will keep on working until the well really dries up. The latter has been found to be an important factor related to social acceptance. When the water table in a well goes down and the traditional pumps can't reach the water any more, users blame it on the pump as they can still draw water with their rope and bucket. Actually it's not the pumps, but the need to place the foot-valve at a certain distance above the bottom of the well to prevent sand coming into the pump that causes the problem. A handdug well should preferably contain at least 1 m of water. In practice the older wells have a depth of about 1 m below the groundwater level of the driest season during the last decades

3.0 Conclusions

The main objective of the survey was to assess the effectiveness of Rope and Washer Pump in supplying water for irrigation farming. The technology has proved to be effective not only in supplying water for irrigation farming but also as Source of social and economic resource, as a tool for Improving rural livelihoods and sustainable development, as an effective adaptation measure contribution to climate change impacts and as Source of food security

Therefore, Rope and washer pump is most effective for low cost irrigation farming since small scale farmers have access to water for crop production through out the year.

Recommendations

With continuous disasters in Malawi due to unreliable rainfall, it is becoming difficult to achieve the country strategic plans and the United Nation Sustainable Development Goal especially the following goals: **Goal 1**: End poverty in all its forms everywhere **Goal 2:** End hunger, achieve food security and improved nutrition and promote sustainable agriculture **Goal 3:** Ensure healthy lives and promote well-being for all at all ages **Goal 5**: Achieve gender equality and empower all women and girls **Goal 6**: Ensure availability and sustainable management of water and sanitation for all **Goal 8:** Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. This Rope Pump technology contributes to the achievement of the above mentioned Sustainable development Goals (**1, 2, 3, 5, 6 and 8**)

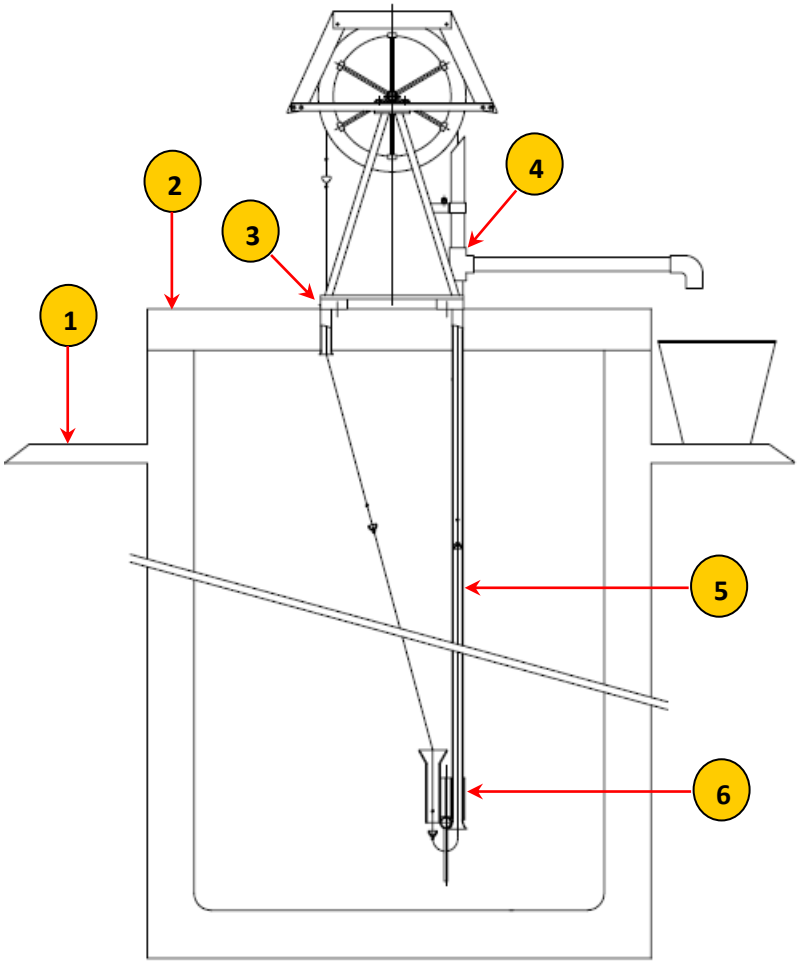
Therefore, the following are the recommendations:

- Different stakeholders should start including rope and washer pump technology when designing and planning for their project implementation in order to improve water accessibility as SDG 6 states.
- Small scale farmers should be the first targeted group since they make the majority of the country's population and are main producer of Malawi's agricultural produce. Hence the technology will boost food production among these majority.
- Women farmers are also good in agricultural production hence there is need of involving more women farmers as beneficiaries in program development.

ROPE PUMPS IN PICTURES

Installing the rope pump

Installing the rope pump on an open well can be done with local available skills and materials. The below picture shows the side view of a rope pump installed on an open well. The explanation of the numbers is written besides the picture (not in a specific order). These items are the important parts and are described in the manual. In this explanation , names ‘apron’ and ‘cover’ are used although in other literature it may be named as e.g. ‘slab’ and ‘lid’.



1 = Apron

2 = Cover

3 = Inlet

4 = Outlet

5 = Raising pipe

6 = Guide box

AB MODEL TYPE OF ROPE PUMP

Enforce the base of the rope pump

Lining the rope pump

Use bricks to reduce the use of cement

Finish the apron with a layer of cement mixture

AB MODEL TYPE OF ROPE PUMPS FOR IRRIGATION FARMING AND DRNIKING PURPOSES

P MODEL TYPE OF ROPE PUMPS FOR BOTH IRRIGATION AND DRINKING WATER PURPOSES (WOODEN POLES ARE USED).

	
Installation	Pump on hand dug well without well rim
	

Irrigating 0.2 ha with a Rope pump	Maintenance of rope pump
	
Production Well cover with manhole	Construction Platform

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