A COMPARATIVE ANALYSIS OF LIFE STYLE OF THE LOCAL PEOPLE BEFORE AND AFTER THE CONSTRUCTION OF THE DAMS IN THE SUB ZONE OF MENDEFERA: A CASE STUDY OF ADI-MENGOTI AND MAI-ARON DAMS

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Abstract

A Comparative Analysis of Life style of the Local People before and after the Construction of the Dams in the Sub Zone of Mendefera: A Case Study of Adi-Mengoti and Mai-Aron Dams

Eritrea is one of the Sahelian countries in the Horn of Africa facing acute shortage of water. In areas where rainfall is low and unreliable, the construction of dams is utmost important for irrigation, domestic and livestock uses. Agriculture is the mainstay of Eritrean people; it has been playing a vital role in the process of economic development. It is estimated that about 75 per cent of the population depends on agriculture and allied activities. In such a country where agriculture is the backbone of the economy regular supply of water for irrigation is as important as the veins and arteries in the human body. In fact, dams serve multi purposes i.e. water supply for agriculture and domestic uses, flood control, hydro-power generation, navigation, fisheries and recreation activities. But in Eritrea, dams are mainly constructed to supply water for irrigation, domestic, industrial and livestock uses. This research paper is carried out to examine a comparative analysis of life style of the local people before and after the construction of the dams in the sub zone of Mendefera (Zoba Debub, Eritrea).

Key words
Dams, Adi-Mengoti, Mai-Aron

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1. Introduction

An adequate amount of regular water supply is the pre-requisite for any kind of human settlement. With the time and space when the communities gradually grow, they come across with different needs and requirements. Among many daily essential and urgent needs is the water which is also known as life.

Eritrea is one of the Sahelian countries in the Horn of Africa which is located on the western shore of Red Sea. It sprawls between 12° 42' and 18° 12' north to 36° 26' and 43° 10' east. It has an area of about 125,750 sqkms, with a population of more than five million are facing the acute shortage of water (Fig. 1). Hence the construction of dams is utmost requirement of the country in order to overcome the problem of water supply. In most of the cases in this country dams have been constructed for irrigation purposes and domestic and livestock uses. There are about 187 dams (excluding ponds) of different sizes and of varying water holding capacity ranging from 10,000 to 1,300,000 cm^3.

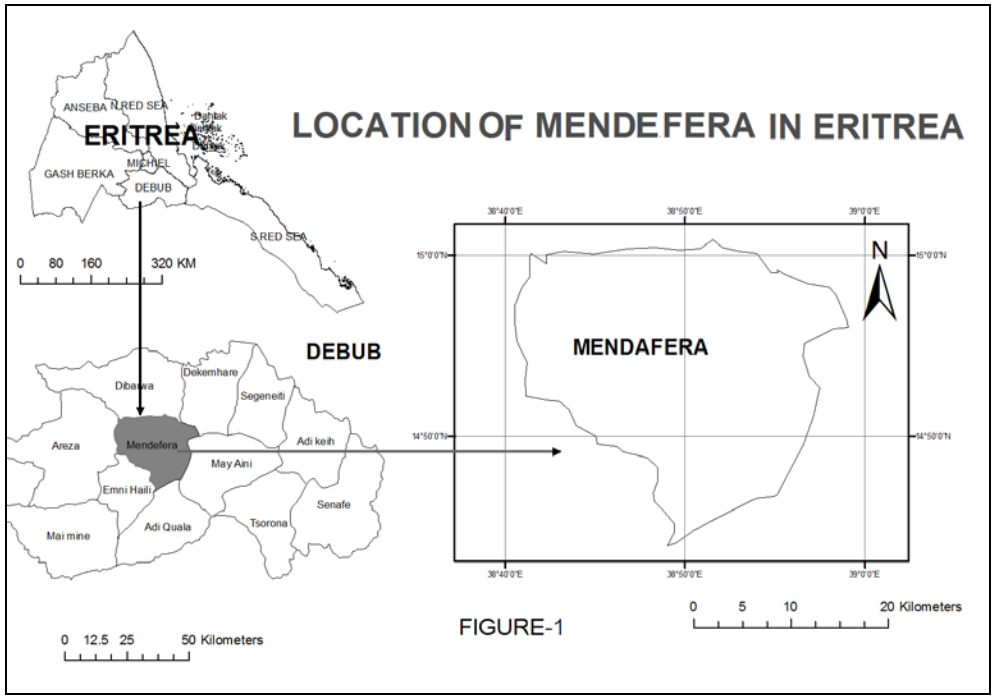

Fig.1: Location of Mendefera in Eritrea.

According to the Ministry of Agriculture in the Debub region, there are 126 dams have been constructed by the Government and different agencies, out of which 31 of the dams were constructed before independence functioning at a minimum level having problem of siltation and environmental impact assessment. Since independence the number of dams has increased reaching up to 95. These dams are partly constructed by many donor countries or International Organizations assist Eritrea in the field of improvement of existing water supply facilities. Most of the dams constructed after independence are fully mechanized and are managed properly.

2. Background literature

Water harvesting has been practiced in Eritrea for many years. Among such techniques, division of spate floods into farmlands, especially in the eastern coastal plains and construction of earthen dams in the central highlands can be cited. Among the oldest techniques of water harvesting are micro-basins and check dams.

