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Investigating water management practices among farmers in Afgoi, Lower Shabelle, Somalia

Anas Ali Madar *

PhD Candidate for Blue Economy and Maritime Security at University for Peace, Wadajir, Airport Road, Mogadishu, Somalia.

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Abstract

Globally water is a key shared resource for health, human development and ecosystems, and it is vital for the eradication of poverty (FAO). The aim of this study was to investigating water management practices among farmers with specific consideration to Afgoi, Lower Shabelle Somalia. The study was guided three objectives i.e. to assess the current water management practices among farmers in Afgoi district, to analyze the challenges of water management among farmers, and to recommend strategies of water management practices among farmers. This study employed a questionnaire survey with sample size 384 from the population and the strategy was simple random sampling. The study found that 60.4% of the respondent's revealed absence of structural measures to manage water and 81.1% perceived changes of rainfall and temperature, the changes have affected crops and livestock in a number of ways resulting in reduced productivity. Finding revealed that 43.0% respondents perceived water scarcity, also the study found that 50.8% of the respondent's lack of knowledge and limited skills in harvesting water and 69.6% result show that supplement irrigation is highly agreed. There are different recommendations for ways of water management in response to water shortage. Awareness of various water management options should be conducted to enhance farmer resilience and sustainable development. Further research should focus on the effectiveness of adaptation methodologies employed by agriculturalists and rural farming in response to water shortage.

Keywords: Water management; Practices; Famers; Investigation; Current; Challenges

1. Introduction

Globally water is a key shared resource for health, human development and ecosystems, and it is vital for the eradication of poverty (Jimenez.C, 2015). Water scarcity is a global concern which typically threatens the sustainability of smallholder farmers' livelihoods and food security. However, this resource confronts serious environmental, economic, social, and political challenges in the world (Hadizadeh, Allahyari, Damalas, & Yazdani, 2018). The problem of water scarcity is growing as more and more people put ever increasing demands on limited supplies, more so in dry areas where rainfall is limiting (Chege & Muindi, 2016). The poor level of adoption of water conservation practices is common in the developing countries (Asfaw & Neka, 2017). In Somalia river catchments are also sensitive to changes in regional climate which can be exacerbated by anthropogenic influences (Biazin, Sterk, Temesgen, Abdulkedir, & Stroosnijder, 2012),

In Afgoi the farmers depend on rainfall and river water flows, so that there is a poor water catchments and reservoirs such Common water harvesting and related activities include dam construction, shallow wells, spring development, watershed management, sinking of boreholes and construction of berkads and also silt deposits along conveyance channels (Oduor A.R. Gadain, 2007). Some studies in the past (Kammer & Win, 1989), show that in catchments of 2.5 to

* Corresponding author: Anas Ali Madar.

4 km2, storms of less than 15 mm rainfall did not produce runoff unless the antecedent moisture content was high. This would mean a threshold daily rainfall value of 20 to 30 mm, and there were only 9 to 16% of the rainfall days which exceeded this threshold values (Koton, 2007).

Agriculture is the main economic activity in sub- Saharan Africa (SSA) supporting over 67% of the population. According to the World Bank, 60% of the population above depends on rainfed agricultural practices which generate 30-40% of the country's Gross Domestic Product (Chege & Muindi, 2016). However, Afgoi areas receive erratic- poorly distributed rainfall, most of these areas are also prone to high surface runoff and poor water infiltration leading to low water availability in crop rooting zone, poor crop root distribution and health, soil erosion and evaporative losses which leads to poor crop production, food insecurity and societal poverty (Oduor A.R. Gadain, 2007).

Climate change models project that especially the farming areas of Afgoi, At the same time, drought and flood events are predicted to become more extreme and more frequent along the Juba and Shabelle Rivers (Muchiri P.W., 2006). Rainwater, ground water, and surface water harvesting is a growing technique to significantly increase water productivity, thus mitigating agricultural water scarcity and allowing increases in crop production levels. Multitudes of indigenous and recently developed rainwater harvesting techniques are used in different parts of SSA (Biazin et al., 2012).

1.1. The Current Water Management Practices

Crop production is next in importance to livestock and its contribution to household economics is growing in importance. The major cereal crops cultivated in Somalia are sorghum and maize. Both crops are grown under rainfed and under irrigated conditions. Commercial crops such sugar cane, bananas, grapefruits and rice were also successfully cultivated in the south along the two rivers. Sadly, most of the commercial farming operations have ceased to function (DINA Synthesis Report, 2018). Crop production system is either water harvesting or water conservation systems that capture runoff water that is stored in reservoirs for later use, or direct rainfall for in-situ soil moisture conservation. Technologies that benefit from direct runoff and that are either used for supplementary or full irrigation include earth dams, ponds, dams and flood/spate water. These technologies are common in south-central and southern districts and some parts of north-western regions. Other areas, such as the southern riverine environs benefit from floodwater flowing mainly from the Juba and Shabelle River basins (SWLIM, 2007).

