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1. INTRODUCTION

1.1 Background of the Study

Basically, the socio-economic development and civilization of the communities is closely associated to the ability to utilize and control over the resources they endowed such as water resources. The economy of these areas is strongly dependent on rain-fed based agriculture and rainfall variability impact costs the economy significantly. Therefore, unless agriculture is de-linked from the strong linkage to rainfall variability, the economy of the areas will continue to be severely affected.

Hence, improved agricultural water management and introduction of modern irrigation agriculture can increase productivity of land, water and labor. To this effect, ;Lege-Kolu' Small Scale Irrigation projects are the newly proposed irrigation development projects that will be developed in areas specifically known as 'Bahima Harchuma' Kebeles of Shenen-Kolu Woreda (Arsi Zone) in Oromiya Regional State, which found at about 105.5 km from Addis Ababa. Mixed farming system is the major economic occupation of the communities living in and around the proposed irrigation project area. However, the production and productivity of both crops and livestock of these areas is not satisfactory due to the existence of different socio-economic factors such as shortage of rainfall, irregularity of rains, traditional farming system, backward production techniques, lack/or inaccessibility of improved agricultural technologies and facilities, etc. Thus, the proposed irrigation project is expected to reduce the ever increasing food security problems of the communities of these areas through providing and facilitating the local communities with improved irrigation technologies along with necessary technical supports and backstopping services so as to increase agricultural production and productivity in line with the application of modern agricultural practices and use of improved agricultural inputs such as high yield seed varieties, fertilizers, pesticides, herbicides, etc.

Modern irrigation agriculture is one of the improved agricultural production technologies that increase production and productivity of different crops through efficient and effective utilization of the existing land and water resources. Hence, the primary objective of this project is to introduce and enhance the use of modern irrigation agricultural practices sustainably to its maximum benefits that enable the local farmers improve their living standards and income levels. Thus, these proposed irrigation projects are aimed to develop about 105.5ha of land areas

by diverting River 'Kolu'' Bahima Harchuma of Shenen-Kolu Woreda located at a distance of about 15 - 18km from the center of the Woreda and expected to benefit about 211 households.

As the data obtained from Plan and Economic Development Office of Shenen Kolu Woreda, the total human population is 118,393 (58,584 male and 59,809 female). Agriculture is the major economic activities of the Woreda's community and contributes in the regional and/or country's economic development. According to the data from the Woreda Agricultural Development Office, sorghum, maize, teff, vegetables such as tomatoes, cabbages, and fruits such as banana, mango; as well as sugarcane and chat were the major crops grown in the areas. Majority of the farmers were well experienced in using irrigation agricultural as well as they were very known and experienced in the production and management of vegetables and fruit crops such as banana, mango, etc.

The major crop pests such as army worms, locusts, bird apes, etc. and crop diseases such as-yellow rust, Leaf rust and African bollworms are some of the challenges of crop production in the areas. Moreover, livestock such as cattle, sheep, horses, donkeys and poultry were the major ones.

As per the data from Woreda Cooperative Office, there were 30 Service Cooperatives engaged in different economic activities of such as supplying agricultural seeds and fertilizers for member farmers since 2002 E.C. In addition to this, the cooperatives were also supplying consumable goods and services such as sugar, edible oil, etc. for their members. Out of the total cooperatives, half of them were engaged in saving and credit activities; and one cooperative engaged in dairy processing and marketing activities.

In general among all the factors that hinder to ensure food security of the study areas, low productivity of agricultural production and backward farming systems which practiced by the local communities might be at the forefront. The improvement of crop production and productivity through using and applying cost-effective and efficient production systems which might be calling for the need of Irrigation Agricultural Technologies is a paramount. To this effect, Oromia Irrigation Development Authority has promoted and initiated the Development of Small-Scale Irrigation Agriculture at wide range and considered it as a major development strategic action plan in its economic development policies by supporting Small Scale Irrigation Agricultural Development activities.

1.2 Project Rationale

The rationale for the proposed irrigation development project was to support the increasing of agricultural production and productivity through enhancing the uses of available resources such as water, irrigated land, etc. effectively and efficiently.

1.3 Objectives

1.3.1 Major Objective

The major objective of this irrigation project is to reduce the ever increasing food insecurity problems of the intended beneficiaries focusing on the aims to the food self sufficiency strategy of the region and/or country at household level. Accordingly, this study was conducted to assess and analyze the socio-economic conditions of the communities along with the assessment of existing and potentials and constraints that might encounter the success of the proposed development project.