Micro-basins are small syncline used to harvest the runoff. In Eritrea half moon shaped (semi-circular) micro-basins are common on sites with modest shapes (5 to 20 %). They can be used to complement on hill side terraces in areas where there are gaps in the natural vegetation. These types of micro-basins are constructed in order to create suitable conditions for tree and shrubs seedlings on degraded sites. When used for planting of trees or shrubs, the primary purpose is to harvest and retain enough water for the seedlings to survive the long dry seasons.

A check dam is a control structure built across the floor of a gully, water way or a drainage channel at predetermined intervals. The purpose of a check dam built in a gully is to trap soil moving with runoff water in the gully. Such soil trapping and soil accumulation above the check dam leads to reduction of the gradient between the check dams and thus reduces the speed of the water. Eventually, check dams can stabilize gullies and protect them from further expansion.

There are many types of check dams, the most common one are concrete dams, brush dams, long crib dams and loose rock dams.

3. Methodology

Research Procedure: The present research paper is mainly based on the primary information collected by the researcher himself from the field. A part of this, the researcher also collected some secondary information from the Ministry of Agriculture, Ministry of Land, Water and Environment and local Government, sub-zone of Mendefera.

In this study, the researcher adopted a multi-stage procedure in order to collect the data from the field. In the first stage, the researcher made a pilot study of the field in order to enter into the mainstream of the research.

On the basis of pilot study, the researcher was able to survey and have a primary knowledge about the two dams i.e. Adi-Mengoti and Mai-Aron and their background of constructions. The researcher was also able to collect the primary information about the number of population reside around these dams.

Apart of these, researcher also collected information related to the kind of domestic affairs, agriculture and livestock which are part of the total life style of the residents in the surrounding of these two dams.

In the third stage, researcher himself along with a local guide (who is completely familiar and well informed about these two localities) reached to the study area and administered his research tool in the field of study.

Nature of the study: The present research is planned to study the life style of the local people before and after the construction of Adi-Mengoti and Mai-Aron dams.

In terms of the life style of the local people before and after the construction of dams is defined as ten years of period. The term 'before' construction of dams refers to ten years before construction of the dams. The term 'after' refers to ten years of period after the construction of dams. But not from the date of completion of construction of dams rather the researcher pre-planned to study the last ten years of time i.e. 2001 to 2010 keeping in view to provide the latest data of the impact of dam on the life style of the local people.

In this study simple mathematical calculations have been used in order to show the change in the study area in terms of crop production, vegetables, and in the number of livestock with the help of calculating the averages and percentage change of different crops, vegetables and average number of livestock per household.

4. The study area

The study area in general is the sub zone of Mendefera in Zoba Debub, but in particular it includes the case study of two dams i.e. Adi-Mengoti and Mai-Aron dams (Fig. 2).

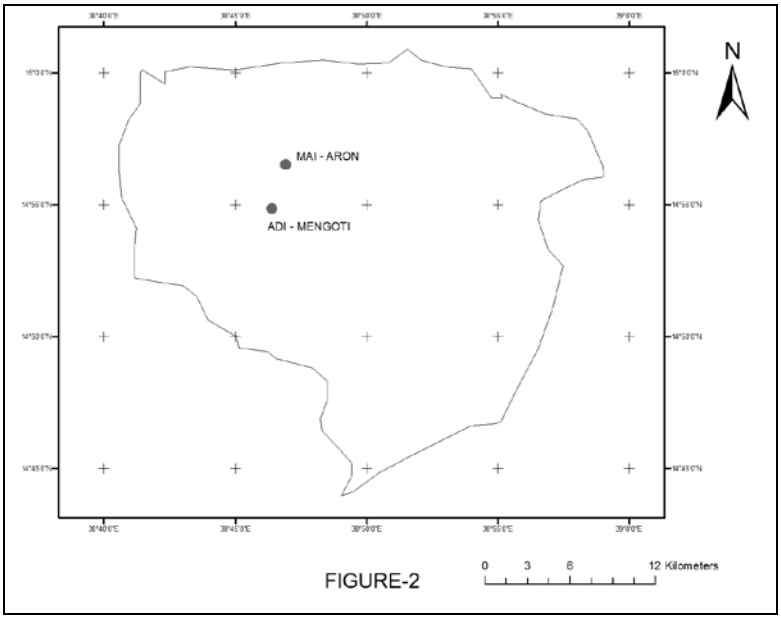

Fig. 2: Location of Adi-Mengoti and Mai-Aron dams in the sub zone of Mendefera.

5. Adi-Mengoti dam

This dam is located 54 km south of Asmara along the main asphalt line road of Asmara-Mendefera and forwarding 5 km to the west direction. It has an altitude of about 2000 metres above Sea level. The latitudinal and longitudinal extent of the area ranges between 14° 55' north to 38° 46' east.
Although there is no weather recording station in the area, it has a highland climatic character. The average annual rainfall ranges between 427.3 to 558.7 mm. The type of rainfall is convectional starting in June and ending in September. The rocks in the

area are dominated by basaltic flow and the type of soil is heavy clay loam. The indigenous inhabitant vegetation found at Adi-Mengoti is Euphorbia, Acacia and there are planted trees like Eucalyptus as well.

This dam was constructed in 1985 by the Ministry of Agriculture with the people's participation. This dam has the capacity of 1,000,000 cm^3 storing of water. In Adi-Mengoti before the construction of the dam, the number of wells was only six while after the construction of the dam, the number of wells rose up to sixty five. The embankment of the dam reaches about seven metres.