Indigenous technologies rainwater harvesting is not new to Somalia. It has been in place since time immemorial. The existence of Berkads, Waro and Xadlings are testimony to a long history of harnessing rainwater for domestic, livestock and crop use. Current rainwater harvesting (RWH) technologies in Somalia and management systems are classified according to rainwater use. Three categories were identified such as crop production systems; livestock production systems; and domestic water harvesting and conservation systems (Koton, 2007).

1.2. Challenges of Water Management Practices

Somalia receives low rainfall and very high temperatures, hence high evaporation from surface reservoirs. This means that large tracks of land are required as catchment areas to generate adequate runoff for ponds or dams. The other problem is silt deposits along conveyance channels. After the rains huge deposits of silt are transported to the reservoirs (Gadain & Jama, 2009).

Flooding of the Juba and Shabelle rivers are due primarily to climatic and anthropogenic processes, while artificial flooding of agricultural land is largely due to illegal manmade openings on the dikes and high natural embankments to create an outlet for irrigation water in the dry season (Gadain & Jama, 2009).

1.3. Strategies of Water Management Practices

In the dry areas, water, not land, is the most limited resource for improved agricultural production. Maximizing water productivity, and not yield per unit of land, is therefore a better strategy for dry farming systems. Under such conditions, more efficient water management techniques must be adopted. Supplemental irrigation (SI) is a highly efficient practice with great potential for increasing agricultural production and improving livelihoods in the dry rainfed areas (Oweis & Hachum, 2006). Water harvesting can improve agriculture by directing and concentrating rainwater through runoff to the plants and other beneficial uses. It was found that over 50% of lost water can be recovered at very little cost. However, socioeconomic and environmental benefits of this practice are far more important than increasing agricultural water productivity (Oweis & Hachum, 2006).

A key strategy is to minimize risk for dry spell induced crop failures, which requires an emphasis on water harvesting systems for supplemental irrigation. Large-scale adoption of water harvesting systems will require a paradigm shift in Integrated Water Resource Management (IWRM), in which rainfall is regarded as the entry point for the governance of freshwater, thus incorporating green water resources (sustaining rainfed agriculture and terrestrial ecosystems) and blue water resources (Rockström et al., 2010). There are two broad strategies for increasing yields in rainfed agriculture when water availability in the root zone constrains crop growth: (1) capturing more water and allowing it to infiltrate into the root zone; and (2) using the available water more efficiently (increasing water productivity) by increasing the plant water uptake capacity and/or reducing non-productive soil evaporation

2. Materials and Methods

This study was conducted using descriptive research design. It is cross-sectional and questionnaire, However the study employed quantitative approach design. This study was conducted in Afgoi, Lower Shebelle, Somalia, according to the (PESS, 2018) the target population size is 252083.

3. Results and Discussion

This section presents the background information of the respondents who's participated in the study. The purpose of this background information is to find out the characteristics of respondents and show the distribution of the population in the study.

3.1. Socio-demographic information

Table 1 Age of the respondents

No.	Average age of the respondents	Frequency	Percent
1	Teenager (28-35)	230	59.2
2	Adolescents (36-50)	105	27.3
4	Adults (51-69)	34	8.8
	70 above	15	3.7
Total		384	100.0

Table **1** indicates that 59.2% of the respondents were aged (28-35) years, followed by 27.3% in the age of (36-50), and 8.8% of the respondents were the age of (51-69), while the least were 3.9% of the respondents were the age of above the 70.

Table 2 Gender

Gender	Frequency	Percent
Male	249	64.7
Female	133	34.5
Total	384	100. 0

Table **2** Shows that Majority of the respondents 64.7% were Male compared to 34.5%. of the respondents was Female.