1.3.2 Specific Objectiveness

The specific objectives of this study include:

- Assessing and describing of the existing socio-economic conditions of the community in the proposed project areas;
- Assessing and analyzing of the major economic bases and livelihood status of the communities in the proposed project areas;
- Identification and analysis of major existing and potential development along with their constraints; and
- Assessment and analysis of existing communities' perceptions towards the proposed Irrigation Development Project in terms of the regional and/or country's development strategies along with possible expertise suggestions and recommendations.

2. STUDY METHODOLOGIES

2.1 Descriptions of the Study Areas

2.1.1 Location

'Lege-Kolu' Small-Scale Irrigation Projects are located in Shenen-Kolu Woreda at an area specifically known as 'Bahima-Harchuma' Kebeles. the project Woreda, is found in Arsi Zone of Oromia Regional State at a distance of about 345 km from Addis Ababa; and at about 315 km from Asella Town (center of the Zone). The Woreda has a total area of about 64,119 ha; and it is divided into 12 rural and 1 urban kebeles.

To this end, the specific project areas Bahima-Harchuma is found at a distance of about 15 - 18km from the Woreda center. As far as the road accessibility condition of the project area is concerned, it is quite necessary to develop accessible road in order to make transportation of construction materials ease.

2.1.2 Climate

As per the data obtained from Agricultural Development Office of Shenen-Kolu Woreda, the entire Woreda was fully characterized by highland agro-climatic conditions; and its altitude ranges from 1,400 – 2,900 meter above sea level. The average annual temperature ranges from 32 - 38^0c.

2.2 Data Type and Sources of Data

In this study process, both quantitative and qualitative data were collected from different possible sources such as individual sample households, kebele agricultural and health experts, relevant officers, elder, religious persons, women and youth representatives; relevant report and/or plan documents of woreda offices like plan and economic development, health, education, water, agriculture, etc.

2.3 Data Collection Methods

Random sampling technique for the selection of sample household; the study kebeles from which these sample households identified was purposively selected from command areas of the project. Based on these criteria, two kebele were selected based on their existing socio-economic

problems; which include: Bahima-Harchuma and Bedeyyi kebeles. To this effect, Household Survey, Focus Group Discussions (FGDs), Key Informant Interviews (KIIs) and Community Consultations; as well as Literature Reviews and Collecting of Secondary Data were used as the study techniques.

2.4 Data Quality Assurance

Data quality was examined from the beginning where data collection processes has started. A socio-economic study team has tried to give due attention to the study starting from preparation and development of questionnaires, checklists, formats, etc. as the most important prerequisites and procedures to undertake the study processes. To this end, being with concerned Woreda and Kebele Officials, appropriate enumerators were selected and oriented how to conduct the household survey data collection, format filling and sample household selection procedures. Following this, deploying the trained enumerators to each study kebele and/or site; then, close mentoring and supervision on the data collection and gathering processes was made. Finally, using double entry techniques and consistency checking methods of data encoding and entering procedures, all collected data and information were entered in the computer for analysis.

2.4 Data Processing and Analysis

Following collection of the data and necessary information, data organizing, coding, encoding, editing and refining have taken place. Accordingly, the survey data were entered into a computer using SPSS and Excel Spreadsheet software for analysis. To this effect, for the purpose of data analysis, descriptive methods such as frequencies, percentiles, ratios, etc. were applied. Then, analyzed data were interpreted and presented in different reporting forms such as narrations, graphs, tables and charts to display the results of the study findings.

3. RESULTS AND DISCUSSIONS

3.1 Population and Demography

3.1.1 Population Size and Density

The population data of the project Woreda and Kebeles were collected from different and relevant sector offices at both Worda and Kebele levels. Thus, according to the data obtained from Plan and Economic Development Office of the project Woreda, the total human population was estimated to be 118,393 (58,584 male and 59,809 female) people; of which, about 96.2% of the people were living in rural areas and the rest 3.8% in urban areas. The total household of the Woreda was estimated to be about 13,396; which means, there were about 8.8 persons per household. Ethnically, majority of the population were Oromos and followed by Somali people, (see Table 1 below).

Table 1: Total Population and Household Size of the Project Areas (2010 E.C.)