5.1 Site selection

Adi-Mengoti site was selected based on horticultural crop production especially vegetables, such as potato, tomato, onion, carrot etc. This dam has the storing capacity of 1,000,000 cubic meter of water and can irrigate 120 hectares of agricultural lands in the downstream area. Almost all the year round the agricultural farmland in the downstream area remains green. These lands are ploughed by both the means of traditional oxen power and tractor especially in the first plough of the land in winter. The farmers produce diversified vegetables and other commercial crops.

Similarly, the farmers' rear animals, they produce forage for their livestock fattening like Alfalfa and cane (corn). These farmers obtain so many things from their livestock, such as milk and milk products, meat and natural fertilizers etc.

Like other dams, Adi-Mengoti dam is also suffering from the problem of siltation. As in other dams siltation is the serious problem which has adversely affected the functioning of the dams especially Adi-Mengoti dam has lost its reservoir or storage capacity almost completely. These problems are minimizing the economic benefits of the dams that would have been achieved by utilizing the stored or harvested water for irrigating the downstream farm lands.

These two sites have been selected because these seem to be a very good model that can be representing the reality on the ground. Besides, these dams are based on acquiring reflective information (data) to represent the need situation in the country.

5.2 Irrigation in Adi-Mengoti

In Adi-Mengoti there is an earthen fill type of dam. The water holding capacity of this dam is about 1,000,000 cubic meters and irrigation potential is about 120 hectares. This dam is situated on agricultural rain fed class soil covering an area of 398.17 sq.km with a spill way of 33 metres. This dam is used for irrigation only for six months.

Farmers in this area irrigate a considerable size of land in the downstream through hand dug wells resulted from the stored water in the reservoir through the recharged ground water. Due to seasonal variation of rainfall in Eritrea, wells have different recharging capacity. The maximum water table of wells are in the months of September, October, November and December. While the minimum recharging rate of wells lie in the months of March, April, May and June. In this period farmers are worried because a serious problem of water scarcity occurs both for irrigation and domestic uses as well. Moreover, during spring, temperature remains high leading to high evaporation and hence the water bodies get decrease in volume. The

shallower wells completely dry while those deeper are active comparatively. These are not used through direct pumping from the reservoir. Irrigation in the highlands of the country particularly in this area is reasonably for the production of high value crops;especially horticultural crops i.e. vegetables such as tomato, potato, onion, cabbage, chard, salad, ziquini, carrot etc. Area and yield of vegetables in Adi-Mengoti farmland is shown in Tab. 1.

Tab. 1: Area and yield of vegetables in Adi-Mengoti Farm Land.

Vegetables	Area (ha)	Average Yield in Quintal	Total Yield in Quintal
Tomato	6.75	104	707
Potato	45.65	126.1	5757
Onion	9.75	93.7	914
Cabbage	24.5	124.2	3043
Chard	10.88	90.6	985
Salad	6.87	112.7	775
Ziquini	0.5	102.6	513
Carrot	0.35	28.57	10
Total	105.25	782.47	12,704

Source: Ministry of Agriculture sub-zone of Mendefera, November, 2008.

The above table shows that a total area of 105.25 hectares of farmland is under irrigation which accounts a total harvest of 12,704 quintal from this area. Among the vegetables, potato stands first followed by cabbage and chard covering 45.65, 24.5 and 10.88 hectares of area respectively. On the other hand, carrot is the least grown vegetable covering about 0.35 hectares of land.

6. Mai-Aron dam

This dam was also constructed in 1985. In the initial stage it was functioning at micro-level for irrigation purposes by dwellers of Mai-Lubus only. In 1994, the Government of Eritrea and Food For Work campaign renewed and broadened this dam in size and volume. Currently, the embankment of the dam has a crest length of 510 meter and crest height of 7 meters. It covers an area of about 23341.96 square meters and has a spillway of 37 meters. This dam is one of the largest dams built in the sub zone of Mendefera with a water holding capacity of 715,000 cubic meters.

Like other dams of this sub zone, Mai-Aron dam is also an earthen dam. Most of the dams of this sub zone provide maximum services of not more than five months. Mai-Aron dam is one of those few dams which provide its services throughout the year. This dam extends its services up to 405 households both for human and animals excluding Mendefera city. Therefore, the construction of this dam was an important measure towards solving the acute shortage of water for different purposes. This dam is playing a greater role in supplying water throughout the year in the surrounding areas. The drinking water for domestic purposes is obtained through digging wells in the downstream of the dam. While for the animals, the villagers such as Adi-Kemen, Mai-Lubus, Adi-Mengoti, Adi-Tsadi, Mai-Harmas, Adi-Zarna, and Adi-Godela use water directly from the dam.

As the population of Mendefera is increasing, so the demand of water supply is parallaly increasing. The pressure of water supply demand in the city has ultimately grown up for various needs such as for irrigation purposes, food production and industrial uses.

7. Types of irrigation used

There are a number of ways to irrigate the farmlands i.e. sprinkle irrigation, drip irrigation and furrow irrigation etc. In fact, it depends upon the availability of water and the type of crops grown.

In the study area mostly potatoes, tomatoes, corn etc. are grown which are planted in rows and are irrigated by the water from narrow ditches called furrow. In the study area, the farmers most commonly use the furrow type of irrigation. In this method rows of furrows are dug across the field. The farmers plant seed in the ridges between the furrows. In this technique, narrow ditches are used to carry water between rows crops. The water flows through a pipe from the ground and pours out through the opening into the furrows.