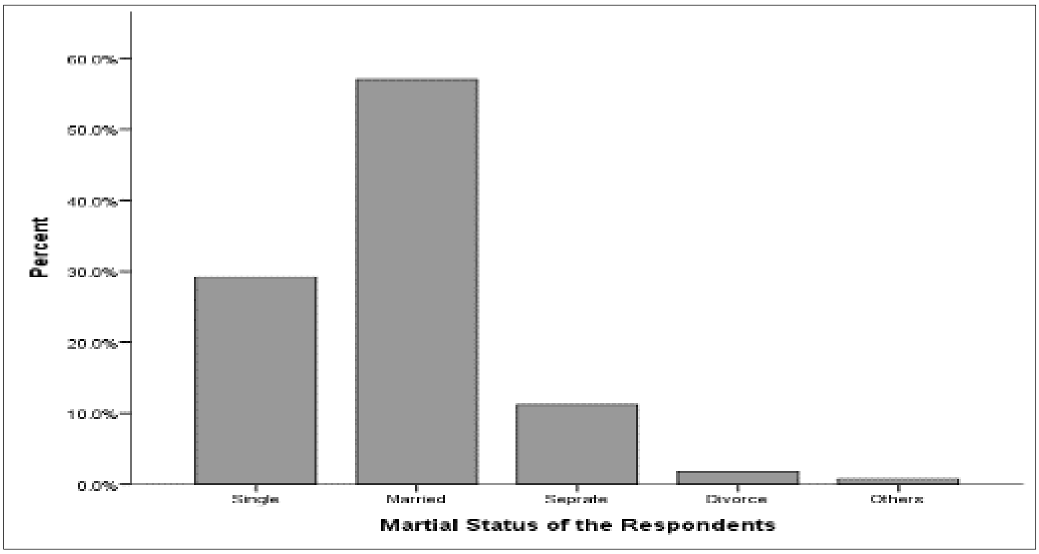

Figure 1 Marital status of the Respondent

Figure 1 shows that 56.9% of the respondents were married, followed by 29.1% of the respondents were single, and 10.9% of the respondents were separated, while 1.6% of the respondents were divorced, and the remaining 0.8% was others.

3.2. Current situations of water management practices

Table 3 There are structural measures to manage and control water

	Frequency	**Percents**
Strongly disagree	95	24.7
Disagree	232	60.4
somewhat disagree	29	7.6
somewhat agree	18	4.7
agree	8	2.1
strongly agree	2	0.5
Total	384	100.0

Table 4 result indicates that 60.4% disagreed, 24.7% strongly disagreed, 7.6 somewhat disagreed and 4.7 somewhat agreed while 2.1 agreed the least 0.5 said strongly agreed. The analysis of the response revealed that there is no structural measures to manage and control water since the collapse of the government, but there is limited construction of dikes, barrages and flood relief canals developed by international organizations. Indigenous technologies rainwater harvesting is not new to Somalia. It has been in place since time immemorial. The existence of channels Berkads, are testimony to a long history of harnessing rainwater for crop use (SWLIM, 2013).

As it is obvious from the table **4,** 63.9% of the respondents agreed rainwater harvesting technique for availing water to the agriculture**,** 5.2 of the respondents strongly agreed**,** 20% of the respondents voted somewhat agreed, 4.4% of the respondents somewhat disagreed, and 6.5% of the respondents voted agreed. Indigenous technologies rainwater harvesting is not new to Somalia. It has been in place since time immemorial. The existence of channels Berkads, are testimony to a long history of harnessing rainwater for crop use (SWLIM, 2013).

Table 4 Famers use rainwater harvesting technique for availing water to the agriculture

	Frequency	Percents
Strongly disagree	3	.8
Disagree	48	12.5
somewhat disagree	17	4.4
somewhat agree	77	20.1
agree	219	57.0
strongly agree	20	5.2
Total	385	100. 0

Table 5 Famers have a systematic network of canals that come from the river to irrigate agriculture

	Frequency	Percents
Strongly disagree	13	3.4
Disagree	41	10.6
somewhat disagree	28	7.3
somewhat agree	65	16.9
agree	205	53.2
strongly agree	31	7.3
Total	384	100.0

Based on the findings from the study, 53.2% (205) of the majority respondents disagreed that farmers have a systematic network of canals for agricultural irrigation. With collapse of the Somalia Government in 1991, virtually all public infrastructure and facilities were run down. The irrigation infrastructure in the former banana production area of the Lower Shabelle Region was not spared either. According to (FAO, 2018), where canals are not functioning, irrigation is only possible for the farms lying along the river or by richer farmers who are able to irrigate using pumps in Afgoi.

