

Irrigated Farming a Panacea to Food Security- Constrains and Way Forward: The Case of Tunyo Division in Marakwet District- Kenya

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Abstract: Due to effects of climate change and resultant unpredictable rain patterns compounded with rising human population necessitates the adoption of modern agricultural techniques to ensure food sufficiency not only in the arid and semi-arid lands (ASAL) but the entire globe wherever they are. Eleven out of forty seven counties in Kenya fall under the category of ASAL. This study delves into the subject of irrigated farming to find out the 'how' and what can be done to ensure there is adequate food supply for the growing population. The study adopted both the qualitative and quantitative techniques to arrive at the conclusion. The study was guided by the following main objective; to find out how irrigated farming can enhance food security, the challenges faced in irrigated farming and the way forward to these challenges by the residents of Tunyo division in Marakwet district-Kenya. The study found out that irrigated farming faces a myriad of challenges; inadequate water for irrigated farming, small parcels of land for farmers, lack of legal documents on ownership of land. The ways forward for the challenges are; environmental conservation, government should expedite legal documentation of land, motivation to farmers on irrigated farming, financial support, and formation of co-operative societies. The study finally concludes that government should put more efforts on irrigated agriculture to ensure food security.

Key words: government, food sufficiency, irrigated agriculture, arid and semi-arid lands, constrains

I. INTRODUCTION

According to Gardner *et al.*, (2011) in their book on history of irrigation noted that various types of irrigation existed and included surface irrigation, sometimes called flood irrigation; furrow, border strip or basin irrigation. There was also sub - irrigation, sometimes called seepage irrigation which had been used for many years in areas with high water table. They noted further that in the present global scale (2000), an estimated 2,788,000 square kilometers (689 million acres) of agricultural land was equipped with irrigation infrastructure globally. About 68% of the area equipped for irrigation was located in Asia, 17% in America, 9% in Europe, 5% in Africa and 1% in Oceania. International Water Management Institute Report (2001) noted that India and Pakistan widely practiced irrigation where there was a statewide program of transferring management of surface irrigation systems to water User Associations. Tyner and

Gamal (2004) reported that the Nile River supplied about 57.5 billion of cubic meters of water to Egypt which has about 3.3 million hectares of agricultural land, 90% of that land lies within the Nile basin and delta and only about two percent 2% was rain fed.

Rukuni, *et al.*, (2006) posit that irrigation development represents the most important interface between water and land resources. Barau *et al.* (1999) stress greater emphasis on irrigation development as a means of increasing food and raw material production as well as promoting rural development. Similarly, (Hussain, *et al.*, (2002) point out that agricultural water/irrigation has been regarded as a powerful factor for providing food security, protection against adverse drought conditions, increased prospects for employment and stable income, and greater opportunity for multiple cropping and crop diversification.

Food security has been defined by different scholars differently. For instance, World Food Summit (1996) defines it as, "a situation when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life". Peacock (1995) on the other hand defines food security as having adequate means of procuring one's basic food needs either by growing, manufacturing, mining or trading. Rukuni, *et al.* (1990) define food security as a situation where all individuals in a population can produce or procure enough food for an active and healthy life. Eicher & Staatz (1985) defined food security as a situation where all individuals in a population have access to a nutritionally adequate diet. The food security equation (Rukuni & Benstern, 1987) has two interrelated components: food availability and food accessibility. Food availability is whereby there is the availability of food through food production, storage or trade. Food accessibility is defined as the ability of the household to acquire food through production, purchases in the market from income earned or transfers.

Kenyan economy relies on agriculture although 80% of the country is arid and semi - arid in which sustainable agriculture would only be achieved through well planned and operated irrigation.