This method is simple and cheap and widely used by the people in less developed parts of the world. But this method suffers from some serious drawbacks also. In this method half of the water used ends up not getting to the crops. Water pumped from the wells and transported to a long distance to reach into the field. This water cannot be reused because so much of it evaporates and transpire in the field. So, it becomes imperative for the cultivators to find the most efficient alternative methods of irrigation.

8. Domestic affairs

Domestic affairs of the people in the study area have been divided into two parts i.e. pre and post construction period of the dams.Before the construction of the dams, the life style of the people was totally dependent upon the amount of summer rainfall which was too meagre to support any kind of activity. The people of nearby villages had great difficulties in supporting themselves and their livestock as well. They were not able to feed their livestock properly due to subsequent drought. As a result of subsequent drought even the city dwellers were not able to get access to a variety of vegetables.

The villagers were facing great problems to get sustainable and clean drinking water because even the wells had temporary capacity of holding water. The people of Mendefera had no enough access to clean water and hence victimised by water borne diseases.

But after the construction of the dams**,** the livelihood of the people drastically changed because of various advantages from the dam water. The beneficiaries of the dams managed not only to support themselves but also they have been able to settle the market economy of the nearby cities. All the people in the nearby villages have been able to drink clean water without travelling long distances from their houses. In the same way the inhabitants of Mendefera have been able to get the desired access to clean water throughout the year.

9. Water supply system in Mendefera

The water distribution system in Mendefera is facilitated through two major techniques. The majority of the city dwellers are served by means of tanker fetch from large vessel (filtrated) water conserver. The dwellers in the city especially those who are residents and the newly constructed houses are under the service of tanker transported with inclusive of nearby villages such as Adi-Bari, Adi-Ugri and Adi-Hare.

On the other hand the central residents of the city who are served by the pipe line are categorised under the service of different ways water dealing such as communal, yard connection and private connection.

The principal mode of water services of Mendefera is private connection, communal water point and water tanker.

Currently, there are about 650 houses in connection to 5 communal water point and water tanker. The present daily per capita consumption for house connection, yard connection and communal water point are about 15 litres per capita per day (Tab. 2).

Tab. 2: Water Supply System in Mendefera.

Item	Water Service	Number of Customers	Tariff in Nakfa/m^3
1	Private Connection	709	4.00
2	Commercial	65	6.00
3	Government	158	6.00
4	Non-Government	158	6.00

Source: Mendefera water supply, 2007.

The above table simply shows the water supply system in Mendefera; where 709 people have private connection, 65 people have commercial connection and 158 people each have Government and non-government connections.

The aggregate water production which is distributed per year to the city is from two main sources. One is the Klowlie dam and the other is the Mai-Aron dam. Klowlie is located in the northern part approximately 4.2 kilometres from the Municipality of Mendefera and Mai-Aron is also located in the north of Mendeferaabout 7 kilometres.Mode of water services provided to the people from the coupledams from 2000 to 2007 is shown in Tab. 3.

Tab. 3: Mode of water services provided to the people from the couple Dams (from 2000 to 2007).

Year	Tanker in m^3	Pipe Line in m^3	Total in m^3
2000	96,320,80	71,924,00	168,244.80
2001	78,428,30	66,789,00	145,217.30
2002	95,841,48	60,793,00	156,634.48
2003	135,588,47	56,279,00	191,867.47
2004	88,534,33	43,458,00	131,992.33
2005	84,852,43	47,175,00	132,027.43
2006	73,706,52	69,208,00	142,914.52
2007	74,442,67	65,480,00	139,922.67

Source: Mendefera water supply, 2007.

Summary: Mai-Aron dam 432 m^3 per day, the highest
Mai-Aron dam 304 m^3 per day, the lowest

Finally, as a city is reinforced to flourish and increase in population these two dams playing a vital role. However, when we see their individual contributions, Adi-Mengoti dam provides service only for five months. This is because the existing seasonal siltation which results to have less amount of water and lack of filtration machinery that resulted turbidity during summer, whereas Mai-Aron dam contributes 432 m^3 and 304 m^3 of water per day i.e. maximum and minimum respectively. Therefore, it could be concluded that the sustainable amount of water for the city is made available from the Mai-Aron dam.

10. Agriculture

Before the construction of the dams, the agricultural activities of the people were dependent only on the summer rainfall. They had no additional means to make their fields productive and were frequently vulnerable to consequent drought and famine for some months of the year. They were forced to grow only specific type of crops that can be harvested within a short period of time.

Since they were practicing rain-fed farming, they used only traditional methods to accomplish their entire agricultural activities. Yield of various crops were very low by any standard. Production of different cereal crops and vegetables per hectare in quintal has been shown for ten years in Tab. 4 and 5, Fig. 3 and 4 respectively.

Tab. 4: Production of Different Crops per Hectare in Quintal (from 1975 to 1984).

Types of Crops	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	Average
Wheat	05	5.5	04	06	05	07	11	12	14	15	8.45
Barley	06	07	05	04	09	10	12	14	16	18	10.1
Sorghum	07	06	07	05	07	09	10	14	15	17	9.7
Taff	04	06	06	04	08	10	12	14	17	19	10
Beans	08	09	07	08	04	09	11	13	15	16	10
Maize	07	07	06	06	05	08	13	15	17	20	10.4

Source: Personal Survey by the Researchers.