Table 6 There are water conservation systems that capture runoff water

	Frequency	Percents
Strongly disagree	11	2.9
Disagree	232	60.3
somewhat disagree	31	8.1
somewhat agree	35	9.1
agree	49	12.7
strongly agree	25	5.8
Total	384	100.0

Table **6** indicates that 60.3% (232) of the respondents disagreed. The situation has been compounded by 16 years of civil strife, especially in the southern regions. Several local and international organizations have initiated civil reconstruction, environmental conservation and livelihood-support programmes. Experts estimate that Somalia is among the 13 African countries that will face water scarcity by 2025. A country is said to be water scarce when its annual per capita water availability falls below 1000 m3. Already, Somalia has less than 500 m3 /per capita/year

(UNECA, 2000). This is attributed to erratic spatial and temporal distribution of rainfall with average annual amounts falling between 100 and 800 mm, high evaporation, and human activities that exacerbate land degradation (SWALIM, 2007).

3.3. Challenges for water management practice

Table 7 Water scarcity has led to increasing pressure on water resources among farmers

	Frequency	Percents
Strongly disagree	22	5.7
Disagree	48	12.5
somewhat disagree	29	7.6
somewhat agree	9	24.3
agree	165	43.0
strongly agree	29	6.8
Total	384	100.0

Based on finding from the respondents indicated that 43.0% agreed on water scarcity has led to increasing pressure on water resources among farmers and there were several causes of water scarcity. The causes ranged from natural calamities, lack of water conservation systems, decreased rainfall patterns, and lack of policy and regulation among farmers.

Two permanent rivers, the Shebelle and the Juba, flow from Ethiopia into southern Somalia. Both river basins provide much needed surface and groundwater for irrigation and to sustain fertile alluvial flood plains covering an area 174,600 km2. Before the central government collapsed in 1990, over 220,000 ha along the flood plains in the middle and lower reaches of the Juba and Shebelle rivers, were under either under controlled irrigation or flood-recession farming. Today, Water scarcity has led to increasing pressure on water resources among famers, and much of the irrigation infrastructure remains in disrepair with only 100,000 ha under cultivation (World Bank, 2018).

Table 8 Lack of knowledge and limited skills in harvesting water are the major problems

	Frequency	Percents
Strongly disagree	9	2.4
Disagree	43	11.3
somewhat disagree	29	7.6
somewhat agree	62	16.2
agree	194	50.8
strongly agree	45	11.8
Total	385	100.0

Finding from the respondents indicated that 50.8% voted agreed, and 16.1% somewhat agreed while 11.3% of the respondents disagreed, so that that there is lack of knowledge and limited skills in harvesting water as majority said, while the remaining others were disagreed.

3.4. Recommendation Ways of Water Management Practices

Findings from respondents indicate that 73% voted that agreed, while 2.1% somewhat agreed. Water plays a pivotal role in sustainable development, poverty reduction and maintaining healthy ecosystems (Semmahasak, 2013). According to (World Bank, 2006) With water management now playing such an influential role in social development, domestic stability and international security, there have been increasing demands placed on governments to assume responsibility for, inter alia, determining appropriate forms of water management, intervening in water abstraction disputes among water users.

Table 9 Water management plays a pivotal role in sustainable agricultural development

	Frequency	Percents
Strongly disagree	17	4.5
Disagree	14	3.7
somewhat disagree	8	2.1
somewhat agree	279	6.8
agree	179	73.0
strongly agree	37	8.9
Total	384	100.0

Table 10 Water harvesting can improve agriculture by directing and concentrating rainwater through runoff to the plants and other beneficial uses

	Frequency	Percents
Strongly disagree	3	.8
Disagree	29	7.6
somewhat disagree	10	2.6
somewhat agree	61	15.9
agree	227	59.3
strongly agree	52	12.0
Total	384	100.0

The result revealed that 59.3% of the respondents agreed, and 15.9% of the respondents somewhat agreed, while 7.6 disagreed. Water harvesting can improve agriculture by directing and concentrating rainwater through runoff to the plants and other beneficial uses. It was found that over 50% of lost water can be recovered at very little cost. However, socioeconomic and environmental benefits of this practice are far more important than increasing agricultural water productivity (Oweis & Hachum, 2006).

Table 11 Supplemental irrigation is a highly efficient practice with great potential for increasing agricultural production and improving livelihoods in the dry rainfed areas

	Frequency	Percents
Strongly disagree	9	2.3
Disagree	36	9.4
somewhat disagree	11	2.9
somewhat agree	65	17.0
agree	199	52.0
strongly agree	63	16.4
Total	385	100.0

Analysis of the supplement irrigation is highly agreed as shown in (table). However, the result shows that 69.6% of the respondents voted agreed while 52% of the respondents somewhat disagreed. Supplemental irrigation (SI) or Deficit irrigation (DI) has been extensively investigated as a valuable and sustainable production strategy for a wide range of crops in dry regions. By limiting water applications to drought-sensitive growth stages, this practice aims to maximize water productivity and to stabilize – rather than maximize – yields (Geerts and Raes 2009, FAO 2002).