Project Area	Total Population			Household Size		
	Male	Female	Total	Male	Female	Total
Shenene-Kolu Woreda	58,584	59,809	118,393	12,568	1,399	13,396
Bahima Harchuma Kebele	2,464	53	2,517	280	6	286

Source: Plan and Economic Development Office of Shenen-Kolu Woreda (2010 E.c)

As it can easily be judged from the population data and land area of the study Woreda, its average population density was estimated to be 1.9 ha per person; (i.e. dividing the total Land area (ha) by total population of the study Woreda, one can get the average population density of that specific area). The following simple calculation shows how the population density of the study Woreda was manipulated:

Pd = Total Land Area ÷ Total Human Population;

= 64,129 ha ÷ 118,393

= **1.9 Persons per ha**

3.1.2 Population Dynamics

Population structure, composition, growth rate, migration, etc. are important characteristics of population dynamics that essentially influence the planning and designing of any development projects. Furthermore, they play great roles in the processes of monitoring and evaluation of the

National and/or Regional Gross Domestic Products (GDPs). To this end, according to the population data obtained from the study areas, about 24% of the communities (15 – 64 years of age) were categorized under economically active labor forces; whereas 76% in-active and/or dependent. Moreover, internal migration is very common in the areas; some community members came from other neighboring regions and/or zones such as Amara region/or zones for different purposes. Hence, due to the existence of such dynamic variables, the size and composition of the population in the study areas would be changed from time to time.

The other important factor is that the presence of low level of socio-economic development which associated with high fertility rate enhances rapid population growth of the areas. As per the population projection of Finance and Economic Development Bureau of Oromia Region (CSA, 2007), the population growth rate of Shenen-Kolu Woreda was estimated to be 3% per annum; which indicates that such continuity of high population growth will bring high population pressure to the existing limited resources (land, water, etc.) of the areas. The presence of high population pressure on such limited resources like arable land results in an increase in the demand for the existing area of land which eventually become exhausted, depleted and degraded land. Hence, being in such socio-economic conditions, it would be impossible to produce adequate food supplies and provide sufficient social services for the rapidly growing population.

3.1.3 Population Projection

According to the population data from the study Woreda, there were 118,393 (58,584 male and 59,809 female) people at the end of year 2010 E.C. Accordingly, supposing the 3% annual growth rate of the Woreda and considering the population data of year 2010 as the base year for the next five years (2011 – 2015 E.C.) was estimated as shown in Table 2 below.

Table 2: Population Projection of Shenen-Kolu Woreda

Year	Male	Female	Total
2012	60,342	61,603	121,945
2013	62,152	63,451	125,603
2014	64,016	65,355	129,371
2015	65,937	67,316	133,252
2016	67,915	69,335	137,250

3.2 Basic Social Services and Institutions

3.2.1 Health Institutions and Services

The availability and accessibility of basic social services and institutions plays great roles in determining the socio-economic conditions of an area. To this effect, according to the data and information obtained from Health Office of Shenen-Kolu Woreda, health sector has been given top priority in order to have and realize the presence of healthy communities who are able to engage in the socio-economic development endeavors of the areas. Accordingly, the number and current status of existing health institutions, service level and coverage as well as, the number and qualification of health personnel working in different health institutions of the study areas were shown in Table 3 and 4 respectively below.

Table 3: Existing Health Institutions and Service Levels (Current Status) of Shenen-Kolu Woreda

Health Institution	Number of Health Institutions	Current Status	
		Functional	Un-functional
Health Centers	2	√	-
Clinic	5	√	
Health Post	12	√	-
Total			

Source: Shenen-Kolu Woreda Health Office; (2010 E.C.)

Table 4 : Number of Health Personnel and Extension Health Workers of Shenen-Kolu Woreda

Health Personnel	Profession/or Education Status	Number
Nurses	Nursing (Diploma)	19
Health Officer	Degree (Health Officer)	2
Pharmacist	Degree (Pharmacy)	2
Health Extension Workers	Certificate (Health Extension)	18
Total		**41**

Source: Shenen-Kolu Woreda Health Office; (2010 E.C.)

3.2.2 Education Institutions and Services

Education is one of the major components of an effort to expand the national resource base through investment in human capital. It is for this reason that governments of most countries of the world today consider education as a primary instrument for nation building. To this effect, in the past three to four decades major efforts have been taken in the education sector of developing countries to provide education to the majority of the population.

Therefore, a rapid population growth in Ethiopia has a tendency to be young people; which means, a high proportion of the people would be less than 15 years of age. According to the Ethiopian Central Statistics Agency data of 2007 G.C, about 48% of the population was children

of age less than 15 years. If the existing fertility rate continues to be constant/or increases over the years, higher proportion of the population would be composed of children who require sufficient and quality education facilities and services.