Alila *et al* (2006) pointed out that, despite the enormous potential for irrigation, irrigation based farming was not widely practiced. Republic of Kenya (2005) reported that minimal levels of irrigated farming therefore resulted in low income for farmers, insufficient food to the people, and the general decline of economic welfare. Agriculture, including irrigation agriculture remains the backbone of Kenya's economy and the single most important sector which contributes approximately 25% of the country's Gross Domestic Product (GDP) and employs 75% of the national labour force. Tunyo Division is one of the areas in Marakwet District where irrigated farming is practiced. However, it regularly experiences breakdown of water furrows and much of the water was often lost through evaporation before reaching the farms. To reverse the negative effects of poor irrigated farming in Tunyo Division and other parts of the country, this study examines the factors that affect irrigation agriculture, as an urgent undertaking and any delay would aggravate the situation.

1.2 The Problem Statement

Rain fed farming is practiced in those regions with good soils and receive well distributed rains throughout the year as well as other necessary weather conditions. On the other hand, irrigation agriculture is carried out in those regions which receive erratic rains but blessed with plenty of good soils Wani *et al*, (2009). In Kenya both rain fed and irrigated farming are both carried out in different parts of the country. Tunyo Division of Marakwet District is a semi - arid region with plenty of land with good soils, and labour. Through appropriate designation and implementation of effective irrigation agricultural practices, one would expect serious engagement of irrigation practices for adequate accomplishment of national development plans.

To effectively succeed in the practice of irrigation agriculture and realize food security and other Sustainable Development Goals (SDGs), some factors such as government policies on irrigation, nature and availability of land, government funding and other stakeholder support, availability of water, training and community participation needed to be carried out appropriately. Effective irrigation agricultural practices are dependent on several factors within and without the respective institutions. The study therefore, sought to determine factors which affected irrigated farming in Tunyo Division. Determination of such factors would enable top managements in the respective institutions to have an understanding of how they affected irrigation agricultural practice hence the making an appropriate responses to address such situations.

II. METHODOLOGY

This paper adopts both a qualitative and a quantitative approach by reviewing available literature and collecting primary data through the use of questionnaire on the subject. The data was analyzed quantitatively by use of graphs, charts and tables. Data interpretation was done thematically to reach a logical conclusion.

III. STUDY AREA

The study was conducted in Tunyo Division of Marakwet District in Elgeyo Marakwet County. The district was created on August 14, 1994 and borders West Pokot to the North, Trans Nzoia to the West, Uasin Gishu to the South West, Keiyo to the South and Baringo to the East. The district is about 61.6 kilometers long and 53 Kilometers wide. It covers a total area of 1709 square kilometers (Marakwet District Development Plan 2002-2007). The district is divided into 29 locations and 88 sub-locations.

Politically, it had two Parliamentary constituencies; Marakwet East and West which shared Tunyo Division, the main focus of the study.

The total population in the District was projected at 177, 705 in 2008 with female population of 90,428 and 87, 277 male. The population under the age of 15 formed 30% of the total population in the district. The dependents (below 15 years and above 65 years) formed more than 50% of the total population (KNBS, 2009). A deliberate move to increase income generating activities and employment activities therefore became very necessary in order to support that population. That would be achieved by harnessing the district's irrigation potential especially in the fertile Kerio valley amongst others.

Topographically, Republic Kenya (1987) noted that, "the district is divided into three (3) zones, namely the highland plateau, Marakwet escarpment and the Kerio Valley. The highland rose gradually from an altitude of 2800m above the sea level on the Charangany hills to the North." Marakwet District Development Plan (2008 - 2012) and District Statistics Office (2009) pointed out that, the average temperature in the district was 24⁰C during the wet season with a maximum of 30⁰C during the hot season. February was considered the hottest month while July was the coldest month. The highland plateau area had the lowest temperatures while the highest temperatures were recorded in the Kerio Valley; an ASAL area where irrigation farming was practiced. Rain - fed agriculture in the Kerio Valley was unreliable owing to erratic rains and harsh weather conditions.

IV. CONSTRAINTS AFFECTING IRRIGATED AGRICULTURE

Like any other part of developing countries, irrigated farming faces a number of challenges ranging from technological backwardness to inadequate knowhow. From the respondents the following challenges were noted;

Nature, Availability of Land and Irrigation Agriculture

Nature and availability of land is very crucial to farming in general. It determines the success or failure of either rain - fed or irrigated farming in the diverse geographical regions such as Tunyo Division, and others.