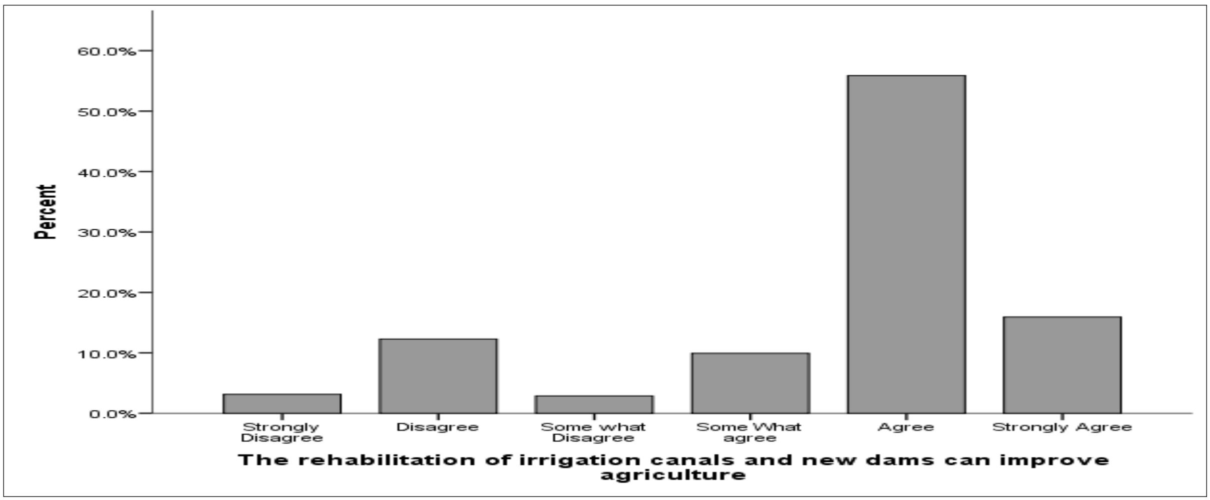

Figure 2 Rehabilitation of canals

The result of figure 4.4.1 indicates that 59.6% of the respondents were voted agreed and there is a need for rehabilitation of irrigation canals and new dams which can improve the agriculture sector.

River embankments eroded, and barrages, pump sluice gates and canal systems had some degree of sedimentation and vegetation growth which reduced the canals' hydraulic sections. Silting up of the drainage system was accelerated by the lack of terminal outlets and the flat topography of the irrigation area, which restricted drainage water from returning into the rivers by gravity (FAO, 2018)

4. Conclusion

The communities in Afgoi are particularly vulnerable to the lack of water management practices due to their poor economic and knowledge capacity to adapt water conservation systems. These challenges include high costs associated with drilling and equipping deep groundwater boreholes, limited knowledge and skills in water harvesting techniques, recurring water shortages in the Shabelle River, security concerns surrounding water management, and the overall low rainfall and high temperatures that characterize the region.

To address these challenges, the proposed strategies for water management practices among Somali farmers include maximizing water management practices for productivity in dry farming systems. (Mvungi et al., 2005) Effective water management strategies that can improve crop yields and resilience to climate variability include the implementation of advanced irrigation techniques, such as drip irrigation, which can optimize water use and enhance water productivity (Dawit et al., 2020).

Recommendations for water management

- Effective water management strategies that can improve crop yields and resilience to climate variability include the implementation of advanced irrigation techniques, such as drip irrigation, which can optimize water use and enhance water productivity. (Dawit et al., 2020)
- The existing indigenous rainwater harvesting practices, such as the use of berkads, should also be revitalized and expanded to capture and store runoff water for later use.
- Additional strategies, such as capacity building, financial and technical support from local and regional governments, and the promotion of market-based farming approaches, can further enhance the adoption and sustainability of efficient water management practices among Somali farmers. (Dawit et al., 2020).
- rehabilitation of canals, Barkeds, dams, reservoirs, and other water infrastructure is critical for capturing and storing water for agriculture (Roberts et al., 2019)

Area for further research

- The contribution of indigenous knowledge on community farming adaptation to water scarcity
- The effectiveness of adaptation methodologies employed by agriculturalists and rural farming in response to water shortage.
- Development local level early warning system that can reduce vulnerability of farmers and pastorals communities to water scarcity
- What cost efficient water management options could be developed keeping in view the agricultural drought and floods farming communities

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