As per the data from Education Office of the study Woreda, there were 33 schools of different levels (starting from KG up to preparatory schools). In all these schools, about 27,214 students were attending classes during 2010 E.C. Similarly, there were about 401 teachers have been engaged in teaching activities; of which 109 were female teachers. With regards to their professional, 70 teachers were first degree holders, 339 diploma and the rest 2 teachers were certificate.

3.2.3 Availability and Accessibility of Water Supply

It is commonly accepted that access to water is a basic human right. The Dublin Conference in 1992 asserted that "... it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price"; (ICWE, 1992). Many societies believe that water has special cultural, religious and social values, which marks it off from other economic goods. In many cultures, goals other than economic efficiency influence the choice of water management institutions. Some religions (e.g., Islam) even prohibit water allocation by market forces. However, the focus on water's special status tends to obscure the fact that, in most societies, only a tiny fraction of water consumption is actually for drinking and preserving life. A large portion of urban water is used for convenience and comfort. In the Western United States, per capita water withdrawal by households frequently exceeds 400 liters per day, about half of which is used to irrigate lands and gardens; and most of the remainder is for flushing toilets, bathing and washing cars.

In general, the value of water to particular users depends crucially on its location, quality and timing. Its location determines its accessibility and cost; its quality affects whether it can be used at all, and at what treatment cost. The time when it is available governs its reliability and its relative value for power, irrigation, environmental or potable uses.

Many countries have reached a state where the quantity or quality of fresh water resources is imposing limits on present use of the resource and on economic development. Others are rapidly approaching a similar critical situation. All these countries face the common problem that existing policies and strategies, and the institutions to implement them, are inadequate to meet

water use needs and sustainable development. To this effect, aquifer management is often complicated by the aggregate impact of the actions of many individuals. Even though each individual may have a negligible impact when taken alone, the sum total can be of major importance. One tube-well has little effect on the total water supply, but thousands of tube-wells can quickly deplete an aquifer. Establishing effective water use management systems to control and regulate water abstraction by these many small-scale and scattered water users is indispensable.

According to the data obtained from Water, Energy and Electricity Office of Shenen-Kolu Woreda, currently potable water supply coverage was 65.4%. On the other hand, about 71,036 people 34.6% of the population of the Woreda were suffering from shortage of pure water supply service. As per the data from the same source, the average distance travelled and/or time taken to fetch a water from different sources was estimated to be 1 km/or 1:00 hrs.

To this effect, at present both groundwater and surface water resources such as deep and shallow wells, hand dug wells and spring water were the most important water supply sources of the project areas; (see Table 6 below).

Table 5: Existing Water Supply Schemes and Services of Shenen-Kolua Woreda by Scheme Type

Water Supply Scheme	**Number of Schemes**
Deep Wells	4
Hand Dug Wells	14
Developed Springs	79
Total	**97**

Source: Shenen-Kolua Woreda Water, Energy and Electricity Development Office; (2010 E.C.)

3.2.4 Agricultural Input Supply and Credit Services

Fertilizers, improved seeds, pesticides, and herbicides were the most important agricultural inputs used by majority of the farmers living in the project Woreda. To this effect, sustainable supply of these agricultural inputs to meet the continuously growing demands will be indispensable. Furthermore, the availability and accessibility of agricultural credit services in the areas is also the other important factor for the enhancement of the agricultural inputs utilization of the study areas.

Accordingly, as per the data and information obtained from concerned sector offices such as agriculture, cooperative, etc., during last 2009/10 crop year, 2,784 qt. of fertilizers and 55 qt. of

different improved seeds were supplied and used in the project Woreda. Moreover, there were some farmers operating traditional practices such as fallowing, addition of manure and crop rotation in order to maintain the fertility of their land. Crop rotation, contour plowing and using of crop residues on farmland as well as construction of check dams, soil bunds, cut of drains and compost making and using, etc. were also the other important activities practiced by local farmers of the study areas.

With regards to agricultural inputs supplying and distribution, as well as saving and credit service provision of the study areas, there were 15 saving and credit service cooperatives who involved in the provision of credit and saving services for member farmers; and 14 multipurpose cooperatives engaged in supplying and distribution of agricultural inputs such as fertilizers, improved seeds, pesticides, herbicides, etc.; as well as supplying of consumable goods and services to member farmers. Moreover, there was one dairy cooperative who engaged in the production and marketing dairy products to member and non-member communities of the study areas; (see Table 7 below).