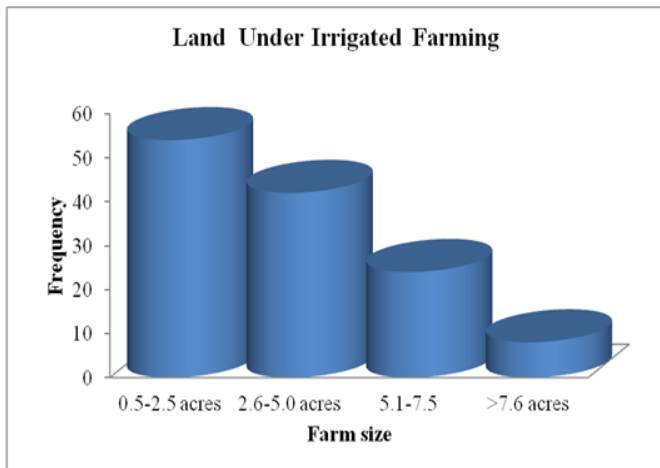
Table 1 Weather Conditions in Tunyo Division

	Frequency	Percent
Conducive	70	58.33
Not conducive	50	41.66
Total	120	100.0

Source: Author (2011).

When asked about weather conditions in Tunyo Division, table 1 shows the respondents' description of problems they encountered as a result of weather conditions. Respondents 70(58.33%) noted that the weather was not all that conducive for carrying out farming without any form of irrigation being carried out.

Figure 1 Land Put Under Irrigated Farming



Source: Author (2011)

Regarding how much land was put under irrigation, figure 1 above shows that 54(45.0%), 42(35.0%), 24(13.33%), 8(6.66%) of the respondents noted that they had put (0.5 - 2.5 acres), (2.6 - 5.0 acres), (5.1 - 7.5 acres), 7.6 acres and over under irrigated farming respectively. That clearly shows that 60% of the respondents in Tunyo Division were small scale farmers who relied on irrigation. It seems therefore that for them to bring more acreage of land under irrigated farming, more efforts should be made by the relevant authorities to make water accessible and adequate for irrigated farming.

Table 2 Legal Document to Prove Ownership of Land

	Frequency	Percent
Yes	38	31.66
No	82	68.33
Total	120	100.0

Source: Author (2011).

On the existence of legal documents to prove land ownership, table 2 above by demographics shows that 82(68.33%) of the respondents had no legal document to prove ownership of their land parcels under both rain - fed and irrigated - farming, 38(31.66%) of them said that they had such documents. That

strongly informed the researcher that in Tunyo Division of Marakwet District; most of the farmers had no legal documents on ownership of land, which in some way might have negatively undermined irrigated farming. The absence of such legal documents cannot allow the farmers to access bank loans or credit. When asked how much of that land they owned or leased, no definite answers were given.

The above response corroborates with Rukuni *et al* (2006) who affirms that problems that befall irrigation schemes emanates from central government departments, such as lack of ownership, financial viability and poor governance. Some of these problems have necessitated government transferring responsibility to farmers, who have continued to mismanage these systems, hence their dilapidation. Poor maintenance and lack of effective control over irrigation practices have resulted in the collapse of many irrigation systems.

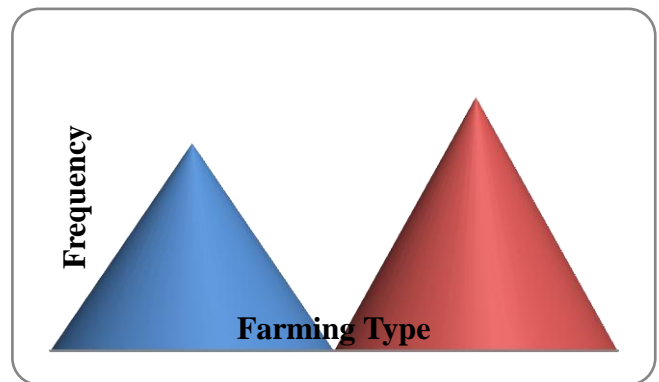
Table 3 Farming Practice

	Frequency	Percent
Yes	62	51.66
No	48	48.33
Total	120	100.0

Source: Author (2011).