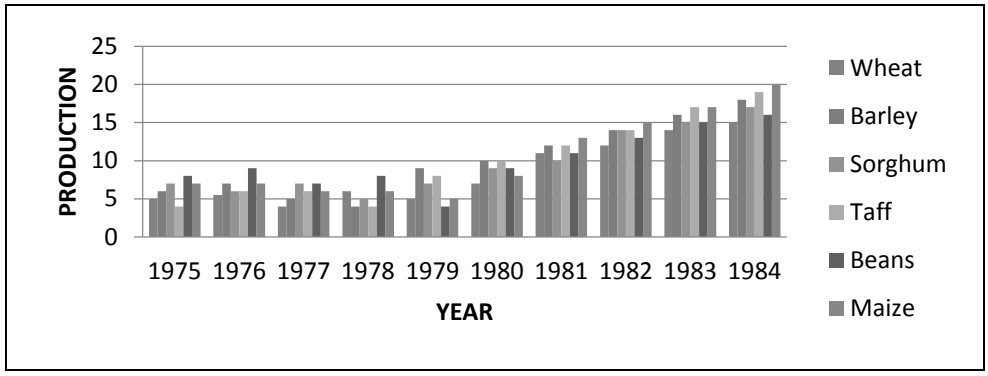

Fig. 3: Production of different crops per hectare in Quintal (from 1975 to 1984).

Tab. 5: Production of Different Crops per Hectare in Quintal (from 2001 to 2010).

Types of Crops	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
Wheat	37	39.5	44	45.5	46	47	48.5	50	52	53	46.25
Barley	40	43	47	48	48.5	49	51.5	53	54.5	56	49.05
Sorghum	39	40.5	42	43.5	44	45.5	47	48	49.5	54	45.3
Taff	43	45	48	49	49.7	51	52.5	54	56	57	50.52
Beans	45	47	52	53	54.5	55	56	58	60	63	54.35
Maize	39	41	44	45	46	46.5	47	47	49	53	45.75

Source: Personal Survey by the Researchers.

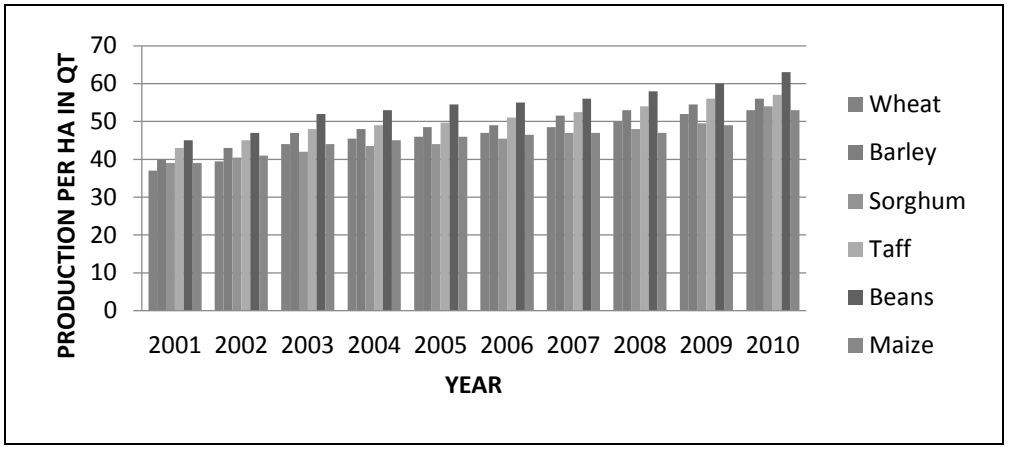

Fig. 4: Production of different crops per hectare in Quintal (from 2001 to 2010).

For the sake of showing the difference in the productivity of different crops before and after the construction of dams, we have applied a formula to calculate the percentage change in the productivity in the following way:

Percentage change= Average Productivity of crops for ten years after the construction of dams×100/Average Productivity of crops for ten years before the construction of dams

Percentage change of individual crops has been given below;

1. Percentage change for Wheat 46.25×100/8.45 = 547.33 per cent
2. Percentage change for Barley 49.05×100/10.1 = 485.64 per cent
3. Percentage change for Sorghum 45.3×100/9.7 = 467.01 per cent
4. Percentage change for Tarff 50.52×100/10 = 505.2 per cent
5. Percentage change for Beans 54.35×100/10 = 543.5 per cent
6. Percentage change for Maize 45.75×100/10.4 = 439.90 per cent

Among the crops, wheat rank first in terms of percentage change with 547.33 per cent followed by Beans and Taff with 543.5 and 505.2 per cent respectively. Maize with only 439.90 per cent recorded lowest percentage change.

Tab. 6: Production of Different Vegetables per Hectare in Quintal (from 1975 to 1984).

Types of Vegetables	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	Average
Tomato	06	07	07	08	09	09	11	12	12	14	9.5
Potato	08	08	11	14	14.5	15	17	17	18	18.5	14.1
Onion	05	5.5	7.5	08	10	12.5	13	15	16	17	10.95
Cabbage	10	14	15	15	16.5	18	19	21	23	23	17.45
Ziquini	04	05	05	08	09	12	14	16	16	17.5	10.65
Carrot	04	06	06	7.5	08	09	12	12.5	13	14	9.2

Source: Personal Survey by the Researchers.