Table 6: Major Agricultural Inputs used in the Study Area; (2010 E.C)

No.	Type of Agri. Input	Unit	Quantity
1	Fertilizers	Quintal	10,101
2	Improved Seeds	‘’	150

Source: Office of Cooperative Organization and Expansion; (2010 E.C)

3.2.5 Road Network and Accessibility

In the Woreda, there was all-weather road accessibility that connects different kebeles of the Woreda; and its total length was estimated to be about 59 km.

3.3 Livelihoods and Major Economic Base of the Study Areas

3.3.1 Basic Economic Activities and Income Sources

Agricultural production is the main economic activity and major sources of income for the communities of the study areas. Hence, the economic base of the study areas is largely agriculture with some off-farm activities such as petty trading, daily labor, etc. Therefore, crop production and animal rearing were the two major economic activities practiced by majority of the communities for both consumption and income earning purposes. Moreover, trading,

contractual works, daily labors and other off-farm economic activities such as hotel and tourism were assessed to be some of the income sources for the communities of the study areas.

3.3.2 Agricultural Production and Farming System

As indicated in the above discussions, crop production and livestock rearing were the two major economic activities commonly practiced by the communities of the study areas. Although agriculture is the main stay for majority of the community members in the study areas, it is characterized by low production and productivity due to the reasons of using backward farming systems; lack of improved agricultural technologies; rapid population growth and pressure on the limitedly existing resources; etc. To this effect, majority of the communities living in the project areas (44.6%) were dependent on the Safety Net Project implemented by Regional Food Security Program. This indicates that there were serious problems of food shortage for the majority of the communities of the Woreda.

In general, the agricultural production activities are assisted through existing agricultural extension services. The agricultural extension services were run by agricultural extension workers or development agents (DAs), and are intended to maximize production and productivity of the areas.

3.3.2.1 Crop Production

Different crops have different cropping calendars based on the amount and distribution of rainfall, agronomic practices, etc. Some crops such as teff, wheat and barley require frequent plowing and others such as beans, peas and linseeds require minimum tillage. To this effect, according to the data obtained from Office of Agricultural Development of Shenen-Kolu Woreda, the major crops grown in the study areas include: sorghum, maize, teff, vegetables, different fruits and others such as root crops, cash crops (coffee, chat, etc) peas and lentils.

Crop pests such as armyworms, locusts, insects, birds, etc. were the most commonly challenging crop production activities of the study areas; as well as yellow rust, leaf rust and African bollworms were the major crop diseases of the study areas.

3.3.2.2 Livestock Rearing

Livestock rearing is the other agricultural activities practiced in the study areas. Table 9 below presents the type and number of livestock reared in ***Shenen-Kolu*** Woreda.

Table 7: Number of Livestock reared in the Project areas by type of animals (2010 E.C)

No	Livestock Type	Number of Heads	Proportion (%)
1	Cattle	77,031	38.49856
2	Sheep	7705	3.850806
3	Goats	36,051	18.01757
4	Horses	5928	2.962696
5	Donkeys	16,345	8.168906
6	Mules	1332	0.665707
7	Poultry	55696	27.83575
	Total	200,088	**100%**

Source: Livestock Development Authority of Shenen-Kolu Woreda (2010 E.C)

In general, livestock rearing has diverse functions in the production systems of the farming communities of the study areas. Food production in the form of meat, milk and milk products constitute a major group of livestock outputs. It is the sources of power, manure or dung and transport services. Hides and skins as well as wools and hairs of some animals are important sources of income and livelihoods of local farmers of the study areas.

Hence, the study areas have vast potentialities for livestock development and production, as the climate is favorable for animal husbandry. As can be seen from the above Table 8, the study Woreda is more suitable for rearing of sheep and cattle, which constitute about 38% of the total livestock population of the areas. Pasture grasses, oats, crop residues, urea treated crop residues, etc. were some of the major livestock feeds of the study areas. However, the presence of different animal diseases and low infrastructural development of the areas have hampered the reproductive performances of the livestock population.

3.4 Land-Use Pattern

Even though it was difficult to obtain real and accurate data on land-use pattern of the study areas, the study team has attempted to manipulate and summarize as presented and described in Table 10 shown below.