On the question of farming practice, table 3 above shows that 62(51.66%) of the respondents reported that they were practicing farmers who mainly grew finger millet, sorghum, maize, mangoes, bananas, and many other crops. It is also noted that 48 (48.33%) of them reported that they were not practicing farmers. It appeared therefore that farming practices were lowly carried out in Tunyo Division and became a pointer that there could be other prominent factors which discouraged residents.

Figure 2 Farming Types and Durations



Source: Author (2011).

When asked about farming types and durations, 54(45.0 %) of the respondents noted that they carried out rain - fed farming whereas 66(55%) of them noted that they carried out irrigated farming. Regarding whether they carried out rain - fed or irrigated farming, farmers in Tunyo division were not optimally practicing irrigated farming.

Availability of Water and Irrigation Agriculture

The availability of water is always very crucial for any crop production especially in both arid and semi - arid lands. Its scarcity will greatly undermine irrigation agriculture. Therefore respective institutions should make necessary efforts to ensure its availability and adequacy benefit farmers.

Table 4 Farming cycle

	Frequency	Percent
No	100	83.67
Yes	20	16.66
Total	120	100.0

Source: Author (2011).

On farming throughout the year, table 4 shows that 100(83.67%) of the respondents noted that farming was not carried out throughout the year while 20(16.66%) of them reported that it was carried out throughout the year. It appeared to the researcher therefore that since farming was not carried out throughout the year, there might have been some hindrances caused by uneven distribution of rain, unsteady water supply, amongst other factors.

The FAO (1997) report identified a number of constraints, which hampered smallholder irrigation development in Zimbabwe. Some of these include high cost of capital investment in irrigation works considering that communal farmers are resource poor, lack of reasonably priced appropriate irrigation technology for the smallholders, shortage of human resources at both technician and farmer levels, lack of decentralized irrigation service companies to give back-up service in rural areas, poor resource base of farmers, fragmented and small size of land holdings, unsecured or lack of land titles and high interest rates.

Further to the above constraints, Gyasi *et al* (2006) noted that in many countries, institutional weaknesses and performance inefficiencies of public irrigation agencies have led to high costs of development and operation of irrigation schemes. Poor maintenance and lack of effective control over irrigation practices have resulted in the collapse of many irrigation systems. The study by Gyasi *et al* (2006) concluded that collective action for the maintenance of community irrigation schemes is more likely to be problematic when the user group size is large and ethnically heterogeneous, and where the scheme is shared by several communities. Use of labour intensive techniques in the rehabilitation of irrigation schemes promotes a sense of ownership and moral responsibility that help ensure sustainability. A high quality of rehabilitation works and regular training activities also contribute to successful irrigation management by communities.

4.1 Alternative Ways of Making Irrigation Agriculture Viable

Apart from nature and availability of land, water, and many other factors, there were also other factors which seemed to make irrigated agriculture successful as presented below;

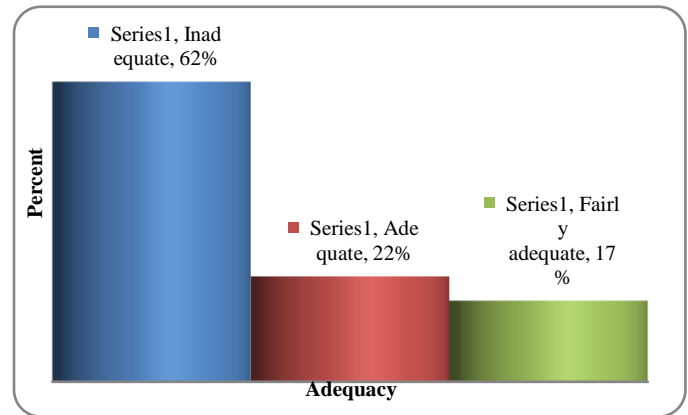
Table 5 Environmental Conservations

	Frequency	Percent
Yes	68	55.66
No	52	44.33
Total	120	100.0

Source: Author (2011).