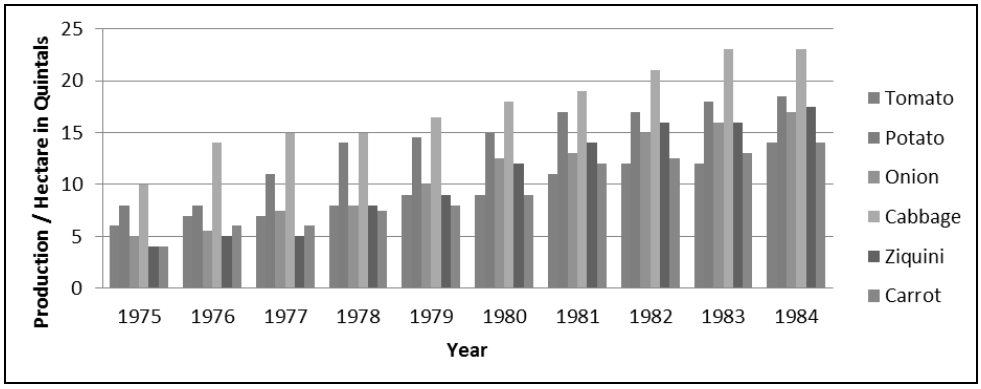

Fig. 5: Production of Different Vegetables per Hectare in Quintal (from 1975 to 1984).

Tab. 7: Production of Different Vegetables per Hectare in Quintal (from 2001 to 2010).

Types of Vegetables	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
Tomato	43	44.5	47	51	55	68	75	80	95	110	46.25
Potato	63	68	74	78	83	91	98	105	112	120	49.05
Onion	45	47	52	58.5	64	73	79	82	91	100	45.3
Cabbage	54	56.5	62	64	67	68	69	70	73	74	50.52
Ziquini	45	47	54	55.5	57	59	60	62	68	75	54.35
Carrot	33	34.5	37	41	47	55	58	60	44.5	70	45.75

Source: Personal Survey by the Researchers.

For the sake of showing the difference in the productivity of different vegetables before and after the construction of dams, we have applied the same formula to calculate the percentage change in the productivity in the following way:

Percentage change= Average productivity of vegetables for ten years after the construction of dams×100/ Average productivity of vegetables for ten years before the construction of dams

Percentage change of different vegetables has been given below;

1. Percentage change for Tomato 46.25×100/9.5 = 703.7 per cent
2. Percentage change for Potato 49.05×100/14.1 = 632.6 per cent
3. Percentage change for Onion 45.3×100/10.95 = 631.5 per cent

4. Percentage change for Cabbage 50.52×100/17.45 = 289.51 per cent
5. Percentage change for Ziquini 54.35×100/10.65 = 546.9 per cent
6. Percentage change for Carrot 45.75×100/9.2 = 521.7 per cent

Among the vegetables, tomato stands first with 703.7 per cent change followed by potato and onion with 632.6 per cent and 631.5 per cent respectively. Cabbage with 289.51 per cent change is the least grown vegetable.

After the construction of the dams, farmers have been able to use water from the dams according to the needs of the crops. In fact, the agricultural practices changed from rain-fed to modern farming system. They practice mechanised farming. Now they no longer suffer from problem of food shortages because of the sufficient yields from their farm lands. Now they have been able to grow different kinds of crops because of the availability of plenty of water for their agricultural fields from the dams, e.g. Taff, Millet, vegetables etc. Production of different cereal crops and vegetables per hectare in quintal has been shown for ten years in Tab. 6 and 7 respectively.

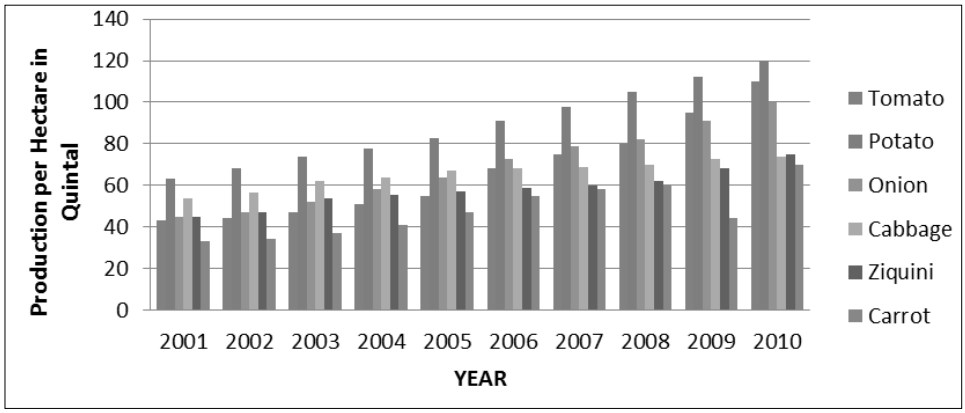

Fig. 6: Production of differente vegetables per hectare in Quinland (from 2001 to 2010).

11. Livestock

Before the construction of the dams, the farmers were not able to feed their animals properly because of water scarcity which resulted into adverse effect on grasses and vegetables. They could not keep as many animals as they desire because of shortage of straw and other animal food.

Most of the farmers used to keep very small number of domestic animals and were unable to supply the required number of animals to the market. The people of Mendefera were not able to get/purchase the animals according to their choices and needs. Types and numbers of cattle per household for ten years have been shown in Tab. 8.

Tab. 8: Types and Numbers of Cattle per Household (from 1975 to 1984).

Types of Cattle	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	Average No. of Cattle per Household
Cattle	04	05	07	06	07	08	08	09	10	11	7.5
Sheep	07	07	08	13	11	14	15	16	15	16	12.2
Goat	01	04	06	05	07	08	09	11	13	13	08
Donkey	02	02	01	03	02	04	04	03	02	03	2.6

Source: Personal Survey by the Researchers.

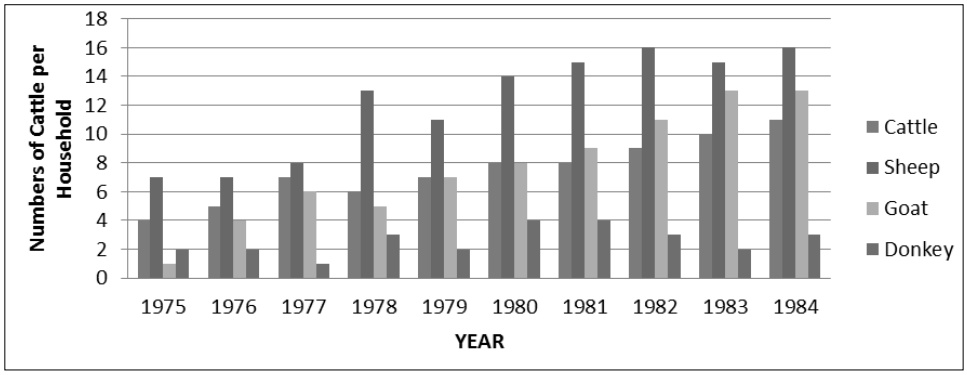

Fig. 7: Types and Numbers of Cattle per Household (from 1975 to 1984).

For the sake of showing the difference in the number of livestock by the farmers before and after the construction of dams, the percentage change has been shown with the help of the given formula:

Percentage change= Average no. of animals per household for ten years after the construction of dams×100/ Average number of animals per household for ten years before the construction of dams

Percentage change of different livestock has been given below;

1. Percentage change for cattle 17.5×100/7.5 = 233.33 per cent
2. Percentage change for sheep 21.7×100/12.2 = 177.86 per cent
3. Percentage change for goat 18.5×100/08 = 231.25 per cent
4. Percentage change for donkey 2.8×100/2.6 = 107.69 per cent

The above calculation clearly shows that among these livestock, the growth of cattle is maximum i.e. 233.33 per cent followed by goat and sheep 231.25 and 177.86 percent respectively. For donkey, the growth is minimum.

After the construction of the dams**,** the scenario of livestock has totally changed in Mendefera. Now the farmers are in a position to feed the desired number of animals and thereby keep a comparatively large number of animals. Moreover, the animals are qualitatively better than those kept before the construction of the dams.

The villagers are now able to keep as many animals as they want because of the availability of water and grasses for their animals. They are able to settle the

livestock market by selling various kinds of domestic animals, e.g. sheep, goats, cattle etc. The city dwellers are now able to buy different kinds of domestic animals from the market according to their financial capacity. Types and numbers of cattle per household for ten years have been shown in Tab. 9.

Tab. 9: Types and Numbers of Cattle per Household (from 2001 to 2010).

Types of Cattle	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average No. of Cattle per Household
Cattle	11	17	18	15	16	17	18	19	21	23	17.5
Sheep	13	17	23	18	19	21	23	25	27	31	21.7
Goat	13	14	18	15	17	18	19	19	23	29	18.5
Donkey	01	01	02	01	04	03	02	04	05	05	2.8

Source: Personal Survey by the Researchers.

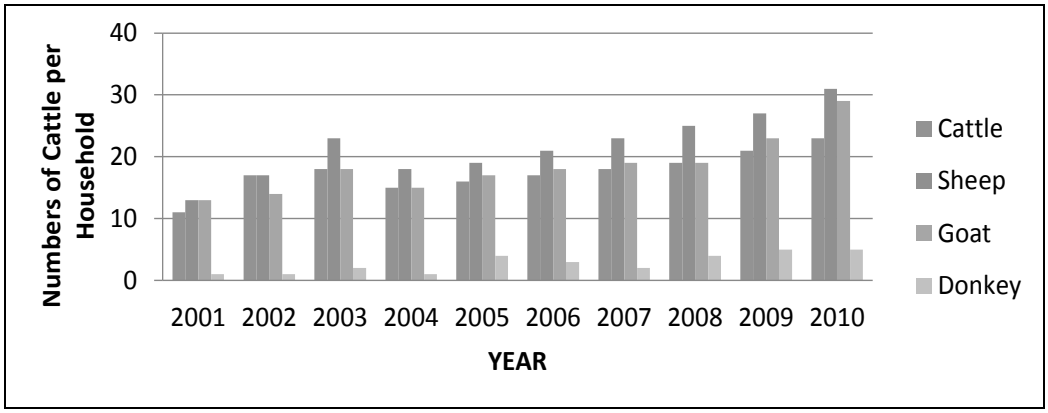

Fig. 8: Types and Numbers of Cattle per Household (from 2001 to 2010).

12. Income improvement

Economic condition of the people in the study area drastically changed after the construction of the dams.A vital significant economic advantage is obtained from irrigation. The farmers now by selling their product cover were able to purchase several goods, clothes, and school uniform and bags for their children. Besides, irrigation has far more positive impact on their livelihood such as health, dietary consumption etc. Apart from this, utilizing irrigation water efficiently enhances production, overcome drought, improve both quality and quantity of harvest. Now they are able to harvest minimum two crops in a year.Average annual production of different vegetables in Quintal, their prices and total revenue obtained in Nakfa is given in Tab. 10.

Tab. 10. Average annual production of different vegetables in Quintal, their prices and total revenue obtained in Nakfa.

Vegetables	Total per year harvest in Quintal	Price per kg in Nakfa	Total revenue obtained in Nakfa
Potato	80	15	84,000
Onion	60	7	54,600
Tomato	50	8	28,000
Cabbage	40	4	11,200

Source: Ministry of Agriculture sub-zone of Mendefera, November, 2008.

The above table clearly shows that the production of different vegetables vary according to their prices. Say for instance, potato dominates all other crops both in terms of total production and prices. On the other hand, cabbage is least produced because of its corresponding low price. Because of locally produced vegetables, the people of the study area did not depend upon the produce of others on the one hand and they are safe-guarded from travelling to the far areas to get such products on the other hand. If we talk about the zonal market price and compare the sub-zone of Mendefera with other sub-zones, we find that in the Mendefera sub-zone the prices are comparatively cheaper than the other sub-zones because in this zone the produce is surplus and are exported to other sub-zones such as Areza, vegetables are exported from Mendefera. That is why in Mendefera price levels are cheaper than Areza. This is only because of the existing dams in the sub-zone which are sources of continuous supply of water for irrigation. According to the data collected from Adi-Mengoti, there were only six wells before the construction of dams in the village. But after the construction of dams the number of wells drastically increased to 95. Water in the wells is supplied by the ground water recharged from the dam reservoir which is main sources of water for drinking and irrigation in the downstream.

13. Conclusion and recommendations

Rainfall in Eritrea is both unreliable and very low. The amount of rainfall that Eritrea receives is sufficient neither for surface water nor for ground water availability. In such a situation dams play a crucial role because it provides water for irrigation and safe-guard people from travelling long distances to fetch drinking water for both human and animals.

According to this study, the construction of dams in the study area has multiple effects. Agricultural production enhanced through utilizing the water for irrigation from the dams. Most of the farmers improved their standard of living, overcome drought and improved both quality and quantity of yield per hectare. According to the interview conducted with the key informants, after the construction of the dams the farmers using irrigation for their farm lands and successfully harvest two crops per year. When we compare the economic conditions of the farmers in the study area in the pre and post dam construction period, we find great differences. Say for instance, before the construction of dams, the farmers were totally depending on the summer rainfall, but after the construction, the rain-fed agriculture transformed into irrigational agriculture where the farmers were able to double their production especially the production of vegetables such as potato, tomato, cabbage, onion etc. In fact, the dams playing a crucial role in the market sustainability of vegetables in

the study area. The construction of dams implies a lot of economic benefits especially in the Eritrean context because of low and highly erratic summer rainfall. However, the dams solved among other problems the problem of food security and seasonal unemployment of the agricultural labourers. Thus, the farmers increased their income and their nutritional habits.

As the dams are the lifeline of the farmers, so their protection is utmost requirement. Based on direct observation and on the responses of the questionnaires from the farmers, the researcher has forwarded the following recommendations in order to protect the dams in the long run.

- In order to avoid siltation, the catchment area of the dams must be properly managed.
- Biological catchment treatment through improved grass cover, plantation of carefully selected tree species etc. could offer an appropriate alternative to rather expensive physical structures.
- The technical design of the dams should be strictly followed in order to keep the reservoir open until the downstream reservoir is filled.
- In order to preserve water in the dams, modern irrigational techniques should be practiced.
- In order to avoid pollutions in the dams, the sites for the dams should be carefully selected so that the drainage from villages could not reach into the dam water.
- Government should construct cold storage houses and tomato paste factory to save the surplus productions.

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A COMPARATIVE ANALYSIS OF LIFE STYLE OF THE LOCAL PEOPLE BEFORE AND AFTER THE CONSTRUCTION OF THE DAMS IN THE SUB ZONE OF MENDEFERA: A CASE STUDY OF ADI-MENGOTI AND MAI-ARON DAMS

Summary

Eritrea is one of the Sahelion countries in the Horn of Africa, located on the western shore of Red Sea. Aridity is the key note of the country. The size of population is more than five million. Agriculture is the mainstay of the people. It is estimated that about 75 per cent of the population depends on agriculture and allied activities. Agriculture has been playing a vital role in the process of economic development of the country. In such a country where agriculture is the backbone of the economy regular water supply for irrigation is very important. Hence, the construction of the dams is utmost requirement of the country in order to overcome the problem of water supply for irrigation, domestic and livestock uses. There are about 187 dams of different sizes and of varying water holding capacity. According to the Ministry of Agriculture in the Debub region, there are 126 dams constructed by the government and different agencies, out of which 31 of the dams were constructed before independence functioning at a minimum level having problem of siltation and environmental assessment. Since independence, the number of dams has increased reaching up to 95. Most of the dams constructed after independence are fully mechanized and are managed properly.

Out of 187 dams, the two dams i.e. Adi-Mengoti and Mai-Aron dams have been selected for the study because these seem to be very good model that can be representing the reality on the ground. However, when we see their individual contributions, Adi-Mengoti dam provides service only for five months whereas Mai-Aron dam is one of those few dams which provide its services throughout the year. Therefore, it could be concluded that the sustainable amount of water for the city is made available from the Mai-Aron dam.

Economic condition of the people drastically changed in the study area after the construction of the dams. A vital significant economic advantage is obtained from irrigation. The farmers now by selling the product cover were able to purchase several goods, clothes, and school uniform and bags for their children. Besides, irrigation has far more positive impact on their livelihood such as health, dietary consumption etc. Apart from this, utilizing irrigation water efficiently enhances production, overcome drought, improve both quality and quantity of harvest. Now they are able to harvest minimum two crops in a year. However, the dams solved among other problems, the problem of food security and seasonal unemployment of the agricultural labourers.