Table 8: Land-Use Pattern of Shenen-Kolu Woreda

No.	Land-Use Pattern	Area of the Land in: ha	
		Hectare	Percent (%)
1	Arable Land (Cultivated and Cultivable Land)	28,864	45.0
2	Grazing Land	14,107	22
3	Forest Land	833	1.0
4	Others	20,325	32
	Total	**64,129**	100

Source: Land Administration Office of Shenen-Kolu Woreda (2010 E.C.)

4. COMMUNITY ATTITUDES, PARTICIPATION AND EXPERIENCES

4.1 Existing Experiences on Practicing Irrigation Agriculture

During the discussions held with the target beneficiaries and community representatives of the project in the presence of pertinent governmental bodies, farmers have expressed their strong feelings and positive attitudes towards the intended irrigation development project. Though there were no strong community-based and managed irrigation projects in the study areas, the past experiences of farmers on using such modern irrigation projects might be a challenge unless there are regular technical supports and trainings for the intended beneficiaries.

However, the beneficiary farmers have expressed their interests and willingness to take part in implementation of the proposed development irrigation project including its management, operation and maintenance activities of the irrigation structures. As a result, the target beneficiaries have signed the petitions and willingly reflecting their commitments to participate at all stages of the project development activities in general and to cover 10% of the project cost through their labor participation and materials supporting during the construction phase. .

5. CHALLENGES POTENTIALS OF THE STUDY AREAS

5.1 Challenges

The climatic condition of the Woreda is too cold to practice agricultural diversifications so as to increase production and productivity of the areas; and the agricultural production and productivity issues of the areas were not yet get improvements due to the fact that there were not yet facilitated and supported by appropriate research and improved farm management practices. Hence, the livelihoods and level of income for the communities of the areas are under different challenges. As a result, local farmers were practicing traditional agricultural production activities. Concerning health sector, lack/or shortage of health professionals such as Lab. Technicians and X-ray Technicians were also the other development challenges of the study areas. In addition, the presence of poor infrastructures and road accessibility in majority of the rural areas of the Woreda were also assessed to be the drawbacks of study Woreda.

5.2 Potentialities

Previous experience of the Woreda shows that the area is very conducive and suitable for different types of agriculture productions especially in relation to the livestock production activities. Furthermore, the topographic land escape of the Woreda is flat and very easy for the development different infrastructures such as access road networks, telecommunications, electricity As well as, the areas have potentials of minerals such as rocks, high labor intensive; access to the central market areas, etc. The Woreda is also rich in ground and river water potentials which is very suitable for implementation of modern irrigation.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

Development plans and policies need up to date information and data. The data of poverty minimization sectors, health, education, agriculture, water mines and energy and rural roads authority have an immense contribution to the development of plans and policies of our country, Ethiopia. Changes have been seen in Shenen-Kolu Woreda regarding these sectors and other government, non-government and private organization since recent years. The Physical and Socio-Economic Profile of Shenen-Kolu Woreda can be used as an input for those who want to

take part in development of our region, Oromiya and the district's Finance and Economic Development Office is standing by to make suitable environment data accessibility and further investigation

6.2 Recommendations

As attempted to describe in the existing socio-economic assessments of this study, the implementation of the proposed irrigation project will bring several economic and social benefits to the local population and contribute for the improvement of their socio-economic status and living standards.

To minimize the potential and possible adverse effects of the proposed development project so as to enhance its positive impacts, it is recommended that the proposed preventing or mitigating measures are included in the project plan and implemented at the right time. In particular the following issues should be given due consideration in order to help the sustainability of the project and ensure protection of the environment.

- Efficient water management and equitable water distribution should be established by establishing a strong Water Users Association that will take care of the duty; and the
- Efficient water management is critically important as it will minimize many of the potential adverse environmental effects such as threats of water related diseases (malaria), erosion, impacts on downstream water uses, etc.
- To overcome public health impacts mainly related to malaria and water-borne diseases provision of environmental health and hygiene education for the farmers are essential.
- To protect soil erosion due to flooding, the farmers should have to use appropriate farm techniques such as contour bunds, soil bunds, rehabilitation of gullies, conservation based Agriculture (grass strips, agro-forestry, plantation on soil conservation structures).
- Before/during implementation of any development activities in the area there should be orientation about rational utilization of resources and conservation method should be introduced to the community; and
- Schemes that are well-designed, adequately funded, properly maintained, well managed, socially acceptable and responsibly used can be perfectly sustainable