Asked about the existence of environmental officer, table 5. above shows that 68(55.66%) of the respondents reported that there was an environmental officer who led members of Tunyo Division in conservation of the various water catchment areas, 52(44.33%) of them reported that such an officer did not exist. It appeared therefore that the environment was not highly regarded by the residents of Tunyo Division and that might interfere with flow of water volumes to the rivers from which irrigation waters are drawn.

Figure 3 Adequacy of environmental conservation



Source: Author (2011).

About the adequacy of environmental conservations, figure 4.13 above shows that 26(21.66%) of the respondents reported that environmental conservations in the division were adequate, 74(61.66%) of them reported that they were not adequately conserved, while 20(16.66%) said that they were fairly adequate. It seemed therefore that, under - conservation of the environment resulted to detrimental effects of poor rainfall patterns, low water volumes into the rivers and lakes as well as the general deterioration of the environment, hence the poor performance of irrigation agriculture in Tunyo Division of Marakwet district.

Table 6 Formation of Farmers Association

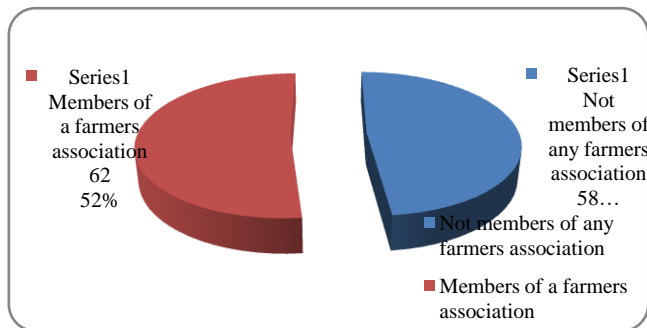
	Frequency	Percent
Act of Parliament	100	83.33
Traditional	20	16.66
Total	120	100.0

Source: Author (2011).

Asked about the formation of farmers association, table 4.14 above shows that 100 (83.33%) of the respondents noted that their association was formed as a result of Cooperative Associations Act Chapter 490 Laws of Kenya; 20(16.66%)

cited a traditional formation while 12(10.0%) gave no responses of how such farmers association was formed. It is always a fact that when farmers belonged to an association, they could realize greater success in their endeavours.

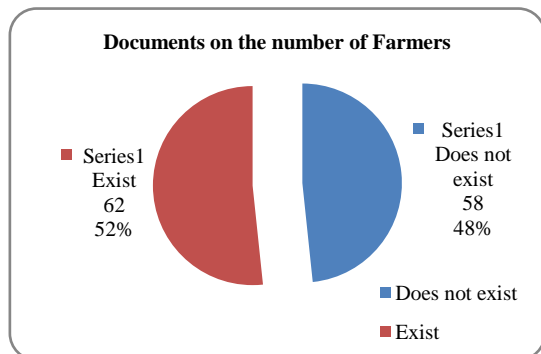
Figure 4 Membership to Farmers Association



Source: Author (2011).

Regarding membership to farmers association, figure 4 above shows that 62(51.6 %) of the respondents noted that they were members of farmers association. Those who did not belong to any farmers association were 58(48.4%). That informed the researcher that farmers in Tunyo Division were fairly organized through such organizations. Farmers should thus be encouraged to form or join existing farmers associations because that seemed to enable them realize greater success.

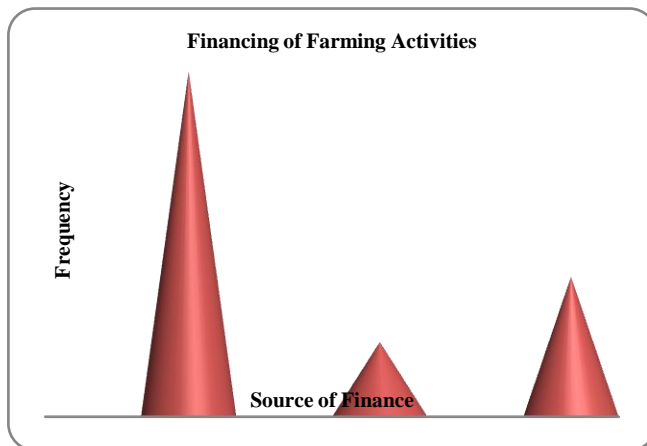
Figure 5 Documents That Showed the Number of Farmers



Source: Author (2011).

When asked about documents that showed the number of farmers, figure 5 above shows that 62(51.66 %) of the respondents reported that there was a document which showed how many members belonged to their association, 58(48.34%) said such a document did not exist such document. That informed the researcher that farmers were fairly organized into associations which helped them realize some benefits such as training on irrigated farming techniques, supply of farm inputs, amongst others. More farmers should be encouraged to increase their membership of such organizations.

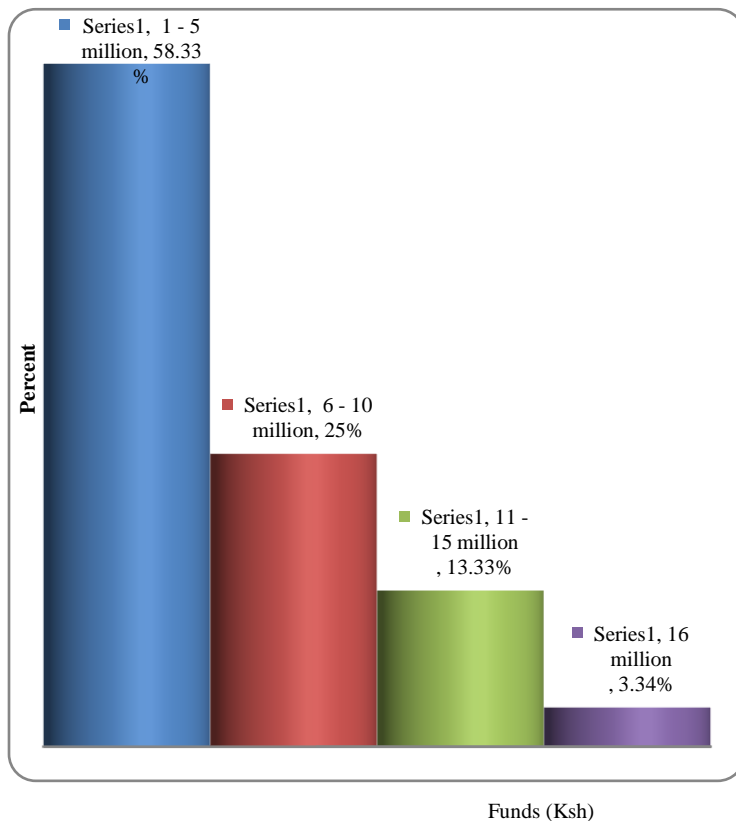
Figure 6 Financing of Farming Activities



Source: Author (2011).

Concerning the financing of farming activities, figure 6 above shows that 74(61.66%) of the respondents noted that they financed their farming activities using owner's equity, 30(25.0%) from government of Kenya and donors while 16(13.33%) pointed out that non - governmental organizations gave them financial assistance towards financing their farming activities. It appeared therefore that much of the funding as indicated above, 74(61.66%) came from owners' equity and that might have undermined irrigation agriculture in Tunyo Division.

Figure 7 Funds for Irrigation and Other Agricultural Activities



Source: Author (2011).

Asked about how much money they received for irrigation and other agricultural activities, figure 7 above shows that 70(58.33%) noted that they had received between Ksh 1 - 5 million, 30(25.0%) between Ksh 6 - 10 million, and 16(13.33%) had received between Ksh 11 - 15 million whereas only 4(3.33%) had received Ksh.16 million and over on annual basis. That money was from government of Kenya, donors, non - governmental organizations, and other sources on annual basis towards financing irrigation and agricultural activities in Tunyo Division.

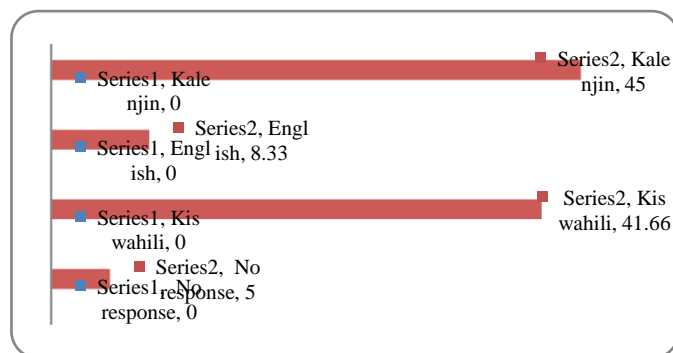
Table 7 Media of Communication with Irrigation Stakeholders

	Frequency	Percent
Privately created	28	23.33
Electronic	62	51.66
Print	30	25.0
Total	120	100.0

Source: Author (2011).

About the media of communication with stakeholders, table 7 shows responses to the question of what media were mainly used while communicating with farmers in Tunyo Division. It was reported that 28(23.33%), 62(51.66%) and 30(25.0%) of the media used were privately created (organizational magazines, suggestion boxes, notice boards, and many others), electronic and print respectively. That media greatly affected how various stake - holder groups in the division interacted as they carried out their daily farming activities. Managements should always strive to identify the most appropriate media for use in their organizations.

Figure 8 Languages Used



Source: Author (2011).

About languages mostly used by the stakeholders, figure 8 above shows that 54(45.0%), 50(41.66), and 10(8.33%) of the respondents reported that they mainly used Kalenjin, Kiswahili and English respectively whenever they communicated. Those who failed to report about the languages they used while communicating were 6(5.0%). That shows that the predominant languages used while communicating with stakeholders were Kalenjin, followed closely by Kiswahili and English. Agricultural or irrigation experts posted by the respective ministries and other government departments should be fluent speakers and writers

of such languages in order to realize effective communication with farmers.

4.2 Conclusions

The following conclusions in view of the study undertaken were made as presented below;

Land was not wholly conducive for rain - fed farming in Tunyo Division and that required irrigation to be carried out on the farms. Farmers also owned small pieces of land with almost no legal document to prove their ownerships.

The appropriate infrastructure had not been put in place to facilitate delivery of water to the various farms due to low levels of technologies applied in Tunyo Division. Farmers were not trained on how to acquire new irrigation techniques and that resulted to inadequate water supply to the farms although there were very many water sources in the division.

Funding of water projects by the government and other stakeholders were not adequate and that caused poor infrastructural development in the division as well as other parts of the country.

Members of Tunyo Division participated in environmental conservation but such conservations were inadequate. That often resulted to destruction of water catchment areas and its detrimental effects of desertification increased evaporation of water, soil erosion, and many others.

4.3 Recommendation

The study makes the following recommendations;

The government should improve its budgetary allocations to irrigated farming in the country especially in the arid and semi-arid lands (ASALs). Stepping up of security services would help in reducing cattle rustling and banditry in the region; reduce destruction on peoples' farms caused by wildlife. The government and other stakeholders should fund more activities that will reclaim more land by constructing modern irrigation infrastructures, among others.

Community involvement in the management of irrigation works and infrastructure had to be upheld at all times in order for irrigation agriculture to be realistic and sustainable. That involvement of the local people made them feel to be real stakeholders in their development priorities.

Farmers should be encouraged to undertake irrigated farming in order to reduce food insecurity in Tunyo Division and the country at large, minimize poverty, and create employment opportunities, amongst other benefits. The government should also build more roads and improve the existing road networks. This would enable farmers deliver their farm produce such as mangoes, bananas, maize, and many other crops to the various markets in time